Advance Release

Beyond the Curse

Policies to Harness the Power of Natural Resources

EDITORS
Rabah Arezki, Thorvaldur Gylfason, and Amadou Sy

INTERNATIONAL MONETARY FUND

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Contents

Foreword

The global economy is going through dramatic changes, with major implications for the demand for natural resources. Over the coming years, emerging economies will increasingly drive global growth. Many countries will take steps to adapt to climate change. And there will be further technological advances in extractive industries. Such changes will clearly impact the demand for natural resources.

A perennial challenge for commodity exporters has been how to manage the impact of volatile commodity prices on macroeconomic and financial stability. Even though commodity prices have stabilized somewhat since the Great Recession, volatility is sure to return—and is already back in agricultural commodity markets. This underscores the importance of having the right macroeconomic policies to manage this volatility. Financial tools, including hedging strategies, clearly matter too.

Another challenge is how to increase competitiveness. Natural-resource-rich countries run a risk of contracting "Dutch disease"—the phenomenon of large commodity exports leading to an appreciation of the real exchange rate, which in turn slows productivity growth in other sectors of the economy. This weakens competitiveness and holds back economic diversification—leaving the economy overly dependent on the natural resource sector.

But perhaps the most fundamental challenge is how to ensure that natural resource wealth is used wisely and shared fairly across society. Natural-resource-rich countries have been blessed with tremendous natural wealth. And yet in many of them, unemployment is high—especially among the young—and millions remain in poverty. It seems only right that these countries' natural riches should be used to tackle constraints on growth and development, to create the decent jobs needed to raise living standards.

Much greater investment in physical, human, and institutional capital is clearly needed to boost productivity and raise competitiveness. This should be supported by structural reforms that tackle constraints on entrepreneurship and that improve the business climate.

At the same time, spending should be at a measured pace. This will safeguard macroeconomic stability, which includes maintaining the real exchange rate at a fair level. It will also allow future generations to benefit from the revenues earned from exhaustible natural resources today.

Strong institutions will play a critical role in ensuring that well-designed policies are indeed effective. Strong fiscal institutions help prevent excess spending in times of plenty—thus leaving enough resources for times of want. And strong financial institutions help manage the impact of spikes in capital inflows on the broader economy. Sound management of foreign exchange reserves is a critical complement in this regard.

Unfortunately, strong institutions have been missing in many resource-rich economies. As a result, economic performance in many countries with abundant natural resources has been quite poor; and even where economies have grown, unemployment, inequality, and the resulting tensions have often undermined social progress. Partly as a result, the blessing of resource riches has too often turned into the curse of conflict.

A strong commitment to good governance lies at the heart of responsible management of natural resource wealth. Good governance helps ensure that commodity revenues can benefit all in society. This is why institutions with a high level of accountability are so important. The experiences of countries like Botswana, Chile, and Indonesia show the important role that strong, independent, and accountable institutions can play in resource-rich countries. I also firmly believe that a vigorous civil society is critical for achieving—and maintaining—a high standard of accountability.

Transparency is an important first step in ensuring accountability—and an issue that the IMF is helping to promote. To support our members' efforts in this area, the IMF developed the *Guide on Resource Revenue Transparency* and the Code of Good Practices on Fiscal Transparency. The IMF also provides technical assistance and training to its members, drawing on its deep experience of working on these issues all over the world.

The IMF remains committed to working with all its members, resource-rich and resource-poor, to tackle the policy challenges of this new global economy. It is my hope that publications like this one—alongside, of course, our close bilateral relations with our members—will contribute to supporting a strong and stable global recovery, to the benefit of all nations of the world.

Christine Lagarde
Managing Director
International Monetary Fund

Acknowledgments

This book is the culmination of the efforts of many policymakers, academics, and World Bank and IMF staff. Their coming together during the high-level seminar organized by the Bank of Algeria and the IMF Institute in Algiers on November 4 to 5, 2010, has been instrumental in fostering the understanding of how countries can manage the challenges of natural resource wealth so as to reap the benefits while avoiding the pitfalls.

This book would not have been possible without the support and encouragement of Leslie Lipschitz, director of the IMF Institute and Mohammed Laksaci, Governor of the Bank of Algeria. We are grateful to Joanne Blake of the IMF's External Relations Department for coordinating the production of the book. Last, but not least, we would like to thank a large number of colleagues at the IMF and staff at the Bank of Algeria for their support.

Rabah Arezki, Thorvaldur Gylfason, and Amadou Sy

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Abbreviations and Acronyms

aNNI	adjusted net national income
CPI	Consumer Price Index
FDI	foreign direct investment
GCC	Gulf Cooperation Council
GNI	gross national income
IT	information technology
LNG	liquid natural gas
NRF	natural resource fund
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
PPP	purchasing power parity
PPT	product price targeting
R&D	research and development
RER	real exchange rate
SNA	System of National Accounts
SWF	sovereign wealth fund
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme

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CHAPTER 1

Overview

LESLIE LIPSCHITZ

This book is based on a high-level seminar that took place in Algiers on November 4th and 5th, 2010, under the title, "Natural Resources, Finance, and Development: Confronting Old and New Challenges." The seminar, organized by the Central Bank of Algeria and the IMF Institute, was aimed chiefly at policymakers in sub-Saharan Africa, and brought together a number of ministers, central bank governors, other senior policymakers, and well-known academics.

Countries that have an abundance of natural resources—and this includes many countries in sub-Saharan Africa—often show a record of relatively poor economic performance compared with non-resource-rich countries. The consensus in both academic and policy circles is that the presence of abundant natural resources poses a number of potential challenges to these countries. Six of them can be readily identified: (i) a loss of competitiveness in potentially dynamic, non-natural resource sectors, (ii) a consequent narrowing of the production base, (iii) excessive reliance on commodities for both government revenues and export earnings, (iv) high vulnerability to fluctuations in commodity prices, (v) macroeconomic and financial volatility, and (vi) rent-seeking behavior that can undermine governance and exacerbate the difficulty of building robust, growth-enabling institutions. The seminar focused on how to manage these challenges so as to reap the benefits of resource wealth while avoiding the pitfalls.

Starting from a diagnosis of the wide range of challenges to macroeconomic management and financial policies that resource-rich countries face, the seminar sought to propose solutions that are context-specific, drawn from the most successful experiences, and capable of being implemented in Africa. Discussed at the seminar, therefore, were fiscal, monetary and exchange rate policies; savings policies; institutional arrangements to safeguard economies against volatility; economic diversification; and institution building.

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THE BROAD PERSPECTIVE

The consensus among both speakers and participants at the seminar was that government revenues derived from natural resource extraction should be used conservatively in order to avoid excessive real appreciation and to safeguard intergenerational equity. Preserving intergenerational equity requires saving and investing a large part of the proceeds to benefit future generations. At the same time, when investing these proceeds, it is not easy to make the choice between investing in external financial assets and investing in domestic physical and human capital (including infrastructure). A deliberate and measured pace of domestic spending, carefully focused on absorptive capacity, can limit real appreciation and attenuate the negative consequences to the economy's tradable sector. Moreover, history is replete with examples of large government spending programs that have been inefficient and wasteful.

Knowledgeable senior officials at the seminar from Norway, Chile, Botswana, and Mexico outlined the history of how their governments addressed the problems posed by the existence of natural resources. Their measures included conducting countercyclical fiscal policies and setting up institutions that limit rent-seeking behavior.

While seminar participants were cautious about spending policies, they recognized that populations in low-income countries have high expectations regarding higher public spending. Large resource windfalls often trigger political pressures to enlarge government spending, in particular in countries with vulnerable populations. Managing those expectations is an important task in all resource-rich countries, and particularly in those with recently discovered resources.

MANAGEMENT OF THE EXTRACTION

All countries with significant natural resources, especially those whose resources are recently discovered, must choose between putting the extraction activity in the hands of multinational companies or keeping it in the hands of state-owned companies. The weight of country experiences worldwide tilts the balance in favor of leaving the extraction as much as possible to the private sector, provided that (i) the companies are selected on a competitive basis, and (ii) the government has the capacity to ensure that contract negotiations lead to a balanced deal where the short- and medium-term objectives of both parties are reconciled. Indeed, such an "optimal contract" would ensure that the inherent time-inconsistency problem is addressed. In other words, governments in resource-rich countries should credibly commit not to expropriate for themselves foreign investments after they have been sunk in exploration and extraction. In this discussion, many countries around the table recognized their lack of capacity to negotiate such contracts and expressed a need for independent international advice and assistance in this crucial area.

FISCAL POLICY

Taxes on rents are relatively efficient and less distorting. Therefore, higher levels of taxation in the natural resource sector make sense and facilitate lower taxes in other sectors. However, this usually leads to a structure of government revenues that is dependent on commodity prices and earnings and so can be highly volatile. There is therefore a need to establish medium-term spending plans, to decouple current spending from volatile government revenues, and to enact a strategy for countercyclical fiscal policy (especially because capital flows that also respond to current account strength, and thus commodity prices, can exacerbate cyclicality).

Fiscal institutions have proven to be instrumental in achieving such decoupling between spending programs and revenues. For countries that cannot establish institutional arrangements capable of credibly committing to countercyclical fiscal policies, the use of financial instruments—such as the Asian puts used to hedge government oil revenues in Mexico—are an effective second-best policy option.

MONETARY POLICY AND EXCHANGE RATE

Chile's floating exchange rate coupled with an inflation-targeting regime has proved remarkably successful in recent years at sheltering the economy from external shocks. Many African countries are fearful of embarking on a fully flexible exchange rate regime, however. This is not the so-called "fear of floating" in the conventional sense—when a degree of fixity leads to foreign exchange liabilities that constitute a balance-sheet disincentive to floating—but simply a reluctance to embark on major institutional change based on a belief that the supportive institutional structure will take time to prepare. It is clear that a more gradualist path to exchange-rate flexibility with inflation targeting will be pursued in many countries, with all the transitional difficulties that this will entail. In fact, the experience of Ghana, which adopted inflation targeting with limited exchange-rate flexibility in 2002–03, clearly illustrates this point.

The seminar stimulated much discussion about how to sterilize current account inflows (at times of high commodity prices) and the capital inflows that are correlated with these windfalls. Because their equilibrium domestic interest rates are almost always higher than those in advanced countries, in resource-rich countries the costs of sterilization can be significant and can create tensions between the fiscal authorities and the central bank. As the case of Botswana makes clear, however, insofar as periods of high commodity prices are also periods of large government surpluses held at the central bank, a properly managed countercyclical fiscal policy will provide a degree of automatic sterilization.

ECONOMIC DIVERSIFICATION

Experiences with industrial policy around the world suggest that it is not a straightforward matter to design an appropriate incentive structure to help lay the

groundwork for economic diversification in resource-rich countries. Seminar participants recognized that some government intervention is unavoidable but also stressed that such policies should be tailored to the context of each economy. It was also recognized that too-active industrial policies would open the door to corruption and thus risk undermining the broader institutional framework.

From the discussions certain things emerged that are clearly undesirable, such as commodity rents that are distributed through very high government salaries, which would have a detrimental effect on private sector development. On the other hand, low, predictable, and non-distorting tax rates on entrepreneurial activity could help foster diversification. Similarly, the use of commodity proceeds to establish a supportive physical and social infrastructure could raise returns and encourage private investment in other sectors.

INSTITUTIONAL ASPECTS

The existence of natural resources tends to distort the allocation of talent. Especially in countries with weak institutions, talent tends to shift out of private entrepreneurial activity and into more lucrative rent-seeking areas, with harmful implications for sustainable growth. Participants in the seminar spent a good deal of time focusing on how institutions should be designed to guard against such developments. For example, strong and reliable property rights can foster financial sector development, allowing the financial system to play a more active and significant role in mediating resources to help build small- and medium-size enterprises in the non-resource-rich sectors of the economy. More generally, checks and balances and greater transparency in managing natural resource revenues can help counteract the misallocation of talent into unproductive activities. However, it was acknowledged that the problem was less difficult in countries with mature industrial economies than in those that were least developed when mineral resources were discovered. This, if anything, merely underscored the importance of a careful approach to institution building.

PART I

Commodity Markets and the Macroeconomy

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CHAPTER 2

Natural Resource Endowment: A Mixed Blessing?

THORVALDUR GYLFASON

INTRODUCTION

Economic geography is no longer what it used to be. For a long time, economic geographers studied raw materials and their distribution around the world and assigned crucial roles to natural resource wealth and raw materials, their ownership, and trade routes. Ownership of those important resources tended to be equated with economic and political strength. The European powers' scramble for Africa that began in 1881—this was when France occupied Tunis with Germany's consent—was mainly a scramble for the great continent's resources. The slave trade from the mid-15th century onward can be viewed the same way.

It wasn't long before it became clear that natural resources do not always confer widely shared benefits on the people from whose territory they are extracted. Even after the end of colonial rule in Africa and elsewhere, many resource-abundant countries—Congo is a case in point—remained in dire straits. Countries that discovered their natural resources after independence, such as Nigeria, also did not make rapid economic progress for reasons that seem to be related in part to poor management of their natural resources. In the same vein, Russia's former president and now Prime Minister Vladimir Putin has said, "Our country is rich, but our people are poor." Even so, some natural-resource-rich countries have made impressive progress. Botswana, Chile, and Mauritius will be singled out in what follows. Meanwhile, several resource-poor countries have managed to become rich, including Hong Kong, Japan, and Singapore.

In the light of experience, the new economic geography puts relatively less emphasis on natural resources by recognizing several distinct sources of wealth, especially the accumulation of human and social capital. By social capital is meant the quality of formal and informal institutions, including governance,

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Figure 2.1
Share of natural capital in total tangible capital

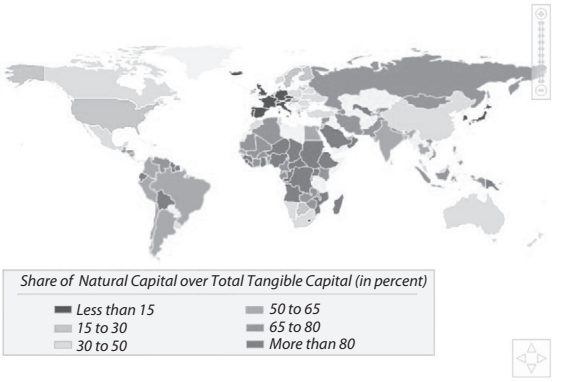
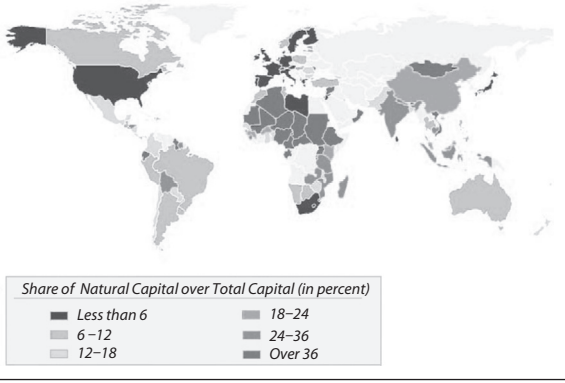


Figure 2.2
Share of natural capital in total capital



transparency, and trust. There are many kinds of man-made capital and, accordingly, many separate sources of economic growth that the people and their governments can bring under their control.

In the world as a whole, natural capital, including cropland, pastureland, subsoil assets, timber resources, nontimber forest resources, and protected areas, constituted a small part of total national wealth in 2005, or just six percent (World Bank, 2010b). If intangible capital—that is, human and social capital—is left out of the computation, natural capital constituted 26 percent of total tangible capital around the world that year. Tangible capital comprises produced capital, urban land, natural capital, and net foreign assets. By contrast, sub-Saharan Africa's natural capital amounts to 28 percent of the region's total wealth and 70 percent of its total tangible capital (Figures 2.1 and 2.2). In the Middle East, the numbers are 34 percent and 58 percent, respectively.

In his memoirs, Lee Kuan Yew, the founding father of Singapore (and prime minister from 1959 to 1991), described his thinking as follows:

> I thought then that wealth depended mainly on the possession of territory and natural resources, whether fertile land ..., or valuable minerals, or oil and gas. It was only after I had been in office for some years that I recognized ... that the decisive factors were the people, their natural abilities, education and training. (Lee Kuan Yew, 1998)

Earlier, in 1966, Prime Minister Lee had this to say in a speech at the Delegates' Conference of the National Trade Union Congress in Singapore:

> In the last 20 or more years since the end of the Second World War, we have seen how the human factor has been one of the most potent factors for economic growth and national recovery as against the natural geographic and mineral resources of a given society. Two nations, Germany and Japan, were both beaten down to their knees. Both lost large tracks of territory … Both found their smaller remaining territories crammed with refugees ... And, in both cases, they were able to recover through an ability to mobilize their human resources. First, there was the basic willingness of the worker to work and pay for what he wants; and second, high standards of technical expertise and American markets and investments. But the latter were not decisive. The decisive factor was the human resources at their disposal. And Germany and Japan have emerged with a strength to be reckoned with in Europe and in Asia. (Lee Kuan Yew, 1966, pp. 3–4)

Recent theory suggests that the interaction of several sources of economic growth and development is important to growth. For example, the conversion of natural capital to human and social capital to boost growth requires, or is at least helped by, good institutions and governance. For another example, investments in human capital and social capital tend to go hand in hand and reinforce one another. Here two types of classification can be helpful.

First, growth can be *extensive*, driven forward by the accumulation of capital, or it can be *intensive*, springing from more efficient use of existing capital and other resources. Among the numerous alternative ways to promote economic and social efficiency, one of the most effective is to accumulate human capital through education, on-the-job training, and health care. There are many other ways to increase efficiency and economic growth as well. For instance, free trade can empower individuals, firms, and countries to break out of the confines of production frontiers that, under autarky, would entail lower standards of life. Other examples abound, as the burgeoning economic growth literature of recent years has made clear. Moreover, it has come to be widely recognized that the quality of institutions and good governance can help generate sustained growth and so can various other factors that are closely related to economic organization, institutions, and policy (Fischer and Sahay, 2000; Campos and Coricelli, 2002; and Acemoglu and Johnson, 2005). Generally, the determinants of growth are closely related and influence growth together as well as separately. In growth theory, everything depends on everything else.

A second classification distinguishes among several different types of capital that, like plants, are capable of growth at different rates:

(i) Saving and investment to build up *real capital*—physical infrastructure, roads and bridges, factories, machinery, equipment, and such;

(ii) Education, training, health care, and social security to build up *human capital*, a better and more productive work force;

(iii) Exports and imports of goods, services, and capital to build up *foreign capital*, serving among other purpose to supplement domestic capital;

(iv) Democracy, freedom, equality, and honesty—that is, absence of corruption—to build up *social capital*, to strengthen the social fabric, the glue that helps hold the economic system together and keep it in good running order;

(v) Economic stability with low inflation to build up *financial capital*, or liquidity, which lubricates the wheels of the economic system and helps keep it running smoothly; and

(vi) Manufacturing and service industries that permit diversification of the national economy away from excessive reliance on low-skill-intensive primary production, including agriculture, based on *natural capital*.

Most would accept that the six items on that list—real capital, human capital, foreign capital, social capital, financial capital, and natural capital—are desirable and helpful in themselves, and most would also agree on the desirability of diversification in economic activity. How these goals can be attained is another matter, however. The above list could be extended, but let us rather notice a couple of things about this short list.

First, capital appears in many different guises, some tangible, some not, but in all its guises it needs to be built up gradually through painstaking investments at the expense of current consumption. A strong capital base requires a lot of good and durable investments in different areas. Second, natural capital differs from the other kinds of capital on the list in that it may be a good idea (for reasons to be discussed below) to be on guard against excessive reliance on this particular kind of capital. Here it is important to distinguish clearly between natural resource *abundance* and natural resource *dependence*. By abundance is meant the amount of natural capital that a country has at its disposal: mineral deposits, oil fields, forests, farm land, and the like. By dependence is meant the extent to which the nation in question depends on these natural resources for its livelihood. Some countries with abundant natural resources, such as Australia, Canada, and the United States, outgrew those resources and are no longer especially dependent on them. Other resource-abundant countries, such as the members of the Organization of Petroleum Exporting Countries (OPEC), do depend on their resources, some of them for practically all that they have. Still other countries, such as Chad and Mali, have few resources and yet depend on those few for the bulk of their export earnings, because they have little else to offer for sale abroad. Yet others, such as Jordan and Panama, have few resources but do not depend in any important manner on the little they have. The idea that diversification away

from natural resources may be good for long-run growth centers on dependence rather than abundance, even if the distinction may is sometimes hard to make in practice. It is quite conceivable that excessive dependence on a few natural resources may hurt economic growth, even if an abundance of natural resources, if well managed, may also be good for growth. By contrast, no country has ever suffered from excessive reliance on human capital built up through education.

The rest of the chapter is organized as follows. First, we consider the implications of natural resources for the conduct of economic policies and the role and design of institutions in resource-rich countries. Second, we briefly review the experience of a dozen resource-rich countries, highlighting the successes of those that have done well, with special emphasis on Norway, the world's third largest oil exporter. Third and last, we turn from story-telling to statistical analysis by offering a quick glance at some of the empirical cross-country evidence that can be brought to bear on the relationship between natural resources, economic growth, and some of the main determinants of growth.

POLICY ISSUES IN NATURAL-RESOURCE-RICH COUNTRIES

This section addresses the three main areas for which the management of natural resources in resource-rich countries raises important issues: (i) fiscal policy, (ii) monetary, financial, and exchange-rate policy, with emphasis on the important role of institutions and governance, and (iii) the need for diversification away from excessive dependence on a few resources as well as away from narrowly based power elites. We begin with taxes.

Fiscal Issues

"Taxes are what we pay for a civilized society," said the American justice Oliver Wendell Holmes. In general, however, taxes distort economic behavior. Therefore, it makes a substantial difference in economic terms how public revenue is raised to finance society's collective needs in addition to the efficiency with which the revenue is spent. The overall objective of tax policy ought to be the collection of enough revenue at the cost of the smallest distortion possible. The worst possible way to collect revenue is to resort to the inflation tax, probably the least efficient and most harmful and distorting of all methods of taxation. Most other taxes have side effects that discourage households and firms from doing desirable things. Import tariffs impede foreign trade and thereby also economic efficiency and growth. Income taxes discourage work and market production. Sales taxes fall disproportionately on low-income households that spend most of their income on necessities and have little to save. Natural-resource-rich countries can to some extent avoid these problems because they possess a tax base that offers them an opportunity to gather public revenue at a minimal cost to efficiency through distortions. This is because the resources will stay put—they are there and cannot move. This argument is akin to the old story that land taxes are more efficient

than taxes on movable factors of production. But there is a difference—a big one. Natural resources belong to the people.

As a matter of near-universal principle, a people's right to its natural resources is a human right proclaimed in primary documents of international law and enshrined in many national constitutions (Wenar, 2008). Thus, Article 1 of the International Covenant on Civil and Political Rights states:

> All people may, for their own ends, freely dispose of their natural wealth and resources….

The first article of the International Covenant on Economic, Social and Cultural Rights is identical. Except in the United States, where rights to oil resources were legally transferred to private companies, natural resources are as a rule common property resources. This means that, by law, the resource rents accrue in large part to the government. Hence, no taxation is really needed except as a formality. In any case, the word "tax" would be inappropriate. Here "fee" is a more fitting word because fees are typically levied in exchange for providing specific services such as a permission to utilize a common property resource. Therefore, resource taxes should rather be referred to as fees or resource depletion charges (Gylfason and Weitzman, 2003). In any event, it is important to use the proceeds from resource fees either to finance socially productive expenditures or to reduce other less efficient sources of revenue to keep the overall tax burden manageable. Good fiscal governance requires careful attention to allocative and technical efficiency on both sides of the fiscal equation, that is, on both public expenditures and the revenue mobilization needed to finance those expenditures.

The legal aspect of natural resources as human rights has another important implication. The accrual of natural resource rents to the government presupposes representative democracy and, hence, as a matter of international law, the legitimacy of the government's right to dispose of the resource rents on behalf of the people. This principle is, for instance, acknowledged in the Permanent Constitution of the State of Qatar, Article 1, which states: "Its political system is democratic." Further, Article 29 states: "Natural wealth and its resources are the property of the State; and the State shall preserve and exploit the same in the best manner in accordance with the provisions of the law." For another example, the Iraqi constitution of 2005 proclaims in Article 108 that "Oil and gas are the property of the Iraqi people in all the regions and provinces." Again, by international law, this proclamation presupposes political diversification through representative democracy. In the same spirit, the preamble to the Algerian Constitution refers to the "recovery of the national resources and the building of a State exclusively for the benefit of the people."

Fish is not oil, but Iceland's fisheries policy sheds light on these issues. Iceland's system of catch quotas, in operation since 1984, shares the main features of the European Union's Common Fisheries Policy in that the fisheries minister sets annual quotas for each species and allocates them free of charge to boat owners based on their catches in 1981-83. The boat owners can then either fill their quotas at sea or sell them, as many have done, thereby reducing the amount of

capital tied up in the fishing industry and pocketing the rents. As a matter of fact, the law stipulating gratis allocation of the quotas to the boat owners was drafted at the offices of The Federation of Icelandic Fishing Vessel Owners. Free trade in quotas enhances efficiency by facilitating a transfer of quotas at the market price from less efficient firms to more efficient ones.

But to be fair and fully efficient, free trade in quotas presupposes that the initial allocation was fair and efficient, that is, that the quotas were sold at fair market value by their rightful owner, in this case the state on behalf of the Icelandic people, to whom Iceland's fish resources belong by law as well as by the International Covenant on Civil and Political Rights as mentioned before.[1] The macroeconomic significance of the fishing rents in Iceland is extremely substantial. By auctioning off the quotas from the outset, rather than giving them away for free and thus prolonging huge overcapacity and inefficiency in the fishing industry, the government could have generated enough revenue to finance the abolition of the personal income tax in Iceland.[2] This opportunity to replace inefficient income taxation by distortion-free fishing fees was missed. Alfred Pigou would also have been disappointed. Fishing fees are an example of a Pigovian tax or fee, by which is meant a levy on a market activity that generates negative externalities. Another example of a Pigovian levy is the "taxation" of oil and gas, whether at the source or at the pump. What oil and fish have in common is the tendency toward excess that is characteristic of the use of common property resources: there is too much fishing going on, thereby endangering fish stocks around the world, and we drive too much, thereby producing congestion that imposes delays on other travelers.

Iceland's failure to make the boat owners pay for the quotas had consequences. It created with the stroke of a pen a wealthy class of individuals who went on to become major players in the political arena able to make sure that their privileges would not be revoked by new legislation. The stories are legend. The latest move by this new elite was to buy the country's second largest newspaper and install as editor the discredited central bank governor, the person who presided over Iceland's fateful banking crash of 2008. That crash wiped out financial assets equivalent to seven times the country's GDP, a unique event in the financial history of the world.

The failure to sell fishing quotas or auction them off rather than hand them out for free can be viewed as part of the lead-up to Iceland's more recent banking fiasco. For how would politicians who got away with handing out for free hugely valuable catch quotas go about privatizing state banks? Would they apply the same method again? They did. They sold two of the three largest banks in Iceland

[1]In 2007, the United Nations Committee on Human Rights declared that the Icelandic quota system constitutes a violation of human rights and instructed the Icelandic government to rectify the fisheries management system by removing the discriminatory element from the system. See International covenant on civil and political rights, CCPR/C/91/D/1306/2004, 14 December 2007.

[2]The natural resource rent from the fisheries has been estimated to amount in long-run equilibrium to about five percent of Iceland's GDP.

at a modest price to political cronies, who then ran them into the ground within six short years. The government has since set up a Special Investigation Commission, which has directed a number of cases involving the banks to the Special Prosecutor's Office set up specifically to investigate possible violations of the law by the banks and others.

Fiscal stabilization is another essential consideration. Because their prices tend to be volatile, abundant natural resources tend to go hand in hand with fluctuations in export revenues. Such volatility calls for fiscal stabilization. This problem raises the classic question of rules versus discretion. Discretionary stabilization measures aimed at building up foreign exchange reserves and fiscal revenues when commodity prices are high and using up reserves and revenues when prices are low can be criticized on the grounds that they tend to kick in too late and thus to become counterproductive, exacerbating the volatility of earnings. Fiscal rules, on the other hand, can be faulted for being too mechanical and insensitive to circumstances. This is a classic dilemma to which a one-size-fits-all solution does not exist.

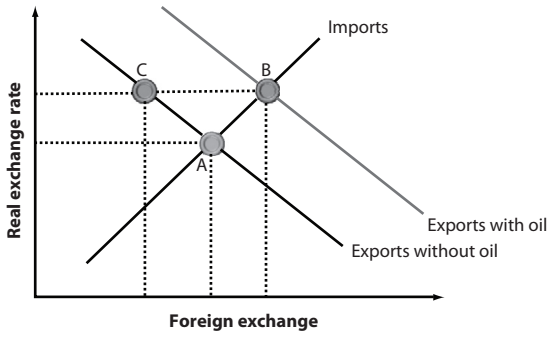
Chile applies a fiscal rule by which the government can run a deficit larger than the target of zero, or one percent surplus relative to GDP, insofar as GDP falls short of potential or the price of copper is below its medium-term (10-year) equilibrium level (Frankel, 2010). The aim of the scheme is to shield producers—and the national economy—from price fluctuations. This makes the scheme subject to similar reservations as price stabilization funds and, more generally, rules-based stabilization policies. The scheme has both pros and cons. A novel aspect of the Chilean scheme is that two panels of experts determine the output gap and the medium-term equilibrium price of copper to reduce the risk of short-sighted political interference.

In Iceland it has likewise been suggested, among other proposals to allow the resource rent to accrue to its rightful owner, that an Open Market Fisheries Committee be set up and vested with a broad mandate and broad powers. Such a committee would set market-based fishing fees to maximize the long-run profitability of fisheries for the benefit of the sole national owner (Gylfason and Weitzman, 2003). The idea is that setting values for fisheries management instruments, including fees, is too important a task to be left in the hands of a politically appointed minister, no matter how capable or well intentioned the currently appointed individual happens to be. The fisheries authorities should be above even the hint of suspicion of manipulation. There needs to be a clear and specific management and accountability structure, formalized in the national interest by the reform legislation. This is the idea behind independent yet accountable central banks, of course, and also behind independent judiciaries and supervisory authorities. The idea is applicable across a broad range of natural resources.

Monetary Policy, Finance, and Exchange Rates

Several monetary policy issues arise in connection with natural resource management. Perhaps the most important one has to do with Dutch disease, so named

Figure 2.3
How oil exports crowd out non-oil exports



for triggering fears of de-industrialization in the Netherlands following the appreciation of the Dutch guilder after the discovery of natural gas deposits in the North Sea around 1960 (Figure 2.3). In fact, the Dutch got over the ailment fairly quickly and have seen their exports and imports rise rapidly relative to GDP. As it turned out, gas exports did not crowd out other exports. So, the "Dutch" part of the term proved to be a misnomer. How about the "disease" part? This remains a matter of some controversy.

Some observers view the dislocations due to high currency values simply as a matter of one sector's benefiting at the expense of others, without seeing any macroeconomic or social damage done. Others view Dutch disease as just that, a disease, pointing to the potentially harmful consequences to economic growth and diversification of the resulting reallocation of resources. These reallocations move resources from high-tech, high-skill-intensive service industries to low-tech, low-skill-intensive primary production. Clearly, an overvalued currency hurts exports and import-competing industries. This is one of the most robust empirical relationships in international economics. The reverse of this phenomenon has been on display for some time in China, where undervaluation of the renminbi continues to boost Chinese exports and import-competing industries, much to the consternation of some of China's trading partners. The point is a simple one: if overvaluation hurts trade and growth, as has been known for a long time, then undervaluation must likewise help trade and growth (Eichengreen, 2008).

Norway's total exports have been stagnant in proportion to GDP since before its oil discoveries around 1970. This means that oil exports there have crowded out non-oil exports one-for-one relative to GDP. Norway has no high-tech companies that could compare, for example, with Sweden's LM Ericsson, Finland's Nokia, or Denmark's Bang and Olufsen. Yet another sign of a tendency toward Dutch disease, albeit a weak tendency, might be Norway's unwillingness, almost unique in Europe, to join the European Union. This lack of interest is based in part on the popular belief that Norway's oil wealth has reduced the country's need for the benefits of European Union membership. Even so, Norway has proved

very good at keeping inflation down to resist overvaluation of its currency. Sustained price stability requires good monetary governance through independent yet accountable central banks. Likewise, the development of a healthy financial sector requires good monetary governance, including credibility and transparency. A lack of transparency seems to have played a role in the financial crisis that began in the United States in 2007.

The volatility of commodity prices poses challenges not only for fiscal policy but also for monetary policy by leading to volatility in exchange rates, export earnings, output, and employment. Experience shows that volatility can be detrimental to investment and growth (Aghion and Banerjee, 2005). Exchange rate volatility is no exception. This is one reason why natural-resource-rich countries are prone to sluggish investment and slow growth. With this in mind, as well as the resounding success of the euro since its launch in 1999, more and more countries in Africa and elsewhere around the world have plans to pool their currencies to foster economic stability and growth. This is the surest way, albeit not a risk-free way, to use monetary policy to avoid overvaluation and excessive currency volatility. To paraphrase Winston Churchill's comment about democracy: the best way to preserve the integrity of the national currency is to abolish it—or, more precisely, share it with others.

The build-up of natural resource funds such as Algeria's Fund for the Regulation of Receipts and other sovereign wealth funds raises a number of issues. With petroleum and natural gas providing Algeria with almost two-thirds of government income, more than a third of GDP, and 95 percent of export earnings, the stabilization fund was set up in 2000 to insulate the Algerian economy from volatility in gas and oil commodity prices.

Several other countries have a similar set-up. And they all have a choice between regarding the fund as part of the government's fiscal chest available for current use and using it as a reserve for the future subject to strict rules about its planned disposal. After a few years of experimenting, Norway decided to place itself firmly at the future-use end of the spectrum, having in recent years invested virtually all its oil revenues in foreign securities and set them aside in a pension fund. Low- and middle-income countries have more pressing current needs and, for that reason, may find the Norwegian method impractical. Even so, they could benefit from trying to de-politicize the use of natural resource revenues by vesting their disposal in an independent authority set up along the lines of independent yet accountable central banks, judiciaries, and supervisory authorities. Understandably, easy revenues from natural resources are especially tempting in the eyes of politicians in urgent need of public support. Therefore, prudence calls for firewalls to be erected between sovereign wealth funds and the heat of the day-to-day political process. This is a question of checks and balances, of finding ways to reduce the risk of natural resource revenues being misspent or even squandered for short-term political gain.

The underlying issue here is the risk of rent seeking, especially in conjunction with ill-defined property rights, imperfect or missing markets, and lax legal structures. The problem with rent seeking, apart from the injustices it tends to

produce, is that it tends also to divert productive efforts and resources away from more socially fruitful economic activity. Without adequate checks and balances, even full-fledged democracies can suffer from this problem, as the aforementioned story of Iceland's fisheries policy demonstrates. Less democratic countries appear to be even more prone to this risk. This is why important international initiatives have recently been taken to encourage increased transparency in the use of natural resource revenues. The Extractive Industries Transparency Initiative aims to set a global standard for transparency in oil, gas, and mining.[3] The Natural Resource Charter lays out "a set of principles for governments and societies on how to best manage the opportunities created by natural resources for development."[4] The Revenue Watch Institute promotes the responsible management of oil, gas, and mineral resources for the public good.[5] Put bluntly, open access to other people's money tends to breed carelessness as well as a false sense of security that may lead to the sentiment that anything goes, resulting in the neglect of many of the things that make countries grow, including education and institutions. This is the sense in which, if it is not well managed, natural capital may tend to crowd out other types of capital.

The question of other people's money raises yet another legal issue. The managers of sovereign wealth funds are not necessarily free to manage the funds entirely as they see fit if their guidelines and rules do not fully comply with international or local laws. Because the legal issues raised by Leif Wenar (2008) are new to most economists and policymakers, it is not clear that these guidelines and rules were always designed to be waterproof. To illustrate the point, Wenar tells the story of Equatorial Guinea, where the oil export boom after 1990 has produced immense but highly concentrated private wealth amid public squalor, even though the oil wealth belongs to the people by Article 1 of the International Covenant on Civil and Political Rights, which Equatorial Guinea has signed.

Another example may be instructive: that of Iceland, where boat owners used their fishing quotas as collateral for their private debts which, for some of them, proved crushing.[6] This meant that, in some cases, the quotas wound up in the hands of the foreign creditors of the boat owners' banks, even though Icelandic law clearly states that foreign owners of Icelandic catch quotas cannot hold onto them and must return them to Icelandic hands within a year. It is unclear whether the foreign creditors were aware of this legal stipulation when they extended their loans, via Icelandic banks, to the fishing firms in question with the quotas as collateral. Besides, the rightful original owner of the quotas, the Icelandic people, was never paid. This legal aspect of Iceland's ongoing financial crisis remains unresolved. There may be lessons here for other nations.

[3]See http://eiti.org/.

[4]See http://www.naturalresourcecharter.org/.

[5]See http://www.revenuewatch.org/about-rwi.

[6]The overall debts of Iceland's fishing firms were at the end of 2008 equivalent to about four times their annual earnings.

Double Diversification

Economic diversification encourages growth by attracting new economic activity that avoids excessive reliance on primary production in agriculture or a few natural-resource-based industries, thus facilitating the transfer of labor from low-paying jobs in low-skill-intensive farming or mining to more lucrative jobs in more high-skill-intensive occupations. Political diversification encourages growth in a similar way by redistributing political power from narrowly based ruling elites to the people, thus in many cases replacing with democracy and pluralism an extended monopoly of sometimes ill-gotten power. The essence of the argument is the same in both cases: diversity pays.

Modern mixed economies need a broad base of manufacturing, trade, and services to be able to offer the people a steadily improving standard of life. Therefore, they need to find ways of diversifying their economic activity away from once-dominant agriculture, which tends to perpetuate poverty, and similarly away from too much dependence on a few natural resources, which tends to stifle or delay the development of modern manufacturing and services. To function well, national economies also need broad political participation and a broad base of power in order to be able to offer the citizenry an efficient and fair way of exercising its political will and civil rights through free assembly and free elections. Without political democracy, bad governments last too long and do too much damage. The need for diversification is especially urgent in resource-rich countries, because they often face a double jeopardy: natural resource wealth that is concentrated in the hands of relatively small groups that seek to preserve their own privileges by standing in the way of both economic and political diversification, which would disperse their power and wealth. Rent seekers typically resist reforms—economic diversification as well as democracy—that would redistribute the rents to their rightful owners (Auty, 2001; Ross, 2001).

While diversification is a widely shared goal, it is not obvious how it can be achieved. Nevertheless, some guidelines can be offered.

First, avoiding overvaluation of the currency is important, because an overvalued currency punishes export industries specializing in manufacturing and services and also punishes import-competing industries. It takes strong discipline to resist the temptation to allow the currency to appreciate above its appropriate level, because politically popular benefits from cheap foreign exchange accrue to both households and firms that depend on imported inputs. We have here yet another reason why independent but accountable central banks, immune by law from political pressures, are so important. Monetary policy is now widely considered to be too important to be left to impatient politicians, which is why central banks in many countries have been granted greater independence from political authorities so they can pursue as they see fit the monetary policy objectives—almost invariably, low inflation—laid down by the government.

The same argument can be applied at least to the stabilization function of fiscal policy as well as to those aspects of fiscal policy that have to do with the disposal of natural resource rents, as mentioned before. Of course, it cannot be

applied to fiscal policy across the board, because government expenditure and revenue decisions are inherently political, and in a democracy they cannot, and must not, be separated from the political process. Other institutions, such as supervisory authorities that monitor banks and financial markets and, where such offices exist, monitor the management of natural resource rents, also need protection through statutory independence from political authorities. Good governance requires institutional design that assures effective checks and balances, and it requires transparency as a prerequisite as well.

Second, consider transparency. Sweden takes transparency seriously, even in its constitution, which consists of four fundamental laws, including the Freedom of the Press Act and the Fundamental Law on Freedom of Expression. Transparency needs to go hand in hand with accountability and with confidentiality, where appropriate, including protection for whistle blowers. In this regard, the Extractive Industries Transparency Initiative, The Revenue Watch Institute, and the Natural Resource Charter have a potentially helpful contribution to make, like Transparency International. Those international efforts deserve to be supplemented by civil society in individual countries, especially in countries that are prone to the problems that often accompany an abundance of natural resources.

Third, more and better education at all levels of schooling is conducive to diversification, because a good education attracts workers to well-paying jobs in services and manufacturing. Education and diversification go hand in hand. In sub-Saharan Africa, the share of services in GDP went up from 46 percent in 1965 to 54 percent in 2008, while in North Africa and the Middle East the services share contracted from 48 percent to 46 percent. By comparison, the high-income countries saw the share of services in GDP expand from 55 percent in 1970 to 73 percent in 2007 (World Bank, 2010b). The new industrial state has become the new services state.

How much government involvement is necessary for diversification? The government plays a key role in education at all levels. Increased school enrollment at the secondary level as well as at colleges and universities would help, besides being desirable in its own right. For graduates to be able to find jobs, the government must also see to it that the exchange rate of the currency is compatible with profitable manufacturing and services exports. Otherwise, young people will not be motivated to educate themselves (Pritchett, 2006). Furthermore, the government needs to foster a business-friendly climate that makes it easy to set up new firms. The World Bank's annual "Ease of Doing Business" ranking is instructive in this regard.[7] The index reflects how easy (or difficult) it is to start a business, deal with construction permits, employ workers, register property, get credit, protect investors, pay taxes, trade across borders, enforce contracts, and close a business. In the current ranking (2010), Singapore is ranked first out of 183 countries, followed by New Zealand, Hong Kong SAR, and China. Those three

[7]http://www.doingbusiness.org/Rankings.

are followed by the United States and the United Kingdom in fourth and fifth place. The top oil producers on the list are Norway, in tenth place, and Saudi Arabia, in thirteenth place.

Does industrial policy have a role to play in promoting diversification? Dani Rodrik (2004) reviews the pros and cons. First, while it is often claimed that governments cannot pick winners, the inability to pick winners needs to be weighed against the ability to cut losses once mistakes have been made. Second, it has been said that developing countries lack the competent civil service needed to make industrial policy work, but most countries do have or can build pockets of bureaucratic excellence. Third, while industrial policy interventions are prone to political capture and corruption, this risk is not confined to industrial policy but is present in other spheres of public policy as well, including privatization. Fourth, different observers read the empirical evidence differently. Some claim that there is little evidence that industrial policy has worked in the past, except in South Korea, while others, including Rodrik (2004), recount several success stories in Latin America and elsewhere in the developing world. In Chile, for instance, the government encouraged a transfer of resources from mining, forestry, fishing, and agriculture to aluminum smelting, salmon farming, and wine production.

Fifth, some hold the view that support for research and development as well as intellectual protection would be more effective than industrial policy, while others believe, on Pigovian grounds, that the government needs to support entrepreneurship in new activities with high social returns and low private returns. Sixth, some claim that international rules no longer leave much scope for industrial policy interventions, while others see plenty of scope.

In general, it seems to be a good idea to encourage new industries in line with the country's comparative advantages and its available expertise in public administration and to follow the market rather than try to take the lead. Even so, there are no easy solutions. Rodrik (2004, p. 3) advocates "strategic collaboration between the private sector and the government with the aim of uncovering where the most significant obstacles to restructuring lie and what type of interventions are most likely to remove them." Policy experiments need to be based on general principles and, at the same time, to be tailored to local circumstances. There is no such thing as a one-size-fits-all industrial policy, and there never was.

NORWAY AND OTHER SUCCESS STORIES

Norway and Oil

Norway always had its natural resources, of course. But it was only with the advent of educated labor that it became possible for the Norwegians to harness those resources on a significant scale. Human capital accumulation was the primary force behind the economic transformation of Norway. Natural capital was secondary. The World Bank attributes 62 percent of Norway's national wealth to intangible capital, including human capital, 21 percent to produced capital and urban land, and 13 percent to natural capital; the remaining four percent share is

attributed to net foreign assets (World Bank, 2010a). Today, earnings from oil constitute a quarter of Norway's GDP and investment, a third of its budget revenues, and half of its export earnings. Norway's Petroleum Fund, established in 1990 and now named Government Pension Fund to reflect its intended use, will before long amount to US$100,000 per person, or almost two times Norway's per capita GDP adjusted for purchasing power parity. It is invested entirely in foreign securities, currently 60 percent in equities and 40 percent in fixed-income securities.

Norway's fiscal policy and the management of its oil wealth have played an important role in stabilizing the local economy. Before, a variable but declining proportion of each year's net oil-tax revenue was transferred to the government budget, essentially to cover the non-oil budget deficit. However, as the relative importance of the petroleum sector declines, the share of petroleum revenues directed to covering budget deficits will naturally tend to rise. Even so, the domestic economy has been largely shielded from the influx of oil money, thereby avoiding overheating and keeping the value of the Norwegian krone from rising. This deliberate strategy averted, or at least limited, the damage to non-oil exports and import-competing industries that would have resulted from a more marked appreciation of the krone in real terms. Low inflation in Norway reflects the government's disciplined fiscal and monetary policy stance and, in particular, its resistance to the temptation to channel the country's oil wealth to current uses on a large scale, even in the face of loud calls for using more of the oil revenue to address domestic social needs rather than continue to build up the Government Pension Fund.

Norway's sensible approach to oil wealth management deserves the attention it has received from other resource-rich countries around the world. Norway's approach has five key features:

(i) From the beginning, before the first drop of oil emerged, the oil and gas reserves within Norwegian jurisdiction were defined by law as common property resources, thereby clearly establishing the legal rights of the Norwegian people to the resource rents;

(ii) On this legal basis, the government has absorbed about 80 percent of the resource rent over the years, having learned the hard way, in the 1970s, to use a relatively small portion of the total to meet current fiscal needs; since then it has been setting most of its oil revenue aside in the Government Pension Fund;

(iii) Further to the preventive legislation passed at the outset, the government laid down economic as well as ethical principles ("commandments") to guide the use and exploitation of the oil and gas for the benefit of current and future generations of Norwegians;

(iv) The traditional main political parties have from the beginning shared an understanding of the need to shield the national economy from an excessive influx of oil money to avoid overheating and waste, though this is a view not shared by the Progress Party (established 1973); and

(v) The central bank (Norges Bank), which with the adoption of inflation targeting in 2001 began moving toward increased independence from the government, manages the Government Pension Fund on behalf of the Ministry of Finance, maintaining a distance between politicians; the fund has grown to around US$450 billion (US$94,000 per person in Norway in 2009).

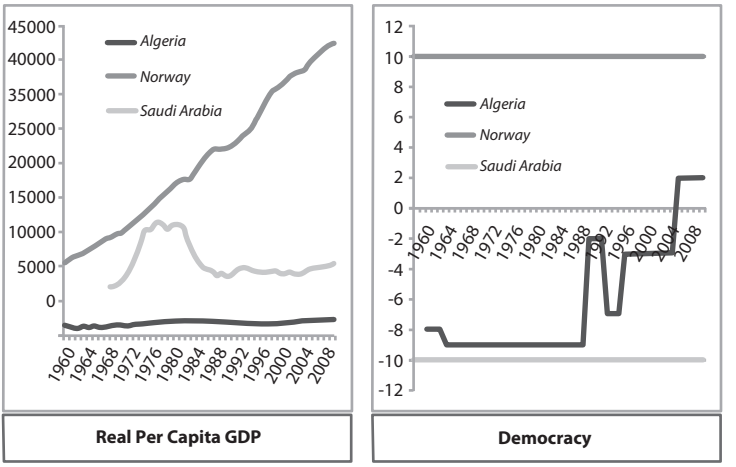
By Norwegian law and in keeping with the International Covenant on Civil and Political Rights, the oil wealth belongs to the state. The petroleum industry extracts oil and gas on public land, albeit offshore. In principle, all the rent from oil and gas should accrue to the Norwegian people through their government. The state's title to these resources constitutes the legal basis for government regulation of the petroleum sector as well as for its taxation. Exploration and production licenses are awarded for a small fee to domestic and foreign oil companies alike. The Norwegian government expropriates the oil and gas rent through taxes and fees as well as direct involvement in the development of the resources rather than through sales or auctioning of exploration and production rights.

For all these reasons, Norway was able to avoid the rent seeking and related problems that have afflicted other oil exporting countries, particularly Iran, Libya, Mexico, Nigeria, Russia, Saudi Arabia, Sudan, and Venezuela, among others. Figure 2.4 shows how Norway and Saudi Arabia grew apart after the mid-1980s, a point when the two countries had a similar per capita GDP. Economic indicators do not do full justice, however, to the impressive progress made by Algeria and Saudi Arabia where, since 1960, life expectancy has increased by no less than 25 years and 27 years, respectively, compared with an increase of seven years in Norway. All things considered, what sets Norway apart is that Norway was a well-functioning, full-fledged democracy long before its oil discoveries. Democrats are less likely than dictators to try to grab resources to consolidate their political power (Mehlum, Moene, and Torvik, 2006). In several other countries, point resources such as oil and minerals have proved particularly "loot-able," though not in Botswana, to which we now turn.

Botswana, Chile, and Mauritius

At its independence in 1966, Botswana started out with 12 kilometers of paved roads, 22 college graduates, and 100 secondary-school graduates (Acemoglu, Johnson, and Robinson, 2003). Diamonds were discovered the following year, in 1967, and now provide tax revenue equivalent to a third of GDP. Botswana has managed its diamond mining quite well and used the rents to support rapid growth that has made Botswana the most prosperous country in mainland Africa, having surpassed South Africa a few years ago in terms of per capita gross national income adjusted for purchasing power parity (World Bank, 2010b). In Botswana, gross secondary-school enrolment rose from 19 percent of each cohort in 1980 to 80 percent in 2006, as compared with an increase from 50 percent to 89 percent in Mauritius over the same period. Between 1980 and 2007, Botswana increased its public expenditure on education from 6 percent of GDP to 8 percent, as compared with 4 percent in Mauritius.

Figure 2.4
Norway and oil

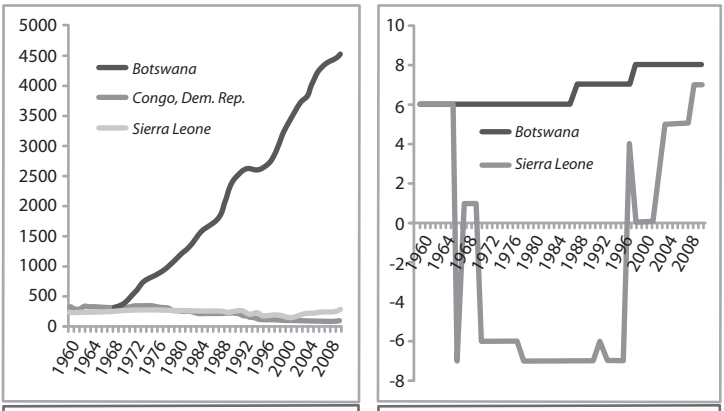


Unlike Sierra Leone's alluvial diamonds, which are easy to mine by shovel and pan and easy to loot, Botswana's kimberlite diamonds lie deep in the ground and can only be mined with large hydraulic shovels and other sophisticated equipment and, therefore, are not very loot-able (Olsson, 2006; Boschini, Pettersson, and Roine, 2007). This difference probably helped Botswana succeed while Sierra Leone failed, and so, most likely, did South African involvement—that of De Beers, in particular—in the Botswanian diamond industry. True, with a Gini coefficient of 60 according to the UNDP,[8] Botswana has one of the world's least equal distributions of income and a correspondingly high poverty rate. Even so, by and large Botswana has enjoyed remarkable economic success accompanied by political stability and a steady advance of democracy (Figure 2.5).

With low inflation, albeit slightly higher (at 10 percent per year on average from 1966 to 2008) than in sub-Saharan Africa as a whole, good policies no doubt contributed to this outcome. So did good institutions. The corruption perceptions index of Transparency International for 2009 ranks Botswana higher than all other African countries, assigning it 37th place in a group of 180 countries.[9] The Ibrahim Index of African governance for 2010 puts Botswana in third place out of 53, just behind Mauritius and the Seychelles.[10] The World Bank's "Ease of Doing Business" index for 2010 has Botswana in 45th place out of 183, behind Mauritius (17th) and South Africa (34th) and ahead of all other African countries as well as, for example, Chile (49th) and Peru (56th). Tragically, due to the HIV/AIDS epidemic, Botswana's remarkable economic achievements have

[8]See http://hdrstats.undp.org/indicators/147.html.
[9]See http://www.transparency.org/policy_research/surveys_indices/cpi/2009/cpi_2009_table.
[10]See http://www.moibrahimfoundation.org/en/section/the-ibrahim-index.

Figure 2.5
Botswana and diamonds



been accompanied by only a modest increase in life expectancy since 1960 of four years, as compared with longer lives by 14 years in Sierra Leone and six years in the Democratic Republic of Congo (Figure 2.5).

Unlike Botswana, Mauritius made a deliberate and successful effort to reduce its reliance on its main export commodity, sugar. This was done through good policies and good institutions, emphasizing education and foreign trade through diplomacy and other means. The share of manufactures in merchandise exports increased from 2 percent in 1970 to 57 percent in 2008. Even so, sugarcane remains the dominant crop, generating 25 percent of export earnings. Since the mid-1970s, total exports have hovered around 50 percent to 60 percent of GDP, as in Botswana. These are high ratios by both African and international standards, even for small countries with populations below two million. Between 1977 and 2008, inflation was kept below 9 percent per year on average. During the same period, investment in Mauritius amounted to 26 percent of GDP against 32 percent in Botswana. Life expectancy at birth in Mauritius has increased by 13 years since 1960. As Figure 2.6 shows, two other sugar exporters, Fiji and Costa Rica, have likewise added to their average life expectancies, by 13 percent and 17 percent, respectively.

Thus, like Botswana, Mauritius did many things right. Beyond the usual suspected determinants of growth that Mauritius got right, including education, exports, and investment, Frankel (2010) suggests that the cosmopolitan nature and origin of the population of Mauritius contributed to the island's successful, harmonious, and democratic development by creating a balance between ethnic groups, as in Singapore, Hong Kong SAR, and Dubai. Frankel points out that the three African countries with the highest governance rankings (Mauritius, Seychelles, and Cape Verde) are all small islands that had no indigenous population, suggesting that it helps that everyone "came from somewhere else" as in the United States (except, of course, for the Native Americans).

Figure 2.6
Mauritius and sugar

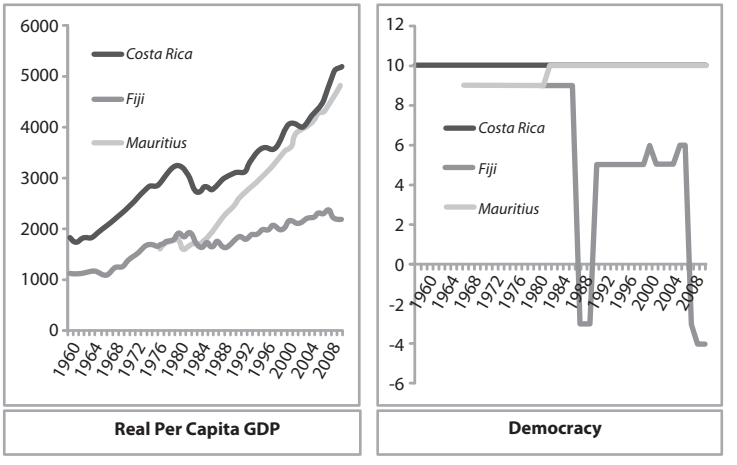


Figure 2.7
Chile and copper

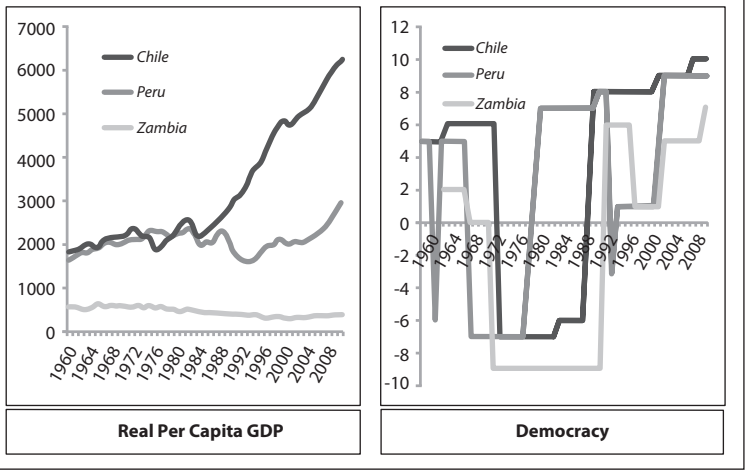


Figure 2.7 shows the development of real per capita GDP and democracy in Chile, Peru, and Zambia. Zambia has failed to grow despite its considerable copper deposits, but all the same it has made commendable albeit uneven progress on the democracy front. The rapid growth of Chile and Peru has gone hand in hand with much lengthened life spans, by 22 years and 26 years, respectively, while life expectancy at birth in Zambia has stood still at 45 years since 1960. Since its return to democracy in 1988, Chile has made rapid progress and become a full-fledged democracy and member of the OECD, tripling its real per capita GDP since the 1980s. Chile has opened up to trade: exports of goods and services increased from 13 percent of GDP in 1960 to 45 percent in 2008. By contrast,

Zambia, also a major copper exporter, saw its exports plunge from 60 percent of GDP at independence in 1964 to 37 percent in 2008. Even so, manufactures accounted for only 12 percent of Chile's total merchandise exports in 2008, compared with 16 percent of exports in Peru, to name another major copper exporter, and 7 percent in Zambia. Chile now sends 84 percent of its young people to secondary school, compared with 98 percent in Peru and 52 percent in Zambia. Inflation is a thing of the past in Chile, while Zambia has grappled with double-digit inflation or worse most of the time since independence. Chile therefore fits into this general pattern: exports, education, investment, and price stability are good for growth, especially when encouraged by good governance, including democracy.

FROM ANECDOTES TO EMPIRICAL TESTING

The time has now come to turn from story-telling to statistical analysis. This section presents a series of growth regression estimates for 164 countries during 1960–2000.[11] The strategy will be to regress the rate of growth of per-capita GDP during this 40-year period on the share of natural capital in total wealth, defined as in Figure 2.2, and then to add to the regression model other potential determinants of growth representing aspects of other types of capital in order to assess the robustness of the initial result—that is, to see if natural capital survives the introduction of additional explanatory variables that are commonly used in empirical growth research. As we add more independent variables, the number of observations drops gradually from 164 to 90 due to missing data. No outliers will be excluded. The estimation method is ordinary least squares (OLS). However, the final benchmark model will also be estimated as a system by the seemingly unrelated regression (SUR) method to demonstrate that the SUR results are essentially the same as the OLS results. This may suggest that, as an empirical matter, the endogeneity of several of the explanatory variables in the growth equations is not, quantitatively speaking, a serious problem in this estimation exercise.

Growth across Countries

Table 2.1 presents the resulting sequence of regressions. An interpretation of the size and economic significance of the coefficients will be offered at the end of the journey. Model 1 describes a statistically significant inverse relationship between per capita growth and the logarithm of initial income (i.e., in 1960). This relationship reflects conditional convergence—the idea that rich countries grow less rapidly than poor ones because the rich have already exploited more of the growth opportunities available to them, for instance by sending more young people to school. Initial income is defined as purchasing-power-parity-adjusted per capita GNI in 2000 divided by an appropriate growth factor to ensure consistency

[11]This section draws on Gylfason, 2008.

TABLE 2.1

Regression results on natural capital and economic growth

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Initial income	-0.738	-0.491	-0.955	-1.066	-1.237	-1.603	-1.702	-1.702
	(5.2)	(3.1)	(5.3)	(5.2)	(7.0)	(7.8)	(8.5)	(8.9)
Natural capital share		-0.043	-0.059	-0.045	-0.043	-0.032	-0.025	-0.025
		(5.3)	(7.1)	(4.7)	(5.3)	(4.0)	(3.1)	(3.3)
Natural capital per person			0.096	0.084	0.062	0.046	0.041	0.041
			(4.5)	(3.7)	(3.3)	(2.5)	(2.3)	(2.4)
Democracy				0.071	0.073	0.073	0.054	0.054
				(2.2)	(2.7)	(2.7)	(2.0)	(2.1)
Investment rate (log)					2.921	1.723	1.341	1.341
					(6.8)	(3.2)	(2.5)	(2.6)
Secondary-school enrolment (log)						0.940	0.556	0.556
						(4.0)	(2.1)	(2.2)
Fertility							-0.402	-0.402
							(2.8)	(3.0)
Countries	164	125	124	113	113	90	90	90
Adjusted R^2	0.14	0.18	0.29	0.27	0.48	0.55	0.58	0.58
Estimation method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	SUR

Note: The dependent variable is the average rate of growth of per capita GDP 1960–2000. t-values are shown within parentheses.

between our income measures in 1960 and 2000 and our measures of economic growth between those years. The coefficient on initial income is significantly negative, as expected.

In Model 2, we add to the regression the World Bank's measure of the natural capital share in total wealth in the year 2000 (recall Figure 2.2), our proxy for natural resource dependence. An increase in the natural capital share reduces growth for given initial income. When natural capital per person, our proxy for natural resource abundance, is added to the regression in Model 3, we see that natural resource dependence continues to hurt growth as hypothesized, even if natural resource abundance has a positive effect on growth. Next, in Model 4, we add democracy as a proxy for one important aspect of social capital to the regression. The democracy variable is taken from the Polity IV Project at the University of Maryland (Marshall and Jaggers, 2001). The democracy variable is defined as the difference between an index of democracy, which runs from zero in hard-core dictatorships to 10 in full-fledged democracies, and an index of autocracy, which similarly runs from 0 in democracies to 10 in dictatorships. Each of the two index components reflects various aspects of democratic rights and freedoms and is an average over the years 1960–2000. The composite democracy index used here spans the range from –10 to 10 (this is the polity2 index in the Polity IV database). The democracy index is significantly correlated with the Ibrahim Index of African governance. The correlation between the average values of the two indices for 53 African countries during 2000–08 is 0.41. Model 4 suggests that democracy is good for growth. All the preceding variables survive.

Model 5 shows that the log of the share of gross domestic investment in GDP makes a significant contribution to growth as expected. The logarithmic formulation is intended to capture decreasing returns to investment. In Model 6, we see how the log of the secondary-school enrolment rate, like investment, stimulates growth without displacing any of the variables inherited from the preceding models.

At last, in Model 7, we enter fertility (measured by the number of births per woman) into the regression to see if it matters for growth. Its influence is suggested by the neoclassical growth model as well as by the idea that reduced fertility can be regarded as an alternative form of investment in human capital by making it possible for most parents to send relatively more of their children to school when they have small families than when they have large ones. We see that increased fertility reduces economic growth as expected, without reducing the statistical significance of the explanatory variables already included in the regression.

The bottom row of Table 2.1 shows how the adjusted R^2 rises gradually as more explanatory variables are added to the growth regression and ultimately reaches 0.58, indicating that Model 7 explains well over half of the cross-country variation in the long-run rate of growth of per capita output.[12] Clearly, Model 7 does not tell the whole story of the determinants of growth; no model does that. For example, despite broad agreement among economists on theoretical grounds that foreign trade is good for growth, indicators of openness to trade often fail to register as significant sources of growth in econometric work. When too many explanatory variables are in a single growth equation, they tend to get in each other's way. Presumably, this happens when two or more explanatory variables compete to explain the same source of efficiency gains.

When an interaction term involving the multiple of the natural capital share and the democracy variable is added to Model 7 in the spirit of Mehlum, Moene, and Torvik (2006) and Collier and Hoeffler (2009), we find that the positive effect of democracy on growth is smaller (and in a few extreme cases turns negative) in countries with a high share of natural capital in national wealth (not shown). This result suggests that increased dependence on natural resources undermines the growth gains from democracy. Collier and Hoeffler (2009) find the same. They report that large resource rents tend to undermine checks and balances, thereby unleashing patronage politics and undercutting the benefits that otherwise would flow from democracy, including electoral competition, to growth. In their results, this mechanism outweighs the channel through which democracy effectively restrains rent seekers, thus making a larger contribution to growth in resource-rich countries than elsewhere. These findings suggest that resource-rich economies need particularly strong checks and balances to contain the potential damage from rent seeking. The regression

[12]The drop in the adjusted R^2 when democracy is added to the regression in Model 4 stems from the decrease in the number of observations.

result above implies that the negative effect of natural resource dependence on growth is significantly more negative in democracies than under authoritarian regimes (not shown). The result suggests that the checks and balances that Collier and Hoeffler (2009) call for are not yet in place in many countries. From this point of view, our empirical findings on the interaction between natural resource dependence and democracy accord also with those of Mehlum, Moene, and Torvik (2006) who report that good institutions deflate the damaging effects of resource dependence on growth.

The results in Model 7 can be questioned on the reasonable grounds that several of the explanatory variables are likely themselves to be endogenous. In particular, it is reasonable to think of democracy, investment, education, and fertility as endogenous economic variables that depend, among other things, on initial income, the sole clearly exogenous variable in the model. For simplicity, we will view the two natural capital variables as exogenous as well. Rather than look for virtually impossible-to-find instruments with the requisite properties to address the potential endogeneity problem at hand, we apply the SUR method. By this method, democracy, investment, education, and fertility are first separately regressed on initial output and the two natural capital variables. By design, the predicted values from those regressions are themselves exogenous. When those predicted values are used instead of the corresponding original values in the growth regression, all the explanatory variables in that regression are exogenous. The effects of natural resource dependence on growth via democracy, investment, education, and fertility are present in the growth equation. Even if the direct effect of natural resource dependence on growth were found to be insignificant, there would still be room for natural resource dependence to move growth through the four dependent variables of the auxiliary equations.

The results of estimating our growth model as part of this five-equation system are presented in Model 8 in Table 2.1. They are virtually the same as in Model 7. Provided we accept that the two natural capital variables are approximately exogenous for our purposes and that the system is correctly specified, the similarity between the results from Models 7 and 8 seems to suggest that endogeneity, at least that part of it that stems from democracy, investment, education, and fertility, does not severely contaminate the results in Model 7.[13]

The results from Model 7 accord reasonably well with a number of recent empirical growth studies. In Model 7, the coefficient on initial income suggests a conditional convergence speed of almost two percent per year. This is not far

[13]The auxiliary equations for democracy, investment, education, and fertility (not presented) show a significantly positive effect of initial income on democracy and education, an insignificant effect on investment, and a significantly negative effect on fertility, all as expected. They also show a significantly negative effect of natural resource dependence on democracy, investment, and education and a significantly positive effect on fertility. At last, they show a significantly positive effect of natural capital abundance on democracy and investment, an insignificant effect on education, and a significantly negative effect on fertility.

below the two percent to three percent range typically reported in econometric growth research. The coefficient on the natural resource dependence variable suggests that an increase in the share of natural capital in total wealth by 20 percentage points reduces per capita growth by half a percentage point, even if natural resource abundance may at the same time be good for growth. This effect is broadly in line with several recent studies, beginning with Sachs and Warner (1995), that have reported an adverse effect of natural resource dependence on growth, based on various measures of the natural resource intensity variable.[14] The coefficient on the natural resource abundance variable is discussed in the next subsection. The coefficient on the investment rate suggests that an increase in investment by 37 percent (e.g., from 18 percent of GDP to 25 percent) increases annual per capita growth by half a percentage point, a strong but fairly typical result in those growth studies that report a statistically significant effect of investment on growth (rather than leaving investment out on the grounds that it is an endogenous variable like growth). The coefficient on the education variable in Model 7 means that an increase in secondary-school enrolment by 90 percent (e.g., from 25 percent to 48 percent) increases per capita growth by half a percentage point. A reduction in fertility from 4.25 births per woman to 3.0 births per woman also increases annual per capita growth by half a percentage point. This suggests a significant population drag on growth or, alternatively, an additional channel through which the build-up of human capital aids growth.

Net Effects of Natural Capital

We have seen that natural capital influences economic growth in two ways. An increase in the share of natural capital in total wealth reduces economic growth, while an increase in natural capital per person stimulates growth. Because natural capital per person equals, by definition, the multiple of the share of natural capital in total wealth and wealth per person, Model 7 in Table 2.1 suggests that the total effect of an increase in the natural capital share on economic growth is –0.025 plus 0.041 times wealth per person (in hundreds of thousands of U.S. dollars). Therefore, the total effect of an increase in the natural capital share on growth declines with wealth per person but remains negative as long as total per capita wealth is below US$61,000 (= $0.025/0.041\times10^5$). For comparison, the median total per capita wealth in our sample is US$35,000. In the sample, 106 countries have total wealth below US$61,000 and 58 countries have more than that. This means that an increase in the natural capital share tends to reduce growth in developing countries, but may well increase growth in industrial countries. Hence, the net effect of an increase in the natural capital share on growth is negative in two-thirds of the countries in the sample. These results can be supplemented by tracing the additional effects of increased natural capital on real capital via blunted incentives to save and invest; on human capital through neglect of education; on social capital via rent seeking, civil and political oppression, corruption, and so forth; on

[14]For a contrary view, see Lederman and Maloney, 2008.

TABLE 2.2

Decomposition of per capita growth (in percent)		
Per capita growth	2.42	1.00
Natural capital share (19.0)	0.47	0.19
Democracy (6.4)	0.35	0.14
Investment (log, 0.29)	0.39	0.16
Secondary-school enrolment (log, 0.86)	0.48	0.20
Fertility (1.8)	0.73	0.30

Note: The table shows the contributions to per capita growth per year of a decrease in the natural capital share and fertility and an increase in democracy, investment, and school life expectancy by one standard deviation for each variable. In the last column, the growth rate in the top row is normalized to one. Standard deviations are shown within parentheses.

financial capital through failure to develop institutions; and on foreign capital through protectionism along the lines discussed in the next section.

Relative Importance of Different Sources of Growth

What do the results reported here suggest about the relative importance of the different determinants of growth included in Model 7? To see this, consider a country whose growth performance is correctly described by Model 7 in Table 2.1 and where five of the determinants of growth listed—natural capital share, democracy, investment, education, and fertility—move in a growth-friendly direction by one standard deviation each (shown within parentheses after each variable), while initial income and natural capital per person remain unchanged.

Table 2.2 shows that such a change would increase the country's per capita growth by 2.42 percentage points and, moreover, disentangles the individual contributions of the five separate determinants of growth to this outcome. For comparison, the median per capita growth rate in our sample from 1960 to 2000 was 1.5 percent per year. The last column normalizes the preceding column by assuming instead that each variable changes by 41 percent of a standard deviation such that per capita growth increases by one percentage point. Strikingly, the human capital variables—education and fertility—account for half of the increase in growth by one percentage point, with investment in real capital, natural resource dependence, and democracy accounting for the remaining half. Accounting for roughly a fifth of the total effect, the natural capital share makes an economically as well as statistically significant contribution to economic growth for the given natural capital per person. Investment and democracy also make a difference to growth, each accounting for roughly a sixth of the total effect. In this exercise, none of these variables can be counted out. They all make a difference.

CONCLUSION

The list of countries that have failed to use their abundant natural resources to foster rapid economic and social progress is a long one. Before we conclude, consider Nigeria, which has not been mentioned thus far in this chapter except in passing.

Nigeria's per capita GDP grew more than twice as fast in its first decade after independence, 1960–1970, as it did subsequently, despite the colossal export revenue boom of the 1970s and beyond. Per capita growth in Nigeria has averaged 1.1 percent per year since 1960. Life expectancy since independence has increased by 10 weeks a year, on average, for a total of ten more years of life for the average Nigerian from independence compared with 25 more years in Algeria, for example. This is not much to show for all of Nigeria's oil proceeds. Gross mismanagement of the oil rent appears to be at the root of Nigeria's problems, and Nigeria is not alone.

To get Nigeria growing again, it has been suggested that oil revenues must be transferred from public hands to the private sector (Sala-i-Martin and Subramanian, 2003). But the private sector is far from infallible too, as events since 2007 in world financial markets, including in Nigeria, have demonstrated once again. Consider this analogy: If judges prove corrupt, the solution is not to privatize the judicial system. Rather, the solution must be to replace the failed judges and reform the system by legal or constitutional means aimed at securing the integrity of the courts.

Nevertheless, if the privatization route is taken in Nigeria, it matters to whom in the private sector the oil rent is transferred. If the rent is divided evenly among the adult population, as in Alaska, the allocation could be deemed fair if not necessarily efficient. If, on the other hand, the resource rent is granted to select interested parties, as in Iceland where fishing quotas are handed free of charge to boat owners, the allocation fails the fairness test as well as the efficiency test.

In this spirit, rather than dwell on failure, this chapter has highlighted some key features of some of the most successful natural-resource-rich countries, especially Norway and also, briefly, Botswana, Chile, and Mauritius. Empowered by vivacious trade, strong emphasis on education, good policies, and good governance, these countries have been able to harness their resource rents for the benefit of their people, the rightful owners of the resources according to local laws as well as the International Covenant on Civil and Political Rights. Privatization was not part of the solution.

The United States remains the sole country that transferred its oil wealth to private companies, though it did so long ago and quite legitimately within its democratic system of government. By contrast, the Norwegian government in its role as guardian of the people has kept a tight grip on the country's oil wealth while at the same time setting up a governance structure intended to safeguard its Oil Fund, now its Pension Fund, from political interference. Clearly, African countries, with their pressing economic and social needs, cannot be expected to show the same patience as the Norwegians. Africa is in a hurry.

Even so, African countries have it within their grasp to build up governance structures designed to separate the management of their resource wealth from short-term political pressures. Any country with an independent judiciary or an independent central bank or both knows, from experience, how to set up institutions to immunize from the vicissitudes of the political process those public policy spheres deemed too important to be left in the hands of politicians.

But even if this task can be satisfactorily accomplished, it will remain desirable and necessary to tailor fiscal, monetary, and exchange-rate policies and institutions in resource-rich countries to their special circumstances, not least to increase as far as possible the efficiency of revenue collection and to uproot the scourge of overvaluation.

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CHAPTER 3

Primary Commodities: Historical Perspectives and Prospects

MARIAN RADETZKI

This chapter is intended to provide a historical framework for the analysis of national commodity export dependence. It is organized into four sections, each treating one of four themes. The first section reviews the significance of primary commodities in the overall economy at different stages of economic development. The second section tracks the long-run decline in bulk transport costs and explores the implications of this for the establishment of markets with a global reach. The third section considers the 50-year wave of deep public intervention and control, in both commodity production and trade, in the middle of the 20th century. The fourth section reviews commodity prices, both long-run trends and short-run instability. The final section of the chapter summarizes the historical findings and looks forward in an attempt to provide some insights relevant to nations heavily dependent on commodity exports.

PRIMARY COMMODITIES IN THE ECONOMIC DEVELOPMENT PROCESS

The significance of the primary commodity sector in a national economy generally declines in the process of economic development. While long historical series to vindicate this statement are hard to come by, research by Simon Kuznets (1966) is illuminating. Kuznets presents the following assessments of the shares of agriculture and mining in GDP in selected countries over extended periods (the year dates are approximate). The contraction in the primary share emerges starkly from his figures:

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Australia	1860: 36%	1940: 26%
Italy	1860: 55%	1950: 26%
United Kingdom	1905: 41%	1950: 13%
United States	1870: 22%	1960: 5%

Data on a more systematic basis do not become available until the late 1930s, and Table 3.1 presents time series for selected countries where these series are reasonably complete. Here too, the primary share exhibits a dramatic decline as the economies develop over time. The table additionally demonstrates far lower primary shares at each point in time for the richer countries, compared with the poorer ones. The latter cross-section observation is confirmed by a broader sample of nations shown in Figure 3.1. There is a strong reverse correlation between the level of economic development and the share of the primary sector in the economy.

A closer look reveals that at early development stages agriculture predominates in the primary sector. In Kuznets' assessments, for instance, the agricultural sector exceeded four-fifths of the total for the initial year, except for Australia, where it was just above 60 percent. Because of its dominance, agriculture also accounts for most of the recorded contraction of the primary share over time. The decline in the much smaller initial share accounted for by mining is less accentuated. In some cases (e.g., Italy, United States), that share appears to have remained relatively stable through the economic development process (Kuznets, 1966).

Exceptions to the observed regularity require mention. Norway is an outstanding example, a country whose primary share has shown no decline over time, as shown in Table 3.1 (where the elevated oil and gas prices in 2006 undoubtedly contributed to the extreme value recorded in that year). Norway also represents an outlier position in Figure 3.1, combining a very high income level with an equally high primary-sector share. The traditional importance of fishing in Norway's economy explains the heavy weight of the

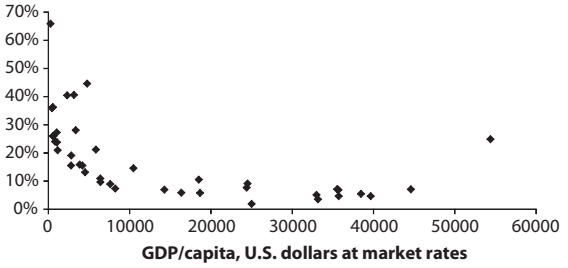
TABLE 3.1

Share of agriculture and mining in GDP (percent), time series, 1938–2006

	1938	1955	1975	1995	Latest
Argentina	25	19	15	8	15 (2005)
Canada	19	14	10	7	8 (2003)
India	–	45	40	31	21 (2005)
Italy	28	25	9	3	3 (2006)
Japan	23	24	7	2	2 (2005)
Norway	15	16	12	16	30 (2006)
South Korea	–	46	27	7	4 (2006)
Thailand	48	46	34	14	13 (2005)
Turkey	48	43	29	17	11 (2006)
United States	11	7	8	3	3 (2005)

Source: UN (annual).

Figure 3.1
Share of primary sector in GDP, 2004



Source: United Nations, Statistics Division, National Accounts Main Aggregates Database (updated), http://unstats.un.org/unsd/snaama/dnllist.asp.
Note: The graph represents 38 countries selected to assure a wide spread in per capita GDP. *Primary sector* is defined as agriculture, hunting, forestry, fishing, mining, and utilities.

primary sector until the 1960s. The subsequent development of offshore oil and gas has made Norway exceedingly rich, while expanding the primary share even more.

Even after taking account of existing exceptions, the data show clearly that the dominant pattern is a decline in the primary share of the economy as nations develop. In rich market economies, the primary sector seldom exceeds 5 percent of GDP. Even in sparsely populated Australia and Canada, with abundant export-oriented agriculture and a rich mineral endowment, the primary sector contributes less than 10 percent of overall national value added.

The finding that the primary sector exhibits declining importance as economies develop is not particularly surprising. Simply expressed, and abstracting from the possibilities offered by foreign trade, a key element in the economic development process is rising productivity that permits satisfying the need for raw materials with ever smaller factor inputs. Labor and capital can then be switched to the secondary sector, that is, the production of manufactures whose sophistication typically increases over time. As the demand for manufactures too is eventually saturated, the factors of production can migrate again, this time to the service sector. The overall economy expands, but the secondary and tertiary sectors more than the primary one, leaving the latter with a declining share of the total. The income elasticity of primary commodities is clearly less than 1.

With this perspective, the path of economic development can be seen as a process of dematerialization. Since all physical inputs originate in the primary sector, and since this sector accounts for a shrinking share of the total, it follows that each dollar's addition to GDP will carry a material weight that declines over time. Table 3.2 illustrates what is involved. It presents the value in U.S. dollars (2000) per kilogram of a set of goods and services, listed in an ascending order. The higher the value, the less primary material inputs will be needed per dollar value represented by the items. The essence of economic development is

TABLE 3.2

Value of selected goods, in U.S. dollars per kilogram, at 2000 prices	
Iron ore	0.02
Steam coal	0.03
Wheat	0.12
Crude oil	0.21
Standard steel	0.25
Newsprint	0.40
Super tanker	2
Motor car	15
Dish washer	25
TV set	60
Submarine	100
Large passenger aircraft	600
Laptop computer	1,000
Mobile telephone	2,000
Jet fighter	6,000
Windows 2000 Software, CD-Rom	20,000
Telecom satellite	40,000
Banking service	almost ∞

Source: Radetzki, 2001.

to move the center of the economy's gravity down the list, toward goods with ever higher value per kilogram. In consequence, as countries grow richer, the need for raw-material inputs will grow more slowly than the overall economy. Materials savings will be further boosted by technological progress which is typically weight reducing. The need for primary materials inputs tends to stagnate with economic development, and in some prosperous nations it has started to shrink in absolute terms as their economies have grown even richer. In any case, global economic growth has exceeded the demand growth for virtually all raw materials.

Most of the global consumption growth in the present century has occurred in emerging economies, with an exceptional position taken by China, on account of that country's size and the pace of its economic expansion. In 2009, China accounted for 12.5 percent of world GDP (measured in purchasing-power-parity-adjusted terms; IMF, 2010), but its share of global oil consumption *growth* in this century was 50 percent (BP, annual). In the case of copper, the growth of China's usage between 2000 and 2008 remarkably corresponded to 113 percent of global expansion (Cochilco, 2009), implying a 12 percent shrinkage in the rest of the world. An even more spectacular case occurred in the iron ore trade, where China's import growth between 2000 and 2009 (560 million metric tons) corresponded to 125 percent of global import growth (450 million metric tons; UNCTAD, 2010). Therefore, excluding China, world iron imports declined by 20 percent.

It is easy to become complacent about the role and importance of the primary sector when its share of the economic activity settles at no more than a few percentage points, as is the case in many prosperous nations. Complacency may continue so long as commodity markets function smoothly and existing needs can be satisfied without serious hurdles. Complacency may also be

encouraged by the fact that sophisticated modern economies have become masters of substitutability, permitting them to do without a particular material. But the ability to substitute will be of no help against a general constraint on the supply of raw materials in the aggregate, for it is overwhelmingly clear that not even the most modern economy can function without assured raw materials availability. The population will die if food supplies fail. The manufacturing sector is critically dependent on raw materials inputs, even if the volumes needed have shrunk impressively compared with the value of manufactured output. The service sector may require quite insignificant inputs of raw materials, but it clearly cannot function if these supplies fail. The classic Paley Report puts it quite succinctly:

> The Materials Problem now demands that we give new and deep consideration to the fundamental upon which all employment, all daily activity, eventually rests: the contents of the earth and its physical environment. (Paley, 1952)

Primary commodities are indispensable, just like an ordinarily inconspicuous glass of water that acquires an immense value in the desert. This is easily forgotten, given the economic insignificance of raw materials in "normal" times when their availability is taken for granted.

FALLING TRANSPORT COSTS AND GLOBALIZING MARKETS

Prior to the mid-19th century, freight rates on long hauls were prohibitively high, except for goods with very elevated unit prices. In consequence, global commodity trade at the time was small in volume and consisted mainly of highly valued luxuries like coffee, cocoa, spices, and precious or semiprecious metals, imported predominantly to industrializing Europe (Landes, 1980). The main subsequent changes in transport technology and transport costs for bulk materials, it seems, occurred in two spurts. The first took place in the latter half of the 19th century; the second began in the 1950s and came to fruition in the 1970s. Each involved the globalization of numerous additional markets for commodities which until then had a limited geographical reach. Globalization involves not only trade flows across oceans and between continents, but also, importantly, a convergence of prices across regional markets.

In the latter half of the 19th century, the application of steam power to transport revolutionized the economics of moving goods on land and across oceans. A large amount of raw materials produced at increasing distances from the coast in overseas territories became economically accessible to the world's industrial centers as overland transport by oxen, horses, and camels was switched to railways and as metal steamships replaced wooden sailing vessels. This becomes dramatically evident in Paul Bairoch's (1965) numbers for the cost of shipping cotton and wheat from New York to Liverpool in constant (1910–14) dollars per ton:

1825: 55.1 1857: 15.7 1880: 8.6 1910: 3.5

Shipping costs are akin to tariff barriers. Little trade will typically take place when the transport charges account for a dominant share of delivered price. Trade will be encouraged as this share declines.

The evolution of cereal imports into Western Europe vividly illustrates the impact that declining costs of transport had on the widening of production sources. Odessa's short-run glory as a leading European port in the mid-1800s was based on a boom in the shipping of Russian and Ukrainian rye and wheat to Western Europe. Much of this trade was lost in the 1870s, first because of a flood of steam-shipped American wheat after the end of the Civil War in the United States, and then because of the extension of Russian railways, which took over the transport of remaining Russian cereals exports.[1] At the same time, new rail connections from the prairies around Chicago to New York made the U.S. cereals even more competitive in Europe. The bulk transport revolution continued during the following decades. Between 1880 and 1910, the cost of transatlantic shipping declined from 18 percent to 8 percent of the price of wheat in the United States (Bairoch, 1965).

The 1880s also saw the introduction of refrigerated ships, permitting the long-distance transport of meat and fruit. The globalization of the markets for many food products speeded up European industrialization by assuring cheaper food supplies to the growing numbers of urban industrial workers. But it also involved painful adjustments for European farmers, who lost out to overseas supplies in many food products and agricultural raw materials like cotton and wool. The impact was profound: In the 1850s, two-thirds of British bread consumption was based on domestic cereals; by the 1880s that proportion had shrunk to 20 percent (Dillard, 1967).

The second spurt in transport technology was far more specific, and significantly, it was triggered by the Suez crisis in the mid-1950s. The shipping industry's response to the canal closure was to opt for huge specialized bulk carriers, along with their concomitant loading and unloading facilities in the harbors, to permit economic transport of low-value products like iron ore, steam coal, bauxite and oil across vastly extended distances. The impact of the effort began to be felt only in the 1970s. The result was a further dramatic decline in the cost of shipping, particularly accentuated for the truly extended, transoceanic transport routes.

Between 1960 and 1988, the average size of a bulk carrier fleet ship had more than doubled. In 1960, virtually all internationally traded iron ore and coal was shipped in vessels of less than 40,000 deadweight tons, but this proportion had declined to 10 percent or less by 1988. Vessels in excess of 100,000 deadweight tons did not exist in 1960, but by 1988 they accounted for 70 percent of iron ore shipments and 40 percent of coal shipments (Lundgren, 1996). These tendencies

[1] *The Economist*, December 16, 2004.

have been further accentuated, and in the current century vessels in excess of 200,000 deadweight tons completely dominate additions to the bulk carrier fleet.[2]

The economic impact of the new bulk transport technology was very substantial, and especially so for the mining industries. Many of Europe's miners faced problems akin to those experienced by its farmers 120 years earlier. Freight rates for getting Brazilian iron ore to Europe declined from $24 per ton in 1960 to $7 in the early 1990s. At the same time, the costs for much shorter shipping distances, such as iron ore from Narvik in Norway to Germany were reduced from $8 to $4 per ton. The shipping cost advantage of the geographic protection afforded to the Swedish supplies shipped through Narvik thus shrank from $16 to only $3 (Lundgren, 1996). The shipping freight rate for coal, measured as a proportion of the total price for U.S. coal in Western Europe, fell from more than 30 percent to less than 15 percent during this 30-year period. The consequence was a fast evolution of global markets for these low-cost products. Long-distance maritime iron ore trade rose from 23 percent of world production in 1960 to 36 percent in 1990 (Lundgren, 1996) and then to 56 percent in 2009 (UNCTAD, 2010). In 1960, transoceanic trade in coal accounted for 2 percent of global output (Lundgren, 1996) but by 2007 that share had risen to 14 percent (IEA, 2009).

The market for natural gas is the most recent to be subjected to the forces of globalization. Gas is an extremely bulky product (prices in the range of $0.1–$0.2/m^3) with transport costs constituting a very high proportion of delivered price. Until at least the 1980s, transport by pipe was the dominant delivery mode. The lowest-cost gas sources had a limited geographical reach, because the transport cost was proportional to distance. Three regional markets developed around the main consumption centers, specifically (i) North America; (ii) Europe (including Russia), both predominantly supplied by pipe from internal sources; and (iii) Japan, Korea, and Taiwan, supplied exclusively by liquid natural gas (LNG)[3] from Australia, Indonesia, and Malaysia. Each of the three markets was, by and large, isolated from the others, with prices evolving along separate levels and patterns. Until the mid-1990s, the East Asian market recorded prices that were twice the level in the United States and 50 percent higher than in Europe (BP, 2010) primarily because of the high cost of liquefaction and shipping. Since then, however, prices have been equalized in the three markets due to a combination of rising prices of piped supply and substantial cost reductions in the LNG production and transport technology. Both developments have stimulated a very fast growth of additional LNG sources, providing an extended web of long distance supply routes, in effect establishing a truly global market for natural gas. In 1989, 15 percent of global natural gas production was traded internationally, and

[2]Private communication in 2010 with Lennart Nilsson, Institute of Shipping Analysis, Göteborg, Sweden.

[3]Approximately 1.4 m^3 of natural gas equals 1 kg of LNG, with prices in the range of US$0.2-0.4/kg. The substantial compression makes LNG economically transportable by ship.

the LNG share accounted for 22 percent (65 billion cubic meters) of the traded total (BP, 1990). By 2009, the traded share had risen to 37 percent (243 billion cubic meters), with one fifth of total trade as LNG (BP, 2010).

The successive technological revolutions gradually reduced the transport costs of bulk commodities by a total of almost 90 percent between the 1870s and 1990s (Lundgren, 1996). The more recent Internet revolution, by facilitating communications, has suppressed the cost of long-distance trade even more. This, in turn, has increased the number of globally traded primary commodities, from selected high-priced luxuries before 1850 to encompass virtually all products with perceptible values by 2005. Even waste—for example, metal scrap, rejects from forestry and agriculture, and packaging material after use—valued as sources of energy extraction or for recycling, is increasingly subject to international trade. Chinese stone for garden decoration is being successfully marketed in Europe.

An important repercussion of the globalization of primary commodity markets has been a growing dependence on imported supply of the world's manufacturing centers, initially Europe, then Japan and the United States, and most recently China.

THE ENTRY AND EXIT OF THE STATE IN THE COMMODITY SECTOR IN THE 20TH CENTURY

There was a 50-year wave of far-reaching public and political intervention in primary commodity markets, beginning in the early 1930s. Since the late 1970s, however, the governments have been abdicating wholesale from their commanding positions in the primary commodity world.

I see four major and two subordinate factors explaining the deep public interventionism in global commodity production and trade. (i) The *Great Depression* of the 1930s led to a price collapse for many primary materials, so deep that it prompted public intervention to rescue farmers and miners. (ii) The *Second World War* created havoc in many supply lines, motivating government entry to restore order. (iii) The *breakup of colonial empires* established many newly independent economies dominated by raw materials, whose governments thought it imperative to expand control, especially in minerals and energy where ownership had traditionally rested in foreign hands. (iv) The second and third quarters of the 20th century were ideologically flavored by strong *beliefs in the need for collective action* to come to grips with the serious fallacies of the market system (Skidelsky, 1996).

The two subordinate factors are (v) the economic *ascendancy of the Soviet Union* and its interventions in international commodity trade; and (vi) the concerns raised by the *emergent import dependence of the United States* for many strategic raw materials. Sometimes, one factor was enough to launch public action, but quite often, several of these factors reinforced one another in triggering it.

In the 1930s depression, falling prices prompted joint action by the governments of Canada and the United States in the wheat markets to cut export supply

and save farmers from further price falls. Similarly, Cuba collaborated with Java in launching export quotas in sugar. The colonial administrations of Malaya and Ceylon instituted export restrictions on rubber, but this scheme met resistance from consuming interests in the United States and was soon abandoned (Rowe, 1965).

In the 1945–65 period, with the scarcities and price spikes of the Second World War and the Korean conflict still fresh memories, commodity agreements were launched by governments, to keep prices within bands acceptable to both exporters and importers. Export controls and buffer stocks were the instruments used. The markets for sugar, wheat, coffee, tin, and many other commodities were subjected to such controls, but eventually they all disintegrated, primarily because they did not live up to the anticipated expectations (Radetzki, 1970).

The decade after the Second World War involved a painful experience for the United States, as the country became dependent on imports of a widening group of commodities of critical importance in both war and peace (Paley, 1952). This prompted the government to build strategic inventories, sometimes of very significant size. The extent to which these inventories assured stable supplies to the United States is unclear, but their acquisition and subsequent disposal created serious instability in the commodity markets (Cooper and Lawrence, 1975; International Tin Council, annual and monthly).

The early 1970s also witnessed commodity price and export controls in several countries, designed to assure supplies at low prices to domestic users. In the United States, price ceilings combined with export restrictions on many commodities were instituted for that purpose (Cooper and Lawrence, 1975). The gasoline queues in the United States in 1974 were a direct consequence of the gasoline price caps. The Canadian government implemented severe constraints on uranium exports in the mid-1970s, purportedly to ensure that national needs were met (Radetzki, 1981).

Foreign aid became common after numerous nations in Africa and Asia gained independence in the 1950s and 1960s, and several commodity agreements were extended by adding elements of foreign assistance. One such extension involved guarantees by the importing member countries to buy predetermined quantities at above-market prices. Another was "food aid," which might have improved nutritional standards but at the same time made life harder for third world farmers (Radetzki, 1970). Sometimes, self-interest rather than altruism motivated the assistance measures, as in the coffee agreement which guaranteed Latin American producers more than the market price with the virtually explicit motive of preventing the spread of non-capitalist political systems (Commodity Research Bureau, 1964; Rowe, 1965).

The Soviet Union was similarly active. It signed a number of bilateral agreements, in a few cases involving the entire commodity export of individual developing countries for many years, in exchange for its manufactures. These agreements were regularly biased in favor of the exporting nation, with an implicit aim to gain political influence. Sometimes it did not work so well for the "beneficiaries," as when the Soviet Union resold large quantities of Cuban sugar

and Indian cloth in Western Europe, suppressing prices for the exporters' sales outside the "agreement" (Radetzki, 1970).

Despite the courtship of developing countries by commodity importers, in the 1960s and 1970s there was a massive wave of nationalizations of foreign-owned positions, primarily in the minerals and energy fields. Compensation was meager in these takeovers. The United States and the United Kingdom lost the most in the process, being the largest foreign direct investors in these sectors. The Soviet Union and Japan did not suffer much, since their ownership holdings were insignificant. The resultant state enterprises in minerals and energy brought in yet another tool for public intervention in primary commodities.

Governments started to retreat from commodities control in the 1980s. Disappointment about the results of public interference became common. State entrepreneurship had not delivered as anticipated. A shift in beliefs also played a crucial role. Confidence in market solutions was boosted by the ideological revolution launched by Margaret Thatcher and Ronald Reagan. "Political failure" replaced "market failure" as the main problem to handle.

Far-reaching consequences have since followed from the public retreat. International commodity agreements in which governments meddle for whatever objective have completely lost their appeal. Instead, hedging on widely extended futures markets is used for the purpose of price stabilization. Publicly controlled strategic stocks in the present century are limited to petroleum, and at less than 5 percent of global annual consumption (IEA, *Oil Market Report*), they represent a trifle compared with the ambitious schemes of earlier decades. Government price controls have not been considered either, despite threefold price increases for materials like copper, iron ore, and oil between 2002 and 2008. The market is seen as an adequate instrument for establishing the value of transactions between exporters and importers. No queues have been seen at the petrol stations or at the strategic metal warehouses in the rich world of late. Attempts in China, India, Indonesia, and other emerging countries to shield their consumers from the oil price rises in 2004–08 did result in queues in some cases, but these attempts have proved unbearably costly to public budgets and are being dismantled (IEA, *Oil Market Report*). A wholesale privatization occurred in the non-fuel mineral sector, but in contrast, state ownership continues unabated in the oil industries of the developing countries, perhaps because of laxer performance requirements stemming from the OPEC cartel's continuing maintenance of monopolistic prices.

Governments' abdication from involvement in primary commodity markets has been quite impressive, though it is far from complete. The most important exception relates to the rich world's agricultural policies which continue to seriously distort the markets for a number of food products. In the middle of the past decade, farm subsidies represented 34 percent of the value of overall farm receipts in the European Union and 58 percent in Japan.[4] For some products, subsidies

[4] *The Economist*, July 1, 2006.

exceeded 100 percent. OPEC represents the other important remnant of public involvement in international commodity markets. The cartel's member governments have remained the dominant owners of the oil industry, and the state-owned oil enterprises worldwide control close to 90 percent of the world's conventional oil resources.[5] The same governments keep a tight rein on policy, in terms of output and prices, as well as on the volume and direction of oil investments. They appoint the corporate managements, often on political merit, and they also control the financial resources available to their oil industries.

Despite these exceptions to public abdication in the primary commodity sectors, it is clear that the era of state interventionism is far past its peak, and that market forces concurrently play a greatly expanded role in international commodity markets.

Nevertheless, events in Bolivia, Russia, and Venezuela since the middle of the last decade suggest that the temptation to maintain state control and to undertake further nationalizations in oil and gas remains strong, especially when prices and profits are high. Fears have been voiced that the recently ascending popularity of state control in some places may be a harbinger of a new wave of public intervention in the resource industries, coming after a 30-year withdrawal.

REAL PRICES: FALLING LONG-RUN TRENDS AND SHORT-RUN INSTABILITY

Long-Run Price Trends

There are two well-argued and opposed lines of thought about the future direction of the trend in long-run real commodity prices. The first, mainly theoretical tradition, asserts that commodity prices will be rising. It derives its roots from classical economists Adam Smith and David Ricardo and is elegantly synthesized in this passage from John Stuart Mill:

> The tendency, then, being to a perpetual increase of the productive power of labour in manufactures. while in agriculture and mining there is a conflict between two tendencies, the one towards an increase of productive power, the other towards a diminution of it, the cost of production being lessened by every improvement in the process, and augmented by every addition to population: it follows that the exchange value of manufactured articles, compared with the products of agriculture and of mines, have, as population and industry advance, a certain and decided tendency to fall. (Mill, 1848, Book IV, Chapter 2)

The notion of raw materials prices rising due to increasing pressures caused by land and mineral scarcities remained out of vogue for a long period during the 20th century because it was contradicted by many empirical observations. Since the early 1970s, however, it has attracted a temporary but intensive concern following the publication of Club of Rome reports about an impending general

[5] *The Economist*, July 1, 2010.

depletion of resources, and then again during the commodity boom early in the present century, when fears of rising scarcity resurfaced in the proclamations of impending "peak oil" and similar production peaks for many other natural resources (Radetzki, forthcoming).

The second tradition is founded on empirical observations, and asserts a falling trend in real commodity prices. It was originally developed by Hans Singer (1950) and Raul Prebisch (1962) who argued that there is an asymmetry in the response of prices to productivity gains between commodities and manufactures. The markets for the former are highly competitive, so any productivity improvement leads to a price decline. The monopolistic organization of the labor and capital employed in manufactures production, in contrast, enables the factors of production to reap the benefit of productivity gains in the form of higher income. The Prebisch–Singer explanation of falling commodity price trends aroused an extended debate. Its critics have remained unconvinced, even though the performance of OPEC appears to support the Prebisch–Singer view.

There are several other, less controversial reasons that could explain a long-run decline in real commodity prices. First, as noted, the income elasticity of demand for most commodities is low, so the slower growth of commodity demand as income expands would tend to result in a weaker commodity price development. In fact, Singer himself used this argument in support of his theory. The second reason is that transport costs ordinarily constitute a higher proportion of the delivered price of commodities than of manufactures. The secular fall in transport costs should therefore have resulted in a stronger decline in CIF commodity price quotations. Third, and probably most important, the manufactures price index in real terms is tricky to construct and interpret because of the continuous shifts in its product composition and in the quality improvements over time of individual manufactures (Svedberg and Tilton, 2006).

Many empirical attempts at establishing the long-run commodity price trends in constant money have been undertaken. Among the more recent attempts are those by Cashin and McDermott (2002), Cuddington, Ludema, and Jayasuriya (2007), Grilli and Yang (1988), Hadass and Williamson (2003) and Harvey and others (2010), and they have yielded very varied results. Depending on the end points of the series, the countries whose trade is covered, the deflator used, and the commodities included, the outcomes of these investigations have typically ranged between stagnant and substantially declining developments, apparently adding more support to the Prebisch–Singer thesis than to the one formulated by the classical economists. There seems to be some tendency for real raw material prices to fall in the long run.

Short-Run Instability and Commodity Booms

An important feature of commodity prices is their rapid, unexpected, and often large movements (Cashin and McDermott, 2002). This is a well known and oft repeated statement, as is the observation that the prices of manufactures tend to be

more stable. Illustrations of violent commodity price gyrations, up as well as down, over relatively short time spans are easy to produce, even when the major commodity boom periods are excluded.

It is equally easy to point to the main reasons for the sharp commodity price instability. The price elasticity of demand for raw materials is usually quite low, given that the cost of such materials typically constitutes a small proportion of the finished product price. Furthermore, a given increase in demand for finished products will regularly result in a more accentuated increase in the demand for the raw materials employed, as the desired inventories are augmented from the finished product marketing stage back through the entire production chain.

Fluctuations in supply also contributed to price instability. Weather is an important cause of supply variations in agricultural crops, even though geographical diversification of production in recent decades has reduced the importance of this factor (IMF, 2006). Mineral supply can be caused to shrink due to strikes or technical accidents, though such failures would have to be widespread to significantly dent the global total. The price elasticity of supply would also be quite low, at least when capacity is fully utilized, which is normally the case in competitive markets. Therefore, with the exception of annual crops, it takes an extended period of time to add to supply capacity, and in the meantime even small variations in demand will result in sharp changes in price.

The above, then, are the main explanations for the short-run price instability observed in most primary commodity markets. Such instability is believed to cause serious macroeconomic problems to countries that are heavily dependent on the exports of one or a few commodities.

Commodity booms are characterized for the purpose of the present analysis as sharp simultaneous increases in the real price of a broad group of commodities. Using this definition, it is possible to detect three such booms in the period since the Second World War, beginning in 1950, 1973, and 2003, respectively (Radetzki, 2006). They were all triggered by demand shocks caused by unusually fast macroeconomic expansion. In all three cases, commodity producers were unable to satisfy the speedy demand growth, and prices exploded to a level far above the long-run equilibrium, defined as the total cost of new marginal supply.

The first two commodity booms collapsed in 1952 and 1974, less than two years after they emerged, in response to profound global recessions and an ensuing shrinkage in commodity demand. The progress of the third boom, which began in 2003, has had a much more complex character (Radetzki, 2006). First, the price increases from the beginning of the boom period until the peak was reached were stronger than during the two predecessors. Second, the durability of this boom was far more extended. In 2007, four years after prices had started to rise, the high price levels persevered, with no recession in sight. When the most profound global economic contraction since the 1930s depression eventually arrived in the second half of 2008, a sharp commodity price correction did indeed occur, but it was of a surprisingly short duration. By the end of 2009, commodity prices were very high again, having recovered a major share of the preceding year's

decline.[6] The explanation to the surprising commodity price recovery in the midst of continuing economic gloom is that the major emerging economies which have accounted for virtually all commodity demand growth in the most recent decade, were little affected by the global recession. By 2009 these nations had already resumed their very fast economic expansion and their commodity demand growth accelerated again.

Claims have been made that the slack monetary policy and inflows of speculative capital into commodity markets in recent years have further boosted commodity prices during the third boom (e.g., Caballero and others, 2008), but in my view these claims are not credible. A financial impact on spot commodity prices requires that commodity inventories expand, and there is no convincing evidence of such expansion in the course of the current boom. On the contrary, in a recent study Irwin and Sanders (2010) assert that stocks were declining, not rising, in most commodity markets between 2006 and 2008, the period comprising the sharpest commodity price increases.

Commodity price levels in the second half of 2010 continue far above their long run equilibrium (Citigroup Global Markets, 2010; UBS Investment Research, 2010), as demonstrated by the very high profits generated by producers. A substantial decline can be anticipated if global demand were to shrink, for whatever reason. Price declines will occur even in the absence of demand contraction, once investments in expanded commodity production capacity become productive. Capacity expansion, however, is proving to be surprisingly time consuming (Radetzki and others, 2008).

POLICY IMPLICATIONS FOR COMMODITY-EXPORTING NATIONS

Several policy implications for nations heavily dependent on commodity exports follow from the above historical overviews. As is revealed by other chapters in the present volume, many other policy recommendations can be formulated for the commodity-exporting nations. What follows here is a partial set based exclusively on the deliberations in the present chapter.

All else being equal, the declining global significance of commodities in terms of their volume in the world economy implies that demand will expand at slower rates than economic growth. This could be seen as a disadvantage for commodity exporters in the aggregate, but not necessarily for individual suitably positioned exporting nations, whose foreign sales could grow by additional market shares.

Most of the future demand growth is likely to occur in emerging economies, with China further enhancing its already important position as a commodity consumer. This suggests a redirection of any marketing efforts aimed at

[6]See IMF's Commodity Price Statistics on the Web at http://www.imf.org/external/np/res/commod/index.asp.

enhancing export sales from the rich, mature countries, where demand stagnates or declines, toward the emerging nations group.

A careful watch is warranted to detect any tendencies toward a macroeconomic slowdown in China, to permit early adjustments to the dire consequences of deteriorating Chinese economic performance for the evolution of commodity demand and commodity prices.

The revolutions in transport costs make it increasingly futile to rely on any advantage based on geography. Suppliers are increasingly facing a truly global market in which they have to compete with output from virtually any corner of the world. This is a challenge but also an opportunity: Importing nations will take less account of the geography of their supply sources and more account of their reliability. Suppliers could gain entry to new markets, with distance constituting ever less deterrence, if they could assure the conditions sought by the importers.

There are valuable insights to be gained from the 50-year experience of public interference in the primary commodity sector. The fact that governments abdicated in disappointment from most of their involvements is a consideration to keep in mind when future policies are formulated. Price stabilization is clearly better handled through the futures markets than with the help of government interference. Maintenance of prices above long-run equilibrium with the help of public regulation commonly ends in a loss of demand with painful consequences to the suppliers. Producer market control to extract monopolistic prices is usually unstable, and the perseverance of the OPEC cartel is an exception to the rule, one made possible by the extremely uneven distribution of oil resources in the ground. Resource rents are regularly extracted better through a coherent fiscal system than through public ownership, given that the inefficiencies of state enterprise result in serious rent dissipation.

Dependence on exports with falling long-run price trends is obviously inferior to reliance on a bundle of export goods with more encouraging price prospects, but profitability and social benefit to the exporting country can nevertheless prevail if progress in technology assures a decline in costs parallel to the price developments.

Projections are usually formulated by assigning an excessive weight to current conditions, and here a warning is in order. When considering future prospects for their economies, commodity exporters are well advised to be conscious that prices in the second half of 2010 were still under the influence of the most powerful commodity boom since the Second World War, and they have far to fall if they are to attain their long run equilibrium levels.

The discussions in this chapter have revealed that the one-sidedness of the commodity-dependent economies involves numerous problems and risks, including slow growth in demand, falling long-run price trends, and short-run instability. But the analyses clearly have not established a general and unambiguous case for diversification. After all, commodity dependence is normally the result of a competitive advantage that yields above-normal returns to the commodity sector. These yields may well be more than adequate to compensate for the disadvantages. On the other hand,

part of the resource rents contained in the above-normal returns will be forgone if forceful measures to diversify are undertaken.

Commodity dependence does not constitute a general trap into technical or other backwardness. Contrary to frequent perceptions, commodity production often requires as much advanced technology and human skill as manufacturing. Modern agriculture and mining make heavy use of microbiology, electronics, and the highly qualified labor that goes with these techniques.

Large and profitable primary commodity production, both agricultural and mineral, holds a prominent place in the economies of prosperous nations like Australia, Canada, Norway, Sweden, and the United States, with long periods of fast growth behind them. Commodity production in these countries would be even greater if the resource base permitted it. The markets or governments would force a contraction of the raw materials industries if they were unprofitable or otherwise socially undesirable.

I conclude, therefore, that a heavy concentration on commodity production in a national economy is not detrimental per se. Diversification out of a commodity sector that has lost its competitive advantage and superior profitability is certainly warranted. But it is much harder to find tenable arguments for recommending that, say, Ivory Coast or Venezuela, both heavily dependent on the exports of a few raw materials, should reduce their commodity reliance by a greater emphasis on manufacturing.

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PART II

Economic Diversification and the Role of Finance

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CHAPTER 4

Economic Diversification in Resource-Rich Countries

ALAN GELB

INTRODUCTION

Developing countries as a whole have been remarkably successful in diversifying their economies and their export structures. This process of diversification has taken many forms. The most prominent change has been the shift toward industry. In the 1960s, some 80 percent of developing country exports were primary commodities; today, almost 80 percent are industrial products. This massive transformation in export structure has been associated with the rise of major industrial power-houses, China most prominently, but also countries such as Korea, India, Brazil, Malaysia, Vietnam, Indonesia, and Mexico. Most of these new industrial powers were previously primary-based economies. Today they are deeply integrated into global production networks across a wide range of sectors, participating in rapidly growing South–South trade, and in most cases rapidly upgrading the sophistication of their export mix.

Other countries have not moved as far towards "footloose" manufactures but have taken advantage of the potential for upgrading their resource-based sectors. For example, between 1975 and 2004 Latin America's share of global markets in metals expanded by 175 percent. During this time its share of global ores and unwrought metals doubled, but its share of worked products increased eightfold (Sinnott, Nash, and de la Torre, 2010). Still other countries have moved away from traditional simple primary exports and toward more complex, yet still primary-based, products and services. The simple primary sectors include horticulture, floriculture, and fresh fish, sectors with formidable demands for efficient logistics services and requiring the ability to comply with sanitary and phytosanitary standards. Some services, such as tourism based on game, beaches, and other natural attractions, can also be considered as resource-based; these also have

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high logistical and technical requirements. Tourism has for some years been the fastest-growing export for sub-Saharan Africa—it now represents the equivalent of over 10 percent of merchandise exports. Much of this is resource-based. Information technology (IT)-related service exports have also been growing, although these are not resource-based.[1]

Sub-Saharan Africa has remained heavily dependent on primary sectors. While about 20 percent of the region's exports are classified as industrial, most of them are modestly processed primary products. Barely one quarter of the region's industrial exports are true manufactures, and the two major categories, automotive products from South Africa and clothing exports from low-income countries, are both supported by special incentive programs (IMF, 2007; Gelb, 2011). As a first approximation, sub-Saharan Africa is not competitive in any sectors that are not based on natural resources.

This chapter considers the issue of diversification from a particular perspective—countries with a very strong comparative advantage in a specific natural resource, especially minerals. Mineral-dominant exporters have particular features and face distinct challenges relative to countries with a balanced endowment of resources. Production linkages with the rest of the economy are relatively limited. Natural rent is highly concentrated and largely realized in the form of fiscal revenues. With some exceptions, notably for artisanal mining, direct employment creation in the mineral sector is often modest.

These tendencies hold to a greater or lesser degree for different minerals and particular economies, but they are particularly marked for oil. Hydrocarbon-rich countries represent an extreme within the range of mineral exporters and deserve special attention. About 35 countries are dependent on hydrocarbons, and new producers, like Ghana and Uganda, are coming on- stream. Within sub-Saharan Africa, oil exporters constitute one-third of the population and land area. Globally, another 12 countries, many of them also in sub-Saharan Africa, are dependent on hard minerals, including copper (Mongolia, Chile, Zambia) and diamonds (Botswana, Sierra Leone).

Such mineral exporters tend to be heavily dependent on their dominant sector. Bornhorst, Gupta, and Thornton (2008) examine 30 oil exporters over the period 1992–2005, a time when oil prices were mostly moderate or low in historical context. They estimate that revenues from hydrocarbons represented on average 16 percent of GDP or 49 percent of total fiscal revenue. For some regions, the averages were higher: For 14 Middle East exporters, they were 20 percent and 57 percent, respectively. But GDP includes both the hydrocarbon sector and a range of other production activities that depend, directly or indirectly, on the oil sector, and many "non-oil" taxes (including import duties and corporate taxes) are themselves dependent on activities and flows that depend on the domestic spending

[1]Tourism based on cultural heritage can also be considered as resource-based to the extent that sites are non-replicable and hence a part of the resource base of the nation. For discussion of the relationship between tourism, heritage sites (which increasingly include natural sites) and development see Arezki, Cherif, and Piotrowski (2009).

and export revenue made possible by the oil sector. The true dependence of these economies on oil is therefore far larger than it appears.

"Sowing the oil" to diversify the economy has been a long-standing goal for many mineral exporters. However, few have managed to break free of dependence on their dominant resource. The objective of this chapter is to look at this problem through the lens of mineral (and especially oil) exporters and focus on some of the policy issues such countries face.

The first question is, Why diversify in the first place? Why try to move away from a sector with very strong comparative advantage? As discussed in the next section, the motive may simply reflect the proposition, which is supported by evidence, that export diversification is associated with higher long-run growth. However, resource exporters differ from one another in many respects, including population, labor force and skills, location, levels of income, reserves, and the potential for other resource-based activities. These differences will shape diversification priorities and policies. For example, productive employment is a major goal in many exporters, including in the Middle East, but there is a striking difference between the six oil-rich labor-importing countries of the Gulf Cooperation Council (GCC) and the other oil-rich but labor-*abundant* countries. Some of the former have extremely large oil reserves and immense mineral riches per capita. Since they are chronic importers of labor their main motivation to diversify cannot be employment for nationals in the usual sense, but they may see a need to diversify assets and income for strategic reasons in the very long run.[2] One outcome has been the Dubai model of development. Dubai, which is discussed further below, is very distinctive, but it does offer some positive and negative lessons for other countries considering a push for diversification. The rest of this chapter considers the more normal cases of low- and middle-income countries that each have a substantial population, large development needs, and a dominant resource sector.

The third section summarizes research on the relationship between resources and rapid growth and development, viewing this from the perspective of diversification. There is still much debate on how resource wealth, or resource dependence, relates to long-term growth. The question is complicated because measures of both resource dependence and resource abundance are at least partly endogenous to growth and income level. The emerging consensus is that resource wealth itself is not necessarily bad. Indeed, the commonsense proposition that it is a good finds considerable support, including from examples like Australia, Canada, and the United States, which have transitioned from resource-based countries to high-income diversified economies. Yet there is a good deal of evidence that diversification of the export bundle is associated with higher long-run growth and that countries that get "locked in" to dependence on a limited range of products do less well in the long run. Moreover, "Dutch disease," defined as a syndrome of

[2]At US$70 per barrel, Abu Dhabi's known oil reserves represent over US$16 million per citizen. Saudi Arabia is an exception among the GCC countries, as it has a considerable and rapidly growing population.

factors that cause countries to lose rather than to benefit from resource wealth, is real for some countries even if it is not inevitable.

One of the main conclusions of the section is that many of the policy and institutional factors that enable countries to manage resource wealth well are equally important for their ability to diversify into other sectors. One important criterion is whether the country has the capacity to smooth out the high macroeconomic volatility that large swings in export prices can transmit to mono-exporters. If not, it will be far more difficult to sustain investment in the nonresource traded sectors, which will be destabilized by large swings in the real exchange rate. Cross-country studies also suggest that the impact of resources on growth is not homogeneous. Rather, the impact depends on whether the country is well endowed with two types of capital that can be seen as complementary to natural resources: human capital and governance or institutional capital. Without these, the country is more likely to experience a resource curse. There is also evidence that countries with lower levels of these complementary assets will find it more difficult to diversify and to advance up the export technology ladder. This suggests that in the long run countries need a balanced endowment of factors to grow. Resource wealth offers opportunities for countries to build human and institutional capital, but many countries lag badly in these areas.

Resource wealth also offers countries a choice: whether to invest the wealth in ways that decrease costs and increase productivity in the nonresource traded sectors, or to spend it in other ways, which will lock in resource dependence. Currently there is much debate over the policies for promoting economic growth and structural change. In particular, views diverge on the right balance between policies that emphasize macroeconomic stability, openness, and a generally sector-neutral role for the state ("horizontal" policies) and policies that favor particular sectors and even firms ("vertical" policies). Old-style industrial policy was heavily identified with planning, protection, and the promotion of heavy industry. As evidence of its costs and ineffectiveness mounted, the weight of opinion shifted toward open markets and minimal state intervention. More recently, however, many countries have been considering a range of active, market-compatible industrial policies aimed at encouraging investment by compensating for market imperfections, such as economies external to individual firms' actions and coordination failures.[3]

This chapter does not take a position on vertical policies in principle—evidence is clear that the result will depend on how they are designed and implemented. It recognizes that some form of vertical policy is probably inevitable for resource-rich countries seeking to diversify. Two reasons why this may be inevitable are (i) because market forces alone would tend to pull the country back toward resource dependence and (ii) because resource rents provide governments with more discretion to implement such policies, for example, through targeted

[3]For a discussion of old-style "comparative advantage defying" policies that involve heavy protection and import-substitution, especially in favor of heavy industry, versus market-friendly "comparative advantage following" policies, see Lin (2009).

public investment programs to bring down the costs of production for nonresource traded sectors. However, the risks are particularly high for countries with resource wealth, where there will be pressure to subvert such policies towards the goal of rent-seeking. If not designed and implemented well, they will work against diversification even if intended to encourage it.

The fourth section of this chapter considers policy frameworks employed to encourage diversification in the context of some country examples. Both horizontal and vertical policies have been used in these countries, and reasonably effectively. The former include macroeconomic policies, especially fiscal policy, to stabilize the economy against the boom-bust cycle, exchange rate management and overall trade policy, as well as the provision of high-quality education and measures to lower the cost of doing business. One illustrative example showing an opportunity unrealized by most oil exporters is the need to improve tax administration for the nonresource sectors. The section also draws some lessons from the Dubai model for countries attempting to create competitiveness through agglomeration externalities (benefits that firms obtain when locating near each other) or special zones.

Policies alone are not the complete answer. We also need to understand why some countries have been able to implement and sustain good policies and others have not. The fifth section briefly discusses some common institutional features of resource exporters that may have been helpful, and notes some of the limits of diversification that geography and environment can impose.

WHY DIVERSIFY?

Why might countries with rich oil or diamond or copper reserves want to diversify in the first place? Does this make sense, given their particular comparative advantage? How does investment in domestic economic diversification, as a strategy, compare with alternatives such as portfolio diversification through saving a high share of resource rents abroad to invest in a range of industries—or simply slowing the rate of reserve depletion to hold more assets under the ground?

One argument is that diversified economies perform better over the long term. There is strong empirical support for this proposition; Hesse (2008), Lederman and Maloney (2007), and others provide analyses and useful summaries. Their results are robust to the exclusion of OECD countries and also to a control for trade openness.[4]

One explanation for this relationship is that engaging in manufacturing enables dynamic learning-by-doing gains that raise productivity and income. A related argument is that diversification exposes producers to a wider range of information, including about foreign markets, and so raises the number of opportunities for producing countries to discover their own untapped potential.

[4]Imbs and Wacziarg (2003) found a U-shaped pattern whereby countries in the earlier stages of development diversify production but countries above a certain level of income tend to re-concentrate production. Most developing countries are therefore in the former stage. See also Rodrik (2004).

Capability in one sector can open the way to others, especially those that use related knowledge.

This leads to the question of whether the benefit from exporting depends on which products are exported. A considerable body of research argues that it does. Certain products are close to each other in product space in the sense that the ability to export one can easily lead to a small jump in capability to produce and export the other. A country that can make toasters, for example, would have the capability to move speedily to a range of other white goods, then perhaps to microwaves and electronics. There may therefore be a greater externality from encouraging investments in such dense sectors in product space than in encouraging products that are on the periphery without clear knowledge, skills, or market relationships with other sectors. It is also preferable if a country's export bundle resembles those of countries with higher levels of productivity and income. Otherwise, the country risks being locked in to low-wage competition with poorer countries.[5]

Not all governments or economists agree with an automatic strong focus on manufacturing industries or on particular industrial subsectors. Some countries may have a strong secondary comparative advantage in a range of resource-based sectors, including secondary minerals, forestry, or tree crops, that are not necessarily connected but which offer good opportunities. Sinnott, Nash, and de la Torre (2010) note that the rate of technical change in the manufacturing sector is not necessarily greater than that in primary sectors and that the latter also offer opportunities for learning-by-doing. Some commodity production is argued to be as valuable in terms of production linkages and spillovers as other types of production. Moreover, they note that, in contrast to earlier views, recent studies have not supported the argument that in the long run primary commodity prices decline relative to the prices of manufactured goods. They also note that some studies suggest that what is important is product concentration itself, rather than the nature of the dominant product.

Other factors may also be important for resource-rich countries. High rates of population growth dilute the long-run level of rents per capita. If population grows at 3 percent per year, the per capita contribution of a constant resource sector will halve in 24 years. Long-run prosperity and social stability will require the productive employment of growing factors of production, including labor. Another argument for diversification is to self-insure against the large macroeconomic shocks transmitted to countries heavily dependent on a limited range of resource exports by wide swings in resource prices.

Still another possibility is that an exporting country might be capital constrained (van der Ploeg and Venables, 2009), with a marginal internal return to investment that is higher than the yield on foreign assets. This would argue for emphasizing domestic investment over saving abroad. In addition, complete

[5]For discussion of these points and methodology, see Hausmann and Klinger (2007) and associated works. The income level of the export bundle (EXPY) is derived from the income levels of countries which demonstrate a comparative advantage in these products.

dependence on a massive external asset fund as the sole nonresource provider of foreign exchange could be considered an unacceptable long-run strategic risk even if the holdings of the fund are diversified across industries. Will such a fund always be considered as a welcome investor by host countries? Could home-country dependence on foreign investments constrain national sovereignty in the possible event of future disagreements? Such considerations could lead to the yield on foreign assets being discounted below their market levels and a premium on domestic investments able to substitute for a savings fund to provide foreign exchange.

The urgency of such arguments will depend on the expected time horizon of rent relative to needs. Physical exhaustion may not be the only issue. While environmental degradation can cause the collapse of societies (e.g., the deforestation of Easter Island), mineral resources have actually run out on a nationwide basis in only a few cases.[6] Advances in drilling and mining technology have often been able to extend the life of producing fields, sometimes by many years, and commercially exploitable reserves are, in any event, more of an economic than a physical concept, since their level depends on the level of prices. Some countries, like Gabon, are likely to see the effects of declining high-rent reserves relatively soon. But even countries with large resource deposits might be concerned about the possibility of technology shocks that threaten to eliminate or sharply reduce their only comparative advantage, either by creating substitutes or by opening up new sources of supply.[7] From this perspective, even keeping resources in the ground is risky and insurance can be an important motivation for diversification.

These considerations have implications for how a country sees diversification as part of its overall strategy. Most countries seek gains in terms of growth and employment, but some might be willing to pay a premium to diversify. The same considerations also influence the type of diversification that a country might pursue. For some purposes, it could be sufficient to diversify within the resource sector, moving from oil to natural gas or hard mining in order to extend rents into the future, and trying to maximize domestic upstream linkages with the resource sector. For other purposes, the focus may be on moving downstream to increase value-added, including through policies to fill gaps in crucial supply

[6]One example is Nauru, which enjoyed very high GDP per capita after independence due to its rich phosphate deposits. In anticipation of the exhaustion of the deposits, substantial investments were made in trust funds aimed to help cushion the transition and provide for Nauru's economic future. However, because of heavy spending from the trust funds, including some wasteful investment activities, the government moved to a situation of virtual bankruptcy. To cut costs it called for a freeze on wages, a reduction of over-staffed public service departments, privatization of numerous government agencies, and closure of some overseas consulates. Economic uncertainty caused by financial mismanagement and corruption, combined with shortages of basic goods, has resulted in domestic unrest. In 2004 Nauru was faced with chaos amid political strife and the collapse of the island's telecommunications system. Nauru is now heavily dependent on Australian aid.

[7]One example is recent advances in hydraulic fracturing technology, which have opened up greatly increased supplies of natural gas in the United States. Fusion power, the development of safe and cheap nuclear technology, or renewable energy technologies plus improved battery technology could each have a major effect on the demand for oil.

chains linking the resource base to downstream industries. In still other cases, the priority will be to shift toward labor-intensive manufactures. Different countries have different resource endowments and constraints, and may have different goals. Some high-income countries, including Australia and Canada, have high-productivity modern economies yet are still heavily dependent on resources for exports.[8] While effective diversification can be a good investment, countries can waste a great deal of resources on ineffective programs or programs targeted toward inappropriate goals.

THE RESOURCE CURSE: A DIVERSIFICATION PERSPECTIVE

The impact of resource rents on economic performance has been a subject of debate. Three main complications arise in the analysis: (i) how to deal with the endogeneity of measures of resource abundance (reserves per head) and resource dependence (the resource intensity of exports or fiscal revenues or GDP);[9] (ii) how to measure outcomes (income levels, growth rates, or broader development indicators); and (iii) how to allow for country heterogeneity. If the result depends, for example, on institutional quality or human capital, the problem may not be natural resources but the lack of these complementary factors.

Studies using resource abundance measures tend to find positive associations between natural resources and growth. "Wealth of nations" estimates find that higher-income countries have higher levels per capita of all types of capital, including natural capital (cropland, forests and sub-soil mineral assets). Natural capital averages only US$3,588 per capita in low-income countries but US$20,227 in those with high incomes.[10] These data hardly suggest that low-income countries are locked into their status by an excess of known natural capital. However, other categories of capital, including human capital and produced capital, increase far more rapidly across the income progression. This suggests that the different types of capital complement each other and that countries do diversify away from reliance on natural capital as they grow richer.

Studies using measures of resource dependence find a negative relation ship with economic growth. For example, Lederman and Maloney (2007) note that between 1980 and 2005 GDP per capita grew far more slowly in net natural resource exporters (0.6 percent) than in net natural resource importers

[8]In 2009, agricultural, energy, forestry, and mining provided about 58 percent of Canada's total exports; agriculture and mining represented 42 percent of Australia's exports. In terms of GDP, the shares are smaller; resource sectors represent about 12 percent of GDP in Canada and 10 percent in Australia.

[9]Measures of resource abundance are higher in richer, more well-governed countries because these have typically seen higher levels of exploration and prospecting. This suggests that much of the resource wealth of poor countries is still awaiting discovery. Measures of resource dependence are higher in poorly governed countries partly because other productive activities are rendered unviable by risk and high costs, and low because low income and demand leave more resources for export.

[10]For estimates of national wealth see World Bank (2006).

(2.2 percent).[11] As discussed above, one interpretation is that countries that are specialized in mineral resources find it more difficult to make the jump to diversify towards products that can open the way to acquiring capabilities in other, more advanced, products that can support higher wages as the country moves up the technology ladder. Oil, for example, is well separated in product space from dense clusters; unless technically sophisticated to the point where it can produce capital equipment, a producer may not learn much from oil production that enables it to produce other products.[12]

However, the question of where best to compete in terms of products could be quite difficult for a specialized mineral exporter. For example, a middle-income exporter starting out on the diversification process will not compete easily with products typically made by low-income resource-poor labor-abundant competitors. But with wage costs and a real exchange rate reflecting the level of income sustained by minerals, it may also not be easy to jump to other products made by nonresource countries at a similar level of income but with superior capacity.

Managing Volatility

One channel for the adverse linkage between resource dependence and growth is volatility. Resource prices are very volatile, particularly for oil, where the coefficient of variation of prices is 0.7. Prices are also very difficult to predict. Since the start of the 1970s, none of the major turning points in the oil market has been widely predicted. Predictions in the early 1980s were for sustained price increases, which proved very far off the outcome. During the recent oil boom, futures prices simply followed the spot price; they were flat, extending the current price out as far as 10 years. Actual prices cannot strictly conform to such a random walk process because of some lower and some upper bound, but estimated prediction models do little or no better than a random walk.

Hamilton (2008) provides a careful study of the statistical properties of oil price series. He finds that the random walk hypothesis cannot be rejected and that, starting from a price of US$115 per barrel, four years into the future we should not be too surprised to find the price of oil either as high as US$391 per barrel or as low as US$34. The latter price was inconceivable at the time of that study and far outside the range of observed futures prices; however, prices did hit US$34 per barrel late in 2008 as the market collapsed. The resulting uncertainty is enormous for producers. Consider, for example, an exporter like Nigeria. With a base value of oil valued at US$100 per bbl, the difference between a price of US$50 and one of US$150 is equivalent to a difference of 50 percent of its GDP.

Oil exporters have typically not succeeded in smoothing these extreme price cycles. They tend to alternate periods of shorter booms, marked by appreciating

[11]Gylfason (this volume) reports these two effects, one positive and the other negative, on one single regression.

[12]Hausmann, Klinger, and Lopez-Calix (2010) analyze this issue in the context of Algeria. Countries like Norway and, more recently, Brazil, have shown the ability to build substantial upstream linkages from oil to industry.

real exchange rates,[13] soaring prices in nontraded sectors (particularly real estate), and high but not spectacular growth rates of GDP, with prolonged slumps. This supply-side pattern mirrors the even larger swings in the rhythm of real absorption, usually led by swings in public spending.

The destructiveness of these cycles is clear from many examples. Mexico borrowed against expectations of increasing real oil prices after 1981 and suffered badly when these expectations turned out to be far off track. Before 1980, Venezuela had been one of the fastest-growing Latin American economies, with long-term growth averaging 6.4 percent. But following several euphoric years after 1974 it experienced a sharp decline, with output per capita halving over the next two decades. Nigeria offers a third example, with voracious public spending outpacing revenue increases up to 1984, followed by sharply lower debt-constrained spending thereafter (Budina and van Wijnbergen, 2008). Simulations show that such cycles can turn a potential oil windfall into an actual loss (Gelb and Grasmann, 2010). A long line of research relates output volatility to slow growth.[14]

Severe macroeconomic instability also makes export diversification more difficult. Hausmann and Rigobon (2003) show how real exchange rate volatility stemming from shocks in markets for concentrated exports will reduce incentives in the nonresource traded sectors for risk-averse investors. Investment will shift toward the nontraded sectors, leading to premature specialization in the dominant resource. This in turn leads to still greater volatility, and to lower growth.[15] One key element of diversification policy, therefore, should be prudent macroeconomic management over the resource cycle to help stabilize the economic setting for the traded sectors.

Because of the importance of fiscal linkages, the prime component of stabilization policy over the boom-bust cycle has to be cautious public spending underpinned by high savings in the boom period to smooth out aggregate demand. Other policies can have a subsidiary role in stabilizing the economic setting for firms in the nonresource traded sectors. But if these firms are to have a reasonably stable base, there is no alternative to efforts to sustain countercyclical fiscal policy over the resource cycle.

Exchange rate policy presents a dilemma. On the upside of a strong cycle, a policy of fixed exchange rates will expose firms to the impact of appreciating demand and soaring prices in the booming nontraded sector. If the policy is sustained on the downside of the cycle, it can result in a painful period of falling

[13]Real exchange rates do appear to be quite responsive to resource exports. For oil exporters, Korhonen and Juurikkala (2007) find a consistent relationship between real the exchange rate and oil prices with an elasticity of about 0.4.

[14]Ramey and Ramey (1995) provide an early analysis; more recent research includes Hnatkovska and Loayza (2003).

[15]Volatility increases because changes in relative prices can only affect the relative demand for nontraded and traded goods. With full specialization, the supply response is zero. Real exchange rates do appear to be quite responsive to resource exports; for oil exporters, Korhonen and Juurikkala (2007) find a consistent relationship between the real exchange rate and oil prices with an elasticity of about 0.4.

demand and deflation. However, flexible rates will expose the firms to external competition even more rapidly in the upward phase of the cycle.[16]

As a number of countries have found, it is also futile to try to protect the nonresource traded sectors by attempting to choke off booming imports through a tightening of import barriers. The only effect will be further appreciation of the real exchange rate, higher domestic prices and input costs, and less competitive production.

Monetary policy also has limitations. A general tightening of credit to slow the booming nontraded sector will have a harmful impact on the traded sectors. It may also further encourage capital inflows, which anyway tend to be procyclical. It may be necessary to use more discriminating tools that can selectively tighten credit to the nontraded sectors to limit construction and real estate booms.[17] For example, faced with a booming real estate market in the 1980s, Malaysia imposed special reserve requirements on the banking system to discourage the diversion of credit from agriculture and industry to the property market.

Building Human Capital

If there is a resource curse, it seems to affect certain types of countries more than others. Bravo-Ortega and de Gregorio (2007) find that the larger the stock of human capital, the more positive the marginal effect of natural resource abundance on growth. Lederman and Maloney (2007) echo this message, noting that rich countries that have successfully used their natural resources to further development outcomes, such as Australia and Norway, have done so on the basis of high and growing levels of human capital.

Studies also provide strong evidence of the importance of human capital for the structure of exports. In their classic study, Maier and Wood (1998) distinguish regions on the basis of two ratios: skills per head and land (a proxy for resources) per head. As population increases, the ratio of land/head declines over time; as countries invest in human capital the skills/head ratio increases. Sub-Saharan Africa ranks highest on land abundance and lowest on skills. In these dimensions, it resembles most closely Latin America some 30 years earlier. Asian economies are relatively skills-abundant and their endowment in this area has been growing.

Maier and Wood show that there is a close relationship, both across regions and over time, between factor ratios and export composition. Regions with high ratios of land to skills tend to specialize in primary products. As the land to skills ratio falls, the export mix shifts, first toward processed primary products, then to

[16]One of several options discussed by Frankel (2009) is to peg the currency to the price of the leading export, so accommodating to terms of trade shocks. The downside is that it destabilizes the local-currency prices of other traded goods, a particularly problematical outcome from the perspective of diversification. For more discussion see Sinnott, Nash, and de la Torre (2010); also Frankel in this volume.

[17]These could include cycle-adjusted capital requirement ratios, loan-loss provision ratios, and lending-to-asset-value ratios to discourage speculation in markets where a potential bubble is forming.

simple manufactures, and then towards more complex and technologically demanding manufactures. Their study suggests that countries that fail to invest heavily in their human capital will find it difficult to move away from primary dependence and toward more sophisticated products.[18] It is also no accident that countries like Finland and Korea, both known for their spectacular evolution from primary-based economies to exporters of hi-tech manufactures over the space of a few decades, also routinely score at the top in international comparisons of the quality of education.[19] Except for Norway, no countries specialized in resources score near these high levels; most lag in human capital relative to their income level. Sustained attention to quality education on a broad basis to close the gap must be a key component of diversification policy.

Institutions and Governance

A substantial body of literature suggests that differences in the quality of institutions are at the root of the diverging growth paths of successful and less successful resource rich countries. For example Mehlum and others (2006) find that the quality of institutions is critical in determining whether countries avoid the resource curse. Natural resources are only found to have a negative impact on growth performance among countries with inferior institutions.

What kinds of institutions are important? Collier (2007) suggests that the issue is not simply whether countries are democratic. Without effective checks and balances on power, competition for natural resource rents can make democracies malfunction. Unlike normal taxation, competition for rents does not invite public scrutiny and political accountability, and therefore encourage the emergence of patronage politics. Eifert, Gelb, and Tallroth (2003) distinguish "factional" democracies from "mature" democracies, and argue that highly personalized politics and rent-seeking in the former cases result in short-horizon, patronage-driven electoral competition and nontransparent allocation of rents. In extreme cases, competition may evolve into open conflict. Some autocracies have managed natural rent well; the risk, as seen in the case of the Suharto regime in Indonesia, is that in the long run they become entrenched and corrupted by resource wealth.

How does the quality of institutions affect the potential for diversification? The extensive debate on how to measure institutions and whether resources undermine them is beyond the scope of this chapter. However, recent research on long-term growth has increasingly emphasized the importance of institutions (Acemoglu, Johnson, and Robinson, 2003). There is a strong and systematic relationship

[18]On the basis of this analysis, it is not surprising that export diversification in African countries has largely involved broadening the range of resource-based products and services (including tourism) and moving up the processing chain, rather than a shift to manufactures. For more discussion of East Asia, including the very important role played by the accumulation of human capital, see Noland and Pack (2003).

[19]In recent PISA assessments of reading (2000), mathematics (2003), and science (2006), Finland and Korea ranked, respectively: 1 and 5; 1 and 2; and 1 and 7 out of 27, 29, and 35 countries, respectively. They also rank high in TIMSS scores, and rank at numbers 7 and 2 in the Global Innovation Index.

between a variety of measures of institutions and level of income per head, particularly for countries not especially rich in natural resources. Institutional quality therefore appears to have a close relationship with the potential of an economy to deliver high incomes by functioning at a high level of productivity. This means that, whatever the exact causality, institutional strength is important in relation to potential economic structure. Manufacturing industry, for example, is more transactions-intensive than subsistence agriculture or off-shore oil rigs. It is more dependent on strong contract enforcement, a rule of law, and a generally strong business environment. In extreme cases of institutional breakdown, economies are likely to retreat back into subsistence farming and enclave mineral production.

Resource economies with strong institutions will therefore have a wider range of potential options for diversification than those where institutions are weak. Unfortunately, most resource exporters have weak institutions, as measured across a number of dimensions, at least relative to their levels of income. Using one set of institutional indicators, the Worldwide Governance Indicators, oil-exporting countries, on average, have an institutional score corresponding to that of far poorer non-oil economies. In some cases, their institutional scores are those of nonresource countries with income levels little over one quarter of their own. The result is not dependent on one particular region. In Gelb and Turner (2008), nine African oil exporters with average GDP per capita of US$979 (at market exchange rates) scored on average in the lowest decile on governance indicators. In contrast, a set of 11 low-income non-oil African countries, with average GDP per capita of only US$300, that had grown relatively rapidly over the previous decade scored around three deciles higher. Some clusters of countries show more strength in certain classes of institutions. The GCC countries, for example, tend to score better on measures reflecting the capacity of the state and the ability to sustain a good regulatory environment. Latin American oil producers, in contrast, tend to score better on measures of political participation and weaker on regulatory policy.

Oil, it could be argued, is not integrated into the rest of the economy in the first place, so it is unreasonable to benchmark governance estimates to the level of income per capita including oil. Some "governance discount" might reasonably have been expected. However, if levels of governance and institutions are taken as indicators of the potential productivity of the non-oil economy (as seems to be the case for nonresource economies in general), the magnitude of the discount suggests the gulf between actual incomes and the baseline level of productivity in the nonresource sectors. Policies to reduce this institutional gulf, whether by determined actions to improve the functioning of the state and its economy-wide service delivery, or to carve out a special development zone for the purpose, are therefore of the utmost importance for diversification policy.

Natural resource wealth opens up windows of opportunity for such policies. The question is whether resource exporters choose to take advantage of them. Botswana has partly invested its diamond income in creating (and paying for) an efficient bureaucracy. The country is perhaps the most striking case of an initially poor mineral exporter with strong initial institutions. Acemoglu, Johnson, and

Robinson (2003) suggest that the foundation was laid before the discovery of diamonds. Its inclusive traditional institutions placed constraints on political elites, and there was minimal disruption to these traditions by colonial rule. Particularly noteworthy was Seretse Khama's initiative in assigning sub-soil mining rights away from the tribes and toward the state, in this way heading off tribal contestation for revenue. Botswana used its diamond income well to further strengthen institutions and capacity. It remunerated civil servants adequately and employed a corps of foreign advisors to work alongside domestic officials, rather than rapidly indigenizing the civil service and lowering its quality. More recently, the government sought and obtained a sovereign debt rating even though Botswana had no immediate need to borrow. The rating was seen as a commitment device, to alert citizens by signaling potential policy slippage by future governments.

In contrast, Equatorial Guinea has been cited as an extreme case where oil rents sustain a pathology of authoritarian rule, instability, and underdevelopment, from which it is difficult to exit. McSharry (2006) analyzes the political economy of oil in Equatorial Guinea, suggesting that the extraordinary weakness of government institutions and the dearth of social programs make it less likely that the government will be able to buy the acquiescence of the population in the same way as, for example, Kuwait or Saudi Arabia.

Another example is tax administration. Oil-exporting countries typically raise lower non-oil tax revenues than other countries; the lower tax yield represents the equivalent of about one fifth of oil revenues (Gelb and Grasmann, 2010). It may be reasonable to substitute some heavily distorting taxes by resource taxes, and a low-tax regime could also be a component of diversification policy. Freed from immediate revenue pressure, countries could streamline taxes, lower rates and broaden bases, abolish nuisance taxes, and improve tax administration. In some cases this has been done (see discussion of Dubai below), but all too often it has not. Knack (2008) finds that the quality of non-oil tax administration (as measured by the World Bank's Country Policy and Institutional Assessments) is actually lower in oil exporting countries than in others.

"Vertical" Policies and Effective Public Spending

Diversification will also be affected by how governments choose to spend resource rents. Any spending with a domestic component will tend to draw resources to the nontraded sectors, appreciate the real exchange rate and weaken the nonresource traded sectors. This effect can be at least partly offset by spending (or tax relief) that reduces production costs in these sectors, raises their efficiency, and encourages the entry of investors with new capabilities and knowledge. Well-designed and implemented investments in infrastructure, human capital, or improving institutions can have this effect, even if applied in a sector-neutral way.

Nevertheless, some level of vertical policy and spending that targets nonresource traded sectors on a broader or more focused basis is probably inevitable in resource-rich countries. It is very difficult to promote all such sectors at the same time against

the pull toward nontraded sectors that results from increased domestic demand fuelled by public spending funded by resource taxes.[20] Given that diversification is a national priority, vertical policies can be seen as efforts to compensate for market incentives distorted by the spending of resource rents. Governments also have greater possibilities for financing such measures, whether tailored infrastructure, tax rebates, investment incentives, or other inducements to invest.

However, vertical policies involve several risks. One is serious distortion of market incentives, in particular toward import-substitution. It is no accident that the more successful countries, discussed below, placed a heavy weight on exporting. Another risk is "lock-in" to the interests of an established rent-seeking elite seeking to benefit from incentives rather than using incentives to encourage competitive investment, often by new players. A third risk is that of diverting the attention of policymakers away from critical economy-wide impediments to diversification and growth. It is often politically easier to introduce some new program rather than address long-standing obstacles to business and the vested interests behind them. The fourth risk, of holding on to failing policies, is especially high for resource-rich countries because there is not the same fiscal pressure to change them. In his evaluation of industrial policy, Richard Auty notes:

> [A] favorable resource endowment may be squandered through the pursuit of less prudent policies than would be practical in a resource-constrained country … There are two important consequences … first, economic damage cumulates … second, political groups become entrenched which have a vested interest. (Auty, 1994, p. 7)

Spending alone, even if it is intended to support diversification, is not enough. Unless it is effective, it will only make diversification more difficult by increasing domestic demand.

THE EXAMPLES OF MALAYSIA, INDONESIA, CHILE, AND DUBAI

Although there are not many examples of developing countries that have built diversified economies from initial conditions of strong concentration in the mineral sectors, there are some notable examples of policy effort and relative success. Coxhead (2007) studied the long-term experience of countries with rich initial endowments of natural resources. He identified five such countries with strong long-term growth: Malaysia, Thailand, Chile, Indonesia, and Sri Lanka. All have diversified toward manufactures or, as in Chile, widened their range of resource-based exports to include new and more sophisticated products. The experience of such countries is therefore of special interest, especially the three with substantial mineral resources.

[20]In a simple general equilibrium model it is only possible to expand all traded sectors if government cuts back on its purchases of nontraded goods and services. This is not a likely response to resource wealth.

Malaysia was fortunate in its rather diversified resource endowment, which included good geographic location and deepwater ports, rubber and tin, as well as forest products, which preceded oil as export staples. Even in 2010, resource-based products represented 42 percent of manufacturing value added.[21] It sustained a high and relatively stable savings rate, and it made massive investments in land development and replanting schemes to expand and modernize the production of rubber and palm oil. It also made heavy investments in technology and infrastructure, especially in the areas of energy, communications, and transport. Although Malaysia did start out on a protectionist path in the 1960s, in 1973–74 it shifted to an extensive export promotion drive based on cheap manufactures. Measures to hold down costs included policies to reduce the costs of labor and manage industrial relations.[22] In the mid-1980s, strategy shifted toward higher-technology products and skills upgrading. Policies included liberalizing skilled immigration, a dramatic expansion in enrolment in polytechnics, exchange relations with universities in Australia and Canada, and skills development programs jointly sponsored by the Federation of Manufacturing and the University of Science and Technology.

Macroeconomic policy in Malaysia also aimed at cost containment. Trade policy moved steadily toward a relatively open trade regime. Devaluations depreciated the real exchange rate (by 22 percent from 1980 to 1992) to maintain incentives. Investments and targeted support were provided through a variety of programs, including free zones, export financing facilities, assistance with research, and product development and marketing, all aimed at reducing production costs and increasing competitiveness. While exporting was never stressed as strongly as a condition for support as in Korea, export performance was an important goal of diversification efforts.

Indonesia shows the importance of using active policies to encourage agriculture in the face of a booming oil sector and so bringing down domestic costs to further encourage diversifying exports. Good luck played a part in this success, which would not have been possible without the development of disease-resistant and high-yield rice varieties. But their diffusion in turn would not have been possible without the unusually broad-based development policies followed by the government. These included very large investments of oil income to develop natural gas resources, both for export to Japan and as an input to fertilizer production. Fertilizer was then distributed at subsidized prices, greatly boosting yields. Agriculture and the rural economy were further strengthened by a series of successful community-based programs that absorbed large quantities of labor and produced

[21]Electronics represented a further 30 percent.

[22]For example, minimum-wage legislation was not enacted for export industries, only in-house unions were permitted, and less than 10 percent of workers in the electronics industries (78 percent of whom were female) were unionized. For more discussion see Kuruvilla (1996).

local infrastructure, including schools, roads and other local construction.[23] Infrastructure, particularly in the rural areas absorbed one quarter of public investment during the oil boom (Auty, 1994).

With a strong agriculture able to feed a growing industrial workforce relatively cheaply, Indonesia moved toward low-wage manufacturing and an export-oriented strategy in the early 1980s.[24] Measures were taken to prevent the real exchange rate from moving too far out of line. These included cautious management of public spending in the boom years 1974–81. Fiscal surpluses and reserves were accumulated despite the fact that official policy called for a balanced budget. Government was also ready to rapidly restructure public spending and scale back planned projects when oil prices began to fall. The exchange rate policy aimed at limiting real exchange rate appreciation, and the policy package included major devaluations on the downside of the oil price cycle in 1983 and 1986 (in the latter case by 60 percent), and further steps to ensure that it did not appreciate thereafter. Trade policy was progressively liberalized after 1985, and exporters were able to access imported inputs at world prices. Foreign direct investment (FDI) was liberalized, especially into exporting sectors. By 2005 manufactures represented 47 percent of merchandise exports.

Unlike Malaysia and Indonesia, Chile has not evolved into a major industrial exporter. But it has developed into a dynamic and more diversified commodity exporter, with an emphasis on high-value primary-based products that draw on its diversified resource base. One key element has been its successful implementation of countercyclical fiscal policy, stabilizing the economy by high savings during the copper boom years and dis-saving when prices began to fall. Chile also focused on improving the business climate, to become the highest rated Latin American country on the World Bank's "Doing Business" indicators.[25]

In addition, Chile offers several successful examples of active vertical public roles in helping to develop the salmon and wine industries. These include encouraging technical development and adaptation, disseminating information on standards, providing infrastructure and information, and coordinating numerous small producers (Benavente, 2006; and Katz, 2006). Both of these industries involved developing long-term public-private partnerships such as those involving CORFO (Production Development Corporation) and Fundación Chile to help producers achieve critical mass and capabilities. Chile has also established a Competitiveness and Innovation Fund in 2005, financing this through a levy on mining, and developed sector clusters with private sector participation and partial

[23]The community-based government programs, known as INPRES, were intended to generate balanced regional development in Indonesia. The acronym refers to "presidential instruction."

[24]Auty (1995) notes that both Indonesia and Malaysia made the errors of promoting inefficient industries during the oil boom period. However, concern to maintain sound macroeconomic management and contain losses limited the effects.

[25]Chile's ranking on "Doing Business" was 40 out of 181 countries in 2009. The 2009 rankings for the other countries discussed in this section are: Malaysia 20, Botswana 38, UAE 46, Indonesia 129, and Algeria 132. The average ranking for nine oil exporters in SSA is 161. The average ranking for the 11 non-oil low-income fast-growing African countries noted in Gelb and Turner (2008) is 138.

funding. Some 50 centers of excellence are in operation, the majority university based, and all competing for funding. Chile also sponsors investment in high-level human capital by funding scholarships for study abroad (Sinnott, Nash, and de la Torre, 2010).

Finally, we consider the Dubai model. Dubai aims to attract investment (with risk implicitly underwritten by recourse to the oil riches of the United Arab Emirates[26]) to invest in infrastructure, real property, and a range of services, as well as establishing a free zone to further build export capacity. Dubai is *sui generis*, especially its dependence on expatriate labor and skills: nationals constitute only 10 percent of the population. But it offers some lessons for other countries considering diversifying their economies through a massive free zone or similar policy.

Dubai's vision was not simply based on "build it and they will come." It was also based on providing incentives to attract foreign direct investments and major multinational companies. These incentives included an efficient bureaucracy with little corruption; a regime of no taxes and low tariffs that proved extremely attractive to companies and expatriates; a free-market economy with low restrictions on movement of funds and transactions; high-tech state-of-the-art infrastructure to sustain an electronic-based system and e-government; public support, direct or indirect, to all major projects; easy and quick processes to issue visas to businessmen and visitors; allowing foreigners to own property in free zone areas; and investing heavily in security. Very open trade and labor policy, a very low tax regime, and an exchange rate pegged to the dollar have made Dubai a relatively stable and low-cost base for business.

Dubai aims to create a new asset, a critical mass of world-class infrastructure, services and business, able to serve as a transport and logistics hub and to reap sufficient agglomeration and "network" externalities to be self-sustaining. To the extent that it succeeds, it will have diversified the local economy, essentially by creating a new one. At the same time, Dubai nationals will still enjoy rent-based income, mostly from land and property rents and statutory participation in businesses usually run by expatriates. Little of the benefit to nationals comes through "normal" employment secured on competitive labor markets.[27]

Whether Dubai is able to succeed and, if so, at what cost to the oil wealth of the UAE, will have to be seen as events unfold following the bursting of the country's property bubble in November 2009. Its experience confirms that the boom-slump model can be very costly. In 2007 it was estimated that since 2004 the six GCC countries had produced oil worth about US$2 trillion at spot prices,

[26]While the debts of Dubai World may not have been formally guaranteed by the government, Abu Dhabi has provided assistance to restructure its debt.

[27]Data from the 2005 International Comparison Project show that the GCC countries have domestic price levels at least 30% lower than those for countries at comparable levels of income per head. Because most of the "fixed factors" usually assumed to constrain the nontraded good sectors are importable in the GCC countries (especially labor), Dutch disease is manifested less by high prices and an appreciated real exchange rate and more by the limited employability of high-cost nationals on a competitive basis in the private sector. Businesses in Dubai are required to take on local partners but not those in the Free Zone. The benefit the latter offer to Dubai is largely in the form of contributing to agglomeration externalities and through demand for real estate and transport and logistics services.

and that more than US$1 trillion had been invested in domestic infrastructure and real estate (Janardhan, 2007). Urban real estate prices rose spectacularly after 2004, from an index of 100 to almost 320, before plunging back to 130 by mid-2009—a spectacular cycle even by the standards of other concurrent property booms.[28] It is not yet clear how the massive losses will be apportioned, but it is clear that at least a part is being paid out of the financial assets of Abu Dhabi. Meanwhile, many properties stand vacant, prices have slipped further, sometimes to as little as a fifth of previous levels, and Dubai faces high-risk spreads on its outstanding obligations.

Do such examples have lessons for other resource-rich countries? Clearly, the potential for diversification is affected by many factors, including the resource base, the capacities of the population, and the quality of economic management. Malaysia and Chile have rich and varied resource bases; Indonesia has an abundant, low-cost labor supply as well as good location. One common theme running through the cases is the importance of avoiding wild swings in the real exchange rate and periods of high overvaluation. Another is the need to reduce costs for the nonresource sectors, whether through macroeconomic management and exchange rate policy, trade policy, well-focused public investments, or other measures. Yet another is the efforts to supplement market incentives in various ways to encourage diversification, while not trying to replace them.

A further theme is the importance of openness to foreign investors, new skills, and new markets. Entry and a focus on exporting have been vital points of policy emphasis for all of the countries.[29] A contrasting picture emerges from analyses of countries in the Middle East and North Africa, many of which are heavily dependent on hydrocarbons. Analyzing the disappointing diversification of that region, Gourdon (2010) notes that the contribution from the introduction of new products has been small, and that what modest diversification has taken place has been due to the diversification of existing products. In contrast, new products have played a major role in the diversification of many countries outside the region. Nabli and others 2008 explain the persistence in the region of vertical industrial policies that favor well-entrenched groups. This is due to the weakness of interest groups that might lobby for more outward-oriented horizontal policies relative to privileged networks that seek to maintain their access to rents. These themes resonate with the analysis of Algeria by Hausmann, Klinger, and Lopez-Calix (2010). They reject the conventional Dutch disease explanations for oil dependence, namely an appreciated real exchange rate and high macroeconomic volatility. Instead, they note a poor business climate, including a lack of clear, predictable, and enforced rules of the game for market activity, and the combination of a

[28]IMF Article IV Consultation, February 2010.

[29]Not all elements of such a package have been followed by all rapidly diversifying countries. Korea, for example, restricted FDI in favor of acquiring technology by licensing and a very strong focus on building domestic capacity. Such a policy will be far more difficult for a country lacking Korea's strong education system.

highly protected internal market and competition for oil rents, which dulls incentives for private-sector investments in new export activities.[30]

Even with good policies, some resource exporters will find it very difficult to diversify. Botswana, for example, scores high in many dimensions of economic management and governance and has managed its diamond wealth in an exemplary manner. But it faces particular constraints that make competitive diversification difficult to achieve. Unlike Dubai, Botswana does not benefit from location; it is sparse, far from major markets, and not on major transport routes. Despite a good investment climate and a history of generous incentives, its industrial sector appears to be less competitive than those of neighboring countries. Its limited water resources limit diversification into agro-based industries, including livestock. And because of the very low cost of transporting raw diamonds, it is hard-pressed to compete with the world's dominant diamond-processing facilities in India, which can draw on abundant, cheap and skilled labor, top-quality technology, and massive scale economies.[31]

SOME COMMON FACTORS IN SUCCESS

Why have some countries managed to sustain good policies, including for diversification? Countries that start off from strong institutional conditions can clearly expect to have a more positive range of alternatives for using oil rent than countries whose institutions are extremely challenged.[32] However, countries such as Chile, the experiences of Indonesia (especially during the first decade of the

[30]Starting from a similar position in 1985, Indonesia has increased its non-oil EXPY (the GDP/capita of the export basket estimated on the basis of the incomes of countries showing comparative advantage in such a bundle of products) at twice the speed of Algeria, despite being a far poorer country.

[31]India accounts for about 60 percent of diamond processing in value, 80 percent in karatage, and 90 percent in pieces. The leading center in Surat processes almost 80 percent of processed solitaire diamonds above one karat (*The Economic Times*, December 28, 2009).

[32] Botswana is perhaps the most striking case of an initially poor mineral exporter with strong initial institutions. Acemoglu, Johnson and Robinson (2003) suggest that the foundation was laid before the discovery of diamonds. Its inclusive traditional institutions placed constraints on political elites, and there was minimal disruption to these traditions by colonial rule. Particularly noteworthy was Seretse Khama's initiative in assigning sub-soil mining rights away from the tribes and toward the state, in this way heading off tribal contestation for revenue. Botswana used its diamond income well to further strengthen institutions and capacity. It remunerated civil servants adequately and employed a corps of foreign advisors to work alongside domestic officials, rather than rapidly indigenizing the civil service and lowering its quality. More recently, the government sought and obtained a sovereign debt rating even though Botswana had no immediate need to borrow. The rating was seen as a commitment device, to alert citizens by signaling potential policy slippage by future governments. In contrast, Equatorial Guinea has been cited as an extreme case where oil rents sustain a pathology of authoritarian rule, instability, and underdevelopment, from which it is difficult to exit. McSharry (2006) analyzes the political economy of oil in Equatorial Guinea, suggesting that the extraordinary weakness of government institutions and the dearth of social programs make it less likely that the government will be able to buy the acquiescence of the population in the same way as, for example, Kuwait or Saudi Arabia.

Suharto government) and Malaysia show that even mineral countries with histories of instability and fractious politics can find windows of opportunity for good management that leads toward diversification. Their experiences suggest a number of common factors.

Considering first Chile, the state has long been viewed as generally capable, and its technical capacity, including its key ministries and central bank, has traditionally been strong. In the early 1970s the country suffered both serious macroeconomic instability and social polarization. The period after the 1970 election of the Allende government and the September 1973 Pinochet coup was particularly traumatic. In 1973–75 the consumer price index rose by 3000 percent; this was followed by a deep debt crisis and economic contraction in the early 1980s. Unemployment levels reached 33 percent by 1982. Following the return of civilian rule in 1990, the traumatic experiences of the two previous decades underpinned widespread consensus around preventing further disruptive boom-bust crises and avoiding conditions that might precipitate the political instability that could lead to a return to military government. The result was a broad constituency in favor of both economic stability and public debt reduction. The strength of this consensus is demonstrated by Chile's response to spiraling copper prices and the exceptional accumulation of surpluses in its copper stabilization fund after 2005. Net public debt fell to minus 14 percent of GDP by 2008. Nevertheless, sustaining these policies has required continuous efforts by the technocracy to reach out to elected officials and explain the implications of over-spending.

Indonesia offers another interesting example of cautious and flexible macroeconomic management—implemented without a dedicated fund, without transparency, and even in violation of fiscal rules—at least during the first part of the Suharto period. This phase was classified as an example of "reforming autocracy" by Eifert, Gelb, and Tallroth (2003). As in post-Pinochet Chile, the Suharto government came into power with a huge stake in stability. The last years of the "Guided Democracy" of the Sukarno period had been increasingly chaotic, including rice riots and ethnic rioting. The 1975 crisis of Pertamina, the national oil company, reinforced the caution of the government, and added to the credibility of the technocrats—a very stable team of economic advisers widely known as the "Berkeley Mafia."[33] This team proved to have both great permanence and leeway to shape policies. Through the oil booms of 1974–81, the government formally adhered to a balanced budget law. However, without disclosure to the public or the parliament, bureaucratic controls were applied to slow actual spending, creating a *de facto* surplus and doubling reserves. Indonesia also managed its spending programs with great flexibility. As oil prices fell after 1981, the government moved aggressively with a drastic reprogramming of its development spending, cancelling projects and cutting subsidies and spending, as well as stabilizing the real exchange rate through progressive devaluation.

[33]Pertamina had been under the management of a military associate of the president, so that its crisis—which required a US$1 billion bailout—strengthened the hand of the technocrats.

Malaysia, another success case, has faced a threat to economic and social stability from either of two paths: rapid growth with Malays politically dominant yet economically disempowered, or economic collapse caused by excessively redistributive policies. These threats were clearly recognized. Neither of these options was attractive, leaving effective economic management and the reinvestment of rents to encourage growth, especially employment-creating growth for Malays, as the only option (Abidin 2001; Rasiah 2006).

Chile, Indonesia, and Malaysia are clearly very different cases, yet they show some common features. First, two goals were seen as important: accelerating development and sustaining economic and social stability. These goals enjoyed a fairly broad basis of support in all of the countries. Second, increasing the level and range of exports was seen as a major development priority. Third, the governments concerned were able to draw on a stable, strong, and credible technocracy, with a good understanding of the risks inherent in a minerals-based development strategy. Close relationships between politicians and technocrats helped to keep these issues at the forefront of policy. Fourth, constituencies rooted in non-oil tradable sectors were powerful in all of the countries. In Malaysia, tin and rubber producers were influential. Agriculture played a similar strategic role in Indonesia, because of its importance in sustaining rural incomes and social stability. In Chile, a range of resource-based commodity exporters that had developed during the years of low copper prices was actively courted by the technocracy and were rolled out as strong advocates for spending restraint during the copper boom. These interests have been important forces for stability; they have helped to restrain sharp exchange rate appreciations that would damage the sectors concerned.[34]

CONCLUSIONS

Some countries with a strong resource base have managed to diversify their economies and exports, but many have not. Although there is evidence that diversifying economies can expect to do better over the long run, the urgency of the issue will vary across countries. Geography, ecology, and other factors severely constrain the possibilities for some countries. Nevertheless, most do have options, whether to widen the range of primary exports, move further down processing value-added chains, or shift toward manufactures. The question for these countries is how strongly they are motivated to diversify and whether they are ready to take the necessary steps to do so.

The first policy message is the need to get some economy-wide horizontal basics right. Good macroeconomic management is critical. Failure to run a countercyclical fiscal policy to contain massive boom-bust cycles destabilizes the traded sectors and contributes to slow growth. Other macroeconomic policies can have only a supporting role. Exchange-rate policy presents dilemmas; the most that can be sought

[34]Similarly, agents of restraint in Botswana included traditional chiefs and cattle owners, and in Norway they included fishing and other decentralized industries that supported cautious spending.

is to prevent extended periods of overvaluation, especially on the downside of a cycle. Trade policy needs to be reasonably open, otherwise domestic spending of rent will raise prices and domestic costs, making it harder for the traded sectors to compete. There may be a special place for selective credit policy to help prevent the real estate booms and asset bubbles that characterize resource cycles.

It is also vital to build other types of capital to complement natural resource wealth. These include human capital and institutional or governance capital. Countries with major shortfalls in these assets are more likely to suffer from a resource curse. They will also find greater difficulty in establishing viable nonresource export sectors, because they will be less able to compete with other countries at roughly comparable levels of income. Resource wealth opens up opportunities for countries to invest in high-quality human capital and in a capable and accountable state, but only a few countries have done so.

Sectors will not diversify either without measures to bring down production costs in the new traded sectors, both to spur efficiency and to encourage new entry. The horizontal policies discussed above will play an essential role; any economy-wide policies that increase the costs or difficulties of doing business make diversification more difficult. But some forms of vertical policy that favor traded sectors, whether on a broader or a narrower basis, are likely in resource-rich countries. They can include focused infrastructure investments, tax and tariff relief, special zones, programs or regulations that bring down labor costs, or other measures. There is still debate on how finely countries can target promising subsectors; while a range of analytic methods can be used to suggest promising focus areas, it will be necessary to maintain flexibility, especially if the intention is to encourage the entry of new investors.

All of the successful countries discussed in this chapter have used such vertical policies, with a strong bias toward broadening the range of operating businesses and exports. There may be special arguments for these policies. As for nonresource economies, such vertical policies might help to address market failures, such as external economies or information or coordination failures, which slow the growth of new business. In addition, assuming that diversification is indeed a national long-term priority, these policies offer one way to counter the market's immediate pull of factors of production toward the nontraded sectors, which comes from the spending of natural rent. Moreover, natural rent also provides government with increased resources to implement vertical policies.

But the risks are particularly high. Securing access to fiscal incentives is a way to capture a share of natural rent, and this increases the pressures for special programs to become a mechanism of distribution to favored insiders. A focus on such programs can reduce policy attention to the basics: it is always easier to introduce a new program than to address the politically difficult problem of confronting the supporters of existing policies and reforming them. Having more fiscal resources also reduces the urgency of reversing failing policies. Even if they are intended to promote diversification, ineffective programs will be worse than not spending at all, since their effect will be on the demand side, pulling factors of production toward the nontraded sectors.

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CHAPTER 5

Finance and Oil: Is There a Resource Curse?

THORSTEN BECK

INTRODUCTION

An extensive literature has identified financial sector development as a critical factor in inclusive economic development (see Levine, 2005, and Beck, 2009, for overviews). Countries with deeper financial systems grow faster, and it is the lowest income quintile that benefits most from this deepening (Beck, Levine, and Loayza, 2000; Beck, Demirgüç-Kunt, and Levine, 2007). Countries with deeper financial systems also experience faster reductions in income inequality and poverty rates. Financial sector development helps industries that are most reliant on external finance grow faster, and it helps enterprises, especially smaller and more opaque ones, overcome financing constraints (Rajan and Zingales, 1998; Beck, Demirgüç-Kunt, and Maksimovic, 2005). The positive effect of financial sector development on economic growth comes through improved resource allocation and productivity growth, rather than increased capital accumulation (Beck, Levine, and Loayza, 2000; Wurgler, 2000).

However, most of this literature is based on broad cross-country samples, following the assumption that the finance-growth relationship is linear and constant across countries.[1] Meanwhile, many other papers in the finance and growth literature drop oil-exporting countries or natural-resource-based economies in general, arguing that their economic development is driven by different factors and that their financial sector has a role and structure that differs from what applies in other economies.

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[1]There are several papers, however, that have shown nonlinear finance–growth relationships, including Aghion, Howitt, and Mayer-Foulkes (2005) and Rioja and Valev (2004a, 2004b).

This chapter focuses on financial deepening in resource-based economies. Specifically, it will test whether the finance and growth relationship varies across countries depending on the degree to which they rely on natural resources and, second, will document the development and structure of financial systems in resource-based economies compared to other countries. In the first section, we will use standard cross-country growth regressions as well as industry-level regressions, allowing for a differential relationship between finance and economic growth depending on the degree to which an economy relies on natural resource exports or is abundant in natural resource wealth. In the second section, we will use aggregate bank-level and firm-level data to explore whether the depth, breadth, and efficiency of financial systems varies systematically across countries with different degrees of natural resource reliance.

Exploring the role financial-sector development plays in the growth of resource-based economies is interesting and important for both academics and policymakers. There is a large literature on the natural resource "curse" and the different channels through which resource abundance can influence growth; understanding the role of financial development in this context is critical. Policymakers who care about the development of their countries need to understand the relative importance of different policy areas and the effectiveness of specific policies. Understanding channels through which resource abundance can stimulate or dampen economic development can be important to developing policies to maximize the benefits of natural capital.

By exploring the role and structure of the financial system in resource-based economies, this chapter builds on the literature that has explored the above-mentioned curse of natural resource abundance (see van der Ploeg, 2011, for a recent survey), which refers to the crowding out of nonresource-based activities or investment through price and incentive effects. One form of this curse—also referred to as Dutch disease—works through the exchange rate mechanism: commodity exports will put upwards pressure on the real exchange rate, which will turn nonresource exports uncompetitive, ultimately depressing the traded goods sector. The decline of British manufacturing after the discovery of oil in the 1970s and the decline of the Dutch manufacturing sector after the discovery of a natural gas field in 1959 are prominent recent examples, although neither decline lasted.

Beyond price effects, the natural resource curse also refers to the distortion of incentives for investing in institutions, education, and other public services due to windfall gains from natural resources, which can ultimately have negative repercussions for political freedom and stability. It is generally easier to make short-term profits from natural resources such as oil than from fixed assets such as manufacturing plants, equipment, and machinery, because proceeds from natural resources depend less on the creation of a market, on human capital, and on research and development (R&D) investment. This in turn reduces incentives to invest in an institutional framework that supports broad domestic market-based exchange, private property rights, and the contractual framework supporting non-commodity production (Besley and Persson, 2010). Natural resource wealth also allows less than democratic governments to buy off political

opposition, avoid accountability, and prevent transparency. Natural resources make it more profitable for the elites to hang on to power and block the development of an open society (Beck and Laeven, 2006). This, in turn, can foster conflict, as seen most prominently across Sub-Saharan Africa (Collier and Hoeffler, 2004). In addition, a commodity-induced bonanza can foster a shift from profit-making entrepreneurship toward socially inefficient rent seeking. However, there is also an interaction between institutional development and resource abundance, with countries above a threshold of institutional development able to reap benefits from natural resource wealth (Mehlum, Moene, and Torvik, 2006).

The empirical literature has provided ample evidence for the natural resource curse and the different channels through which it affects growth. However, this literature has also noted a wide cross-country variation in experiences. On the one hand, Nigeria has experienced negative growth since its independence, associated with exchange rate effects, rent seeking, and violence stemming from oil exports, while on the other hand Botswana has experienced positive growth over the past 50 years, despite being heavily reliant on diamond exports. However, according to Gylfason (2001), only 4 out of 65 resource-based economies can be considered success stories in terms of growth (Indonesia, Malaysia, Thailand, and Botswana), and the three Asian countries in that group still fared less well than their East Asian neighbors Hong Kong, Singapore, and South Korea. With few exceptions, however, the literature has not considered the effect of natural resource abundance on financial development or the role of financial institutions in mitigating the natural resource curse (van der Ploeg, 2011).[2]

In exploring whether there is a natural resource curse in financial development, this chapter also builds on a large literature on the determinants of financial deepening across countries. Boyd, Levine, and Smith (2001) show the importance of macroeconomic stability for financial deepening, while La Porta and others (1997, 1998) and Djankov, McLiesh, and Shleifer (2007) show the importance that contractual and information frameworks have for financial development.[3] A related literature has explored the importance of historical factors, such as legal tradition, and geographic traits in forming institutional and specifically financial development (see Beck and Levine, 2005, for a survey).

Theory and the institutional literature provide different hypotheses on the effects natural resource abundance has on financial system development. Both demand-side and supply-side effects are analyzed. Take first the demand side. On the one hand, windfall gains from natural resource abundance and the consequent expansion of the nontraded goods sector can lead to higher demand for financial services, including consumer credit. On the other hand, there is lower

[2]Two exceptions are Bhattacharyya and Hodler (2010), who show a negative relationship between resource dependence and financing development in countries with low levels of democracy using country-level data, and Barajas, Chami, and Yousefi (2010), who explore the finance and growth relationship across countries with different degrees of resource dependence. Gylfason (2004) also offers some suggestive evidence of lower financial development in resource-based economies.

[3]See Beck (2006) for an overview.

demand for external financing from the natural resource sector than from the nonresource traded goods sector, which will suffer in a Dutch disease scenario. Further, the literature has documented lower savings and investment rates in resource-based economies, which in turn can also explain those economies' lower demand for financial services. Specifically, resource-rich countries can use their resource revenues for consumption smoothing, which weakens the incentive to build an effective financial system to serve as a buffer to smooth consumption over the business cycle (Gylfason, 2004). Take next the supply side. Higher investment in the natural resource sector can lead to lower investment in the financial sector and draw away skills from the financial system. In addition, the fact that financial systems depend heavily on sound institutional frameworks, including effective contractual frameworks, can hamper financial deepening in countries where natural resource abundance undermines institutional development.

Theory also makes ambiguous predictions about the finance-growth relationship in resource-based economies. On the one hand, the financial system might be less important, since growth depends less on finance-intensive sectors. On the other hand, financial system development might be more important to compensate for the negative effects of Dutch disease and in order to diversify the economy. In addition, financial systems in resource-based economies can help counter the negative impact of real exchange rate volatility (Aghion and others, 2009).

The following empirical results show that financial development is as important for economic growth in resource-based economies as in other countries. On the other hand, resource-based economies do have less developed financial systems, and while their banks are more liquid, better capitalized, and more profitable, they give fewer loans to firms. Firms in these economies use less external finance than firms elsewhere, and a smaller share of them uses bank loans, although there is the same level of demand as in other countries, thus pointing to supply constraints. Overall, there is some indication of a natural resource curse in financial development, the weight of which falls more on enterprises than on households.

Since this chapter is one of the first to rigorously explore the role of financial systems in resource-based economies, several caveats are due. First, we work with very rough measures of natural resource dependence, although we test the robustness of our results across several indicators. Second, this is a very broad but also preliminary exploration of the role of financial systems in resource-based economies; what we gain in breadth, we miss in depth in the different dimensions. Several of the topics explored in this chapter could profitably be subjected to more in-depth explorations, which would also have to address issues of identification.

This chapter is related to a small literature on the institutional resource curse. Beck and Laeven (2006) show that variations in the extent of natural resources across transition economies can partly explain variations in their institution building after 1990, when all these countries faced the same challenge of building market-compatible institutions. Cross-country regressions have confirmed this negative relationship between natural resource abundance and the rule of law (Norman, 2009), control of corruption (Papyrakis and Gerlagh, 2004) and overall institutional capacity (Isham and others, 2005).

The remainder of the chapter is structured as follows. The next (second) section assesses whether the finance and growth relationship varies across countries according to the degree of importance that commodities have in the economy. The third section explores whether commodity-based economies have lower levels of financial development and is thus a test of the resource curse for financial system development. The fourth section analyzes banks' balance sheets and income statements to show whether banks are different in resource-based economies. The fifth section uses firm-level survey data to explore differences in firms' use of external finance and firms' financing obstacles across countries with a different reliance on natural resources and aggregate outreach data. The last section concludes and provides some policy discussion.

FINANCE AND GROWTH: IS THERE A NATURAL RESOURCE DISCOUNT?

This section explores whether the positive relationship between financial development and economic growth varies across countries depending on the degree of natural resource reliance. In order to do so, we use Barro-style standard cross-country finance and growth regressions, adding a variable capturing natural resource reliance or abundance plus its interaction with financial development.

We use two indicators to gauge the reliance of economies on natural resources. The first indicator is *Natural Resource Exports*, which is the sum of fuel, ores, and metal exports relative to GDP.[4] Data come from the World Bank's World Development Indicators, and are available for a broad cross-section of countries on an annual basis over the period 1960 to 2007. The second indicator is *Subsoil Assets* per capita and refers to natural assets (World Bank, 2006). It is computed as the net present value of the income these resources are able to produce, calculated for the year 2000. Natural Resource Exports ranges from zero, in countries like Mauritius, to almost 100 percent in many oil-exporting countries. Similarly, Subsoil Assets per capita ranges from zero, in countries like Singapore, to US$80,000 in Saudi Arabia. Given the wide variation, we use the log of one plus Subsoil Assets in our regressions. It is important to note that there are important differences between these two measures, with Natural Resource Exports referring to the realized income stream based on the resources and Subsoil Assets referring to the actual wealth.[5] However, the two measures are highly and significantly correlated with each other, suggesting that most economies that are abundant in natural resources also rely on natural resources as an export good. It is also important to note that both measures have their shortcomings. The ratio of Natural Resource Exports to GDP can be driven as much by the numerator as by the denominator and depends very much on the extraction rate. Subsoil Assets per capita is a more direct measure of natural resource

[4]We therefore abstract from agricultural commodities.

[5]Brunnschweiler and Bulte (2008) point to important differences in the effect of natural resource dependence and natural resource abundance on institutional and economic development.

wealth, but it relies heavily on assumptions about reserves and extraction costs (van der Ploeg and Poelhekke, 2010).

As an indicator of financial development, we use a standard indicator from the literature, *Private Credit*, which is the total claims by financial institutions outstanding on the domestic nonfinancial private sector, divided by GDP. This indicator ranges from less than 2 percent in the Democratic Republic of Congo to almost 150 percent in Switzerland. As an alternative indicator, we use *Liquid Liabilities* to GDP, which is defined as currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries, divided by GDP, and thus focuses on banks' liability side. Both indicators are from the World Bank's Financial Development and Structure Database (Beck, Demirgüç-Kunt, and Levine, 2010). All other macroeconomic indicators are from the World Development Indicators (WDI) of the World Bank.

We average real GDP per capita growth over the period 1980 to 2007 and run the following regressions:

$$g(i) = \alpha_1 + \beta_1 \text{Private Credit (i)} + \beta_2 \text{Private Credit (i)} * \text{Natural Resources (i)} + \beta_3 \text{Natural Resources (i)} + \gamma' C(i) + \varepsilon(i) \quad (1)$$

where β_1 captures the general effect of financial development on growth, while β_2 captures the differential effect in economies that are more resource based. Following the finance and growth literature, our set of conditioning information includes (i) the log of initial real GDP per capita to control for convergence, (ii) average years of schooling to control for human capital accumulation, (iii) the share of exports and imports to GDP, (iv) the inflation rate, and (v) the ratio of government expenditures to GDP.[6] With the exception of initial GDP per capita, all explanatory variables are averaged over the sample period, 1980 to 2007.[7]

The results in Table 5.1 do not show any significant difference in the finance and growth relationship linked with the degree of natural resource reliance. The column 1 results confirm the findings in the cross-country finance and growth literature showing a positive relationship between financial development and long-run economic growth, while the column 2 results do not show any differential effect of financial development on growth in resource-based economies, since the coefficient on the interaction term enters negatively, but insignificantly. Columns 3 and 4 confirm our findings using our alternative indicator of natural resource abundance, Subsoil Assets, and our alternative indicator of financial development, Liquid Liabilities, respectively. Among the control variables, government consumption enters negatively and significantly, while years of schooling enters positively and significantly. Initial GDP per capita enters negatively, though it is not consistently

[6]Similar sets of conditioning information were used by Beck, Levine, and Loayza (2000) and Beck and Levine (2004).

[7]In the context of this chapter, we will not address issues of causality and omitted variable. A large literature has shown that the relationship between financial development and growth is robust to controlling for biases due to endogeneity, measurement, and omitted variables. See Beck (2009) for a survey.

TABLE 5.1

Finance, natural resources, and growth across countries

	(1) GDP pc growth	(2) GDP pc growth	(3) GDP pc growth	(4) GDP pc growth	(5) Growth in Gini	(6) Growth in Gini
Initial GDP per capita	-0.00354*	-0.00356*	-0.00274	-0.00561***		
Private credit	0.00735***	0.00798***		0.0105***	-0.00521**	-0.00467*
Inflation	0.00185	0.00228	-0.00067	0.00142	1.30E-05	1.35E-05
Government consumption	-0.0112**	-0.0114**	-0.0101**	-0.0101**		
Trade	0.00545**	0.00552**	*0.00425	0.00203	-0.00088	-0.00079
Years of schooling	0.00227***	0.00222***	0.00226**	0.00308***	0.000685	0.000494
Natural resource exports	-0.0284***	0.0360**	-0.0368**		0.0212**	0.00453
Natural resource exports* Private credit		-0.00657				-0.0108
Liquid liabilities			0.0101***			
Natural resource exports* Liquid liabilities			-0.00912			
Subsoil assets				-0.00064		
Subsoil assets* Private credit				-0.00033		
Initial Gini					-0.0173***	-0.0173***
GDP pc growth					0.0464	0.0533
Constant	0.0450**	0.0462**	0.0412**	0.0699***	0.0578***	0.0581***
Observations	104	104	102	102	64	64
R-squared	0.419	0.421	0.411	0.381	0.322	0.329

Note: The symbols ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

significant, while trade openness enters positively, but not always with a significant coefficient. Finally, inflation enters insignificantly, which can be explained by the negative impact that inflation has on financial development (Boyd, Levine, and Smith, 2001) and which thus indirectly affects economic growth. In unreported regressions, we also use a dummy variable for countries with Natural Resource Exports greater than 10 percent of GDP and confirm our findings. Finally, we control whether the insignificant coefficient estimate for the interaction term is not driven by the absence of a nonlinear term of Private Credit to GDP; controlling for a squared term of Private Credit to GDP does not change our findings.

Columns 5 and 6 consider the relationship between finance and income inequality. Building on previous work by Beck, Demirgüç-Kunt, and Levine (2007), we regress the average annual growth rate in the Gini coefficient on financial development, Natural Resource Export, their interaction and a set of conditioning information.[8] We find that financial development has a negative relationship

[8]We focus on the change in income distribution rather than the level as complement to the GDP per capita regressions. Specifically, changes in relative and absolute poverty levels can be decomposed into changes in average income growth (i.e. GDP per capita growth) and changes in income inequality. While columns 1 to 4 of Table 5.1 focus on the former, columns 5 and 6 focus on the latter. See Beck, Demirgüç-Kunt, and Levine (2007) for a more detailed discussion.

with the growth rate in the Gini coefficient, while Natural Resource Reliance has a positive, thus inequality-increasing, impact. The interaction term between the two, on the other hand, does not enter significantly.

The results in Table 5.1 suggest that the finance and growth and the finance and inequality relationships hold as much for resource-based economies as for other economies. The insignificant interaction term between natural resource dependence and financial development, however, can also be interpreted as indicating that financial development does not have a dampening impact on the negative role of natural resources in the overall growth process.

In a second step, we test whether industries that are more dependent on external finance grow faster in countries with deeper financial systems and whether this relationship depends on a country's reliance on natural resources. This test follows the seminal work by Rajan and Zingales (1998) who show that financial development is indeed beneficial for industries that depend more on external financing sources, where this demand is measured for large U.S. corporations that face a flat supply curve. Since financial deepening is especially relevant for manufacturing—a sector, on the other hand, that might easily be crowded out by natural resource abundance—this test seems especially relevant to our assessment whether the finance and growth relationship holds for natural resource countries as much as it does for other countries. Specifically, we extend the Rajan and Zingales (1998) test as follows:

$$g(i,k) = \alpha(i) + \lambda(k) + \beta_1(\text{External}(k)*\text{Private Credit}(i)) + \gamma\text{Share}(i,k) + \beta 2(\text{External}(k)*\text{Private Credit}(i)*\text{Natural Resources}(i)) + \varepsilon(i,k) \quad (2)$$

where *g(i,k)* is growth of industry *k* in country *i*, averaged over the 1980s, *External(k)* is an industry-level measure of external dependence that does not vary across countries, α and λ are vectors of country and industry dummies, respectively, and *Share* is the initial share of industry *k*'s value added in total manufacturing value added of country *i*. By including industry- and country-specific effects, the coefficient β measures the differential growth impact of financial development on high-dependence industries relative to low-dependence industries. While β_1 captures the overall effect of financial development on industry growth dependent on the need of the industry for external finance, β_2 measures the differential effect of this interaction depending on the abundance or reliance of the country on natural resources. We also include the interaction between external dependence and natural resources.[9]

Table 5.2 shows weak evidence that the finance and growth relationship might be even stronger for countries that rely more on natural resources. While the interaction between Private Credit and External Dependence enters positively and significantly, the triple interaction with Natural Resource Exports enters positively but insignificantly (column 1). We find similar findings when using

[9]We do not have to (and cannot) include the interaction between Private Credit to GDP and natural resources in the presence of country dummies.

TABLE 5.2

Industry growth, finance, and natural resources across countries

	Industry growth	Industry growth	Industry growth
Initial share	-0.936***	-1.080***	-1.111***
Private credit*external dependence	0.0804**	0.0535	0.0766**
Private credit*external dependence* Natural resource exports	0.0408		
External dependence*natural resource exports	0.111		
Private credit*external dependence* Subsoil assets		0.00922	
External dependence*subsoil assets		-0.0046	
Private credit*external dependence* Natural resource dummy			0.163*
External dependence*natural resource dummy			-0.0677
Observations	1,105	1,132	1,147
R-squared	0.302	0.277	0.281

Note: The symbols ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Subsoil Assets, though here the interaction between Private Credit and External Dependence also enters insignificantly, possibly due to multi-collinearity with the triple interaction term (column 2). When we use the Natural Export Dummy (indicating Natural Exports greater than 10 percent of GDP), however, the triple interaction enters positively and significantly at the 10 percent level (column 3), providing some evidence that the role of the financial system in channeling funds to manufacturing industries that need them most might be even more important in resource-based economies.

Summarizing, this initial evidence does not provide strong evidence that the relationship between finance and growth differs across countries according to the degree of natural resource abundance, nor that the relationship between finance and changes in income inequality differs. Financial development is not less important for growth in resource-based economies, and *it might be even more important*. These results are certainly not conclusive. More work is needed in this area, especially using industry and firm-level data and disaggregating GDP into its resource-related and nonresource-related components. Preliminary work by Barajas, Chami, and Yousefi (2010) shows that there might be a differential effect if one considers panel rather than cross-country regressions, with financial development having lower if not negative impact on growth in oil-exporting countries. In related work, van der Ploeg and Poelhekke (2009) show that financial development has a dampening impact on volatility in resource-based economies, with positive repercussions for economic growth. Apparently, then, policymakers in resource-based economies should care about financial sector deepening as much as policymakers in other countries.

Having shown that financial development is as important for economic growth in resource-based economies as in other countries, we now explore whether the development and structure of financial systems differs across countries with different degrees of resource abundance.

FINANCE AND NATURAL RESOURCES—IS THERE A RESOURCE CURSE?

This section explores whether there is empirical evidence for a resource curse in financial development. Specifically, we assess whether economies more reliant on natural resources have lower levels of financial development after controlling for standard factors associated with variation in financial development across countries.

Controlling for economic development, we find that countries that rely more on natural resource exports have lower levels of Private Credit. Figure 5.1 presents a partial scatter plot of Private Credit and Natural Resource Exports, controlling for GDP per capita. Here we present data across countries, with data averaged over the period 2000 to 2007. In the following, we will use multivariate regression analysis to assess the robustness of this finding while controlling for other determinants of financial development.

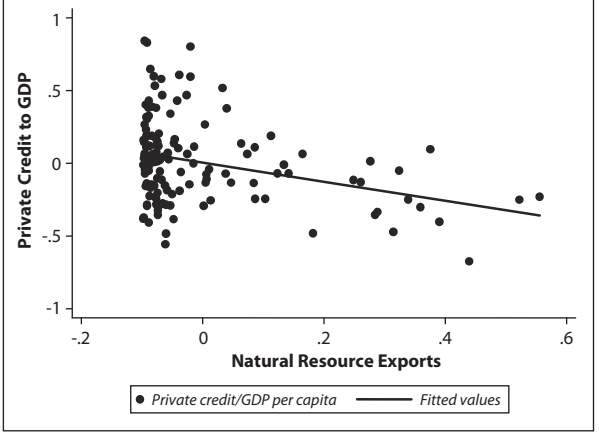
The literature has pointed to macroeconomic stability and the efficiency of the contractual and information frameworks as important determinants of financial sector development (Boyd, Levine, and Smith, 2001; Djankov, McLiesh, and Shleifer, 2007). In our analysis, we therefore control for (i) the log of real GDP per capita, averaged over the sample period (ii) the average inflation rate between 2000 and 2007, (iii) time to enforce a contract in number of days, and (iv) the efficiency of the credit information system, with the latter two measures averaged over the period 2003 to 2007. Specifically, we run the following regressions.

$$\text{Private Credit (i)} = \beta \text{Natural Resources (i)} + \gamma' C(i) + \varepsilon(i) \qquad (3)$$

In addition to the two financial system indicators introduced above, we focus on several other indicators, all from the Financial Development and Structure Database (Beck, Demirgüç-Kunt, and Levine, 2010). The *Loan-Deposit Ratio* is a measure of intermediation efficiency and is the ratio of total bank claims outstanding on domestic nonfinancial sectors to total bank deposits. Higher ratios indicate higher intermediation efficiency; ratios above one, however, might indicate overheating of the financial system. We also use two indicators to gauge the development of the stock market. Specifically, *Stock Market Capitalization* to GDP is a measure of stock market size relative to real economic activity, and *Stock Market Turnover* is an indicator of stock market trading relative to stock market capitalization and therefore a measure of the liquidity of the market.

In addition to the financial development indicators defined above, we consider the relationship between natural resource reliance and two indicators of financial structure, that is, the degree to which a financial system is market-based or bank-based. Following Beck and Levine (2002), we define *Structure-Size* as the ratio of Stock Market Capitalization and Bank Assets, where the latter is defined as total banking claims on the nonfinancial (private and public) domestic sectors. Higher ratios would indicate a financial system that is more market-based. *Structure-Efficiency* is defined as

Figure 5.1
Financial development and natural resource dependence



the product of Stock Market Turnover and banks' Net Interest Margin (a negative indicator of bank efficiency). Higher numbers would again indicate a financial system that is more market-based.

Table 5.3 shows that countries relying more heavily on natural resource exports have lower levels of financial development, even after controlling for other determinants of financial development. The effect is not only statistically large but also economically large. Take the example of column 1. One standard deviation higher Natural Resource Exports implies 10 percentage points lower Private Credit.[10] Consistent with the literature, there is a negative relationship of inflation and contract enforcement inefficiency, while the efficiency of credit information sharing does not enter significantly. Consistent with Figure 5.1, the log of GDP per capita enters positively and significantly. The column 2 results confirm this finding using Subsoil Assets as the indicator of natural resources, while column 3 confirms the results using Liquid Liabilities. The column 4 results show that lower levels of financial intermediation do not imply lower intermediation efficiency, since Natural Resources does not enter significantly in the regression of the aggregate Loan-Deposit Ratio. Results in columns 5 and 6 show that in economies that rely more on natural resources, stock exchanges are not smaller but they are significantly less liquid. Natural Resource Exports enters insignificantly in the regression of Stock Market Capitalization to GDP, but negatively and significantly in the regression of Stock Market Turnover.

[10]It is important to note, however, that not all resource-based economies have a lower level of Private Credit than predicted by the other variables. Norway and other high-income countries have even higher levels of Private Credit than predicted by the other included variables, while many developing resource-based economies have significantly lower levels. This points to a need for further exploration of the differential effects of natural resource abundance in future research.

Finally, the results in columns 7 and 8 show that when measured by size, resource-based economies have financial systems that are more market-based, while when measured by efficiency, they have systems that are more bank-based. Given the previous results, we can interpret this as suggesting that the market-based nature, in terms of size, stems from the smaller banking systems in resource-based economies, while the bank-based nature, in terms of efficiency, stems from the lower stock market liquidity in these countries. We confirm the findings of Table 5.3 using our alternative indicators of natural resource abundance, Subsoil Assets and the Natural Resource Export dummy.

The results so far have focused on cross-country variation in financial development, but there is also a large variation within countries over time. How do countries with different degrees of natural resource dependence develop their financial systems? Does natural resource abundance help or impede further financial deepening as demand for financial services increases with economic development?

Table 5.4 explores the within-country variation of financial development as a function of natural resource reliance. Specifically, here we present estimations with country-fixed effects to explore how Private Credit develops over time with GDP per capita. We focus on a longer sample period, using annual data over the period 1960 to 2007. We use this sample to assess how the financial system deepens as a function of economic development and other macroeconomic indicators, and whether these relationships vary according to the degree of natural resource reliance.

$$FD(i,t) = \beta_1 \text{ GDP per capita } (i,t) + \beta_2 \text{ GDP per capita}(i,t)*\text{Natural Resources } (i,t) + \beta_3 \text{ Natural Resources}(i,t) + \gamma' C(i,t) + \delta' X(i) + \varepsilon(i,t) \quad (4)$$

Unlike in Table 5.3, we include all indicators in logs so that we can interpret the coefficient estimates as elasticities. While β_1 shows the relationship between Private Credit and GDP per capita, β_2 indicates whether this relationship is significantly higher or lower in countries with higher reliance on natural resources. We do not include indicators of the contractual or information framework, since the time-series variation and data availability in these indicators are limited. We do include country-specific fixed effects and other time-varying country variables as explained below. By including country-specific effects, we effectively explore relationships within countries over time and abstract from the cross-country variation.

The results in Table 5.4 indicate that Private Credit increases with GDP per capita, but to a lower extent in countries that rely more on natural resource exports. While the elasticity of Private Credit to GDP per capita is almost one for countries with no Natural Resource Exports, this elasticity is significantly lower in countries with higher Natural Resources. The column 2 results show that the significant interaction between GDP per capita and Natural Resource Exports is not driven by general trade openness. While there is a positive relationship between Private Credit and the trade share, this relationship is more muted in countries with a higher reliance on natural resources.[11] The column 3 regression, on the other hand, shows that the relationship inverts when using Subsoil Assets, an indicator of natural resource

[11]When computing trade share to GDP net of natural resource exports, our findings are confirmed.

TABLE 5.3

Financial development across countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Private Credit	Private Credit	Liquid Liabilities	Loan-deposit ratio	Stock market capitalization	Stock market turnover	Structure-Size	Structure-Efficiency
Inflation	-1.750***	-0.39	-1.976***	-0.032	0.106***	-0.0296	0.45	0.00762**
GDP per capita	0.181***	0.188***	0.178***	0.0349	0.256***	0.0911*	0.128**	-0.000205
Time to enforce contract	-0.000178***	-0.000132**	-6.72E-05	-0.000238**	-0.000201	-0.000231	2.62E-05	-1.37E-05
Information sharing	0.00568	0.0197	-0.0602**	0.0654***	-0.043	0.0452*	-0.0226	0.00203*
Natural resource exports	-0.658***		-0.733***	0.384	0.0148	-0.704***	1.557***	-0.0251**
Subsoil assets		-0.0145**						
Observations	142	149	140	152	106	106	102	103
R-squared	0.662	0.6	0.464	0.178	0.359	0.159	0.193	0.073

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

TABLE 5.4

Financial development over time					
	(1)	(2)	(3)	(4)	(5)
	Private Credit	Private Credit	Private Credit	Private Credit	Private Credit
GDP per capita	0.902***	1.100***	1.304***	1.526***	1.544***
Inflation	-0.0538***	-0.0543**	-0.0481***	-0.0393***	-0.0477***
Natural resource exports		2.014***	1.655**	-4.034***	
Natural resource exports* GDP per capita		-0.418***	-0.375***	0.205	
Trade	0.194***	0.505***	1.116***	0.921***	0.924***
Trade * GDP per capita		-0.0433**	-0.132***	-0.112***	-0.122***
Natural resource exports* Real exchange rate				-0.000642**	-0.00279***
Real exchange rate* Natural resource exports				0.00608***	
Subsoil assets* GDP per capita			0.0232***		0.000875
Subsoil assets* Real exchange rate					0.000601***
Observations	3,428	3,428	4,31!	1,803	1,770
R-squared	0.401	0.402	0.31″	0.36	0.352
Number of countries	148	148	153	86	84

Note: The symbols ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

abundance rather than exports. Countries with higher natural resource wealth deepen their financial systems at a faster rate than other countries. This points to an important difference between measures of resource dependence and measures of resource abundance, as already noted by Brunnschweiler and Bulte (2008), and indicates that natural resource abundance can actually be used to the advantage of countries in financial deepening. An important caveat, however, is that Subsoil Assets is measured in 2000, that is, it includes information that was available at this point in time, not necessarily in 1960.

The results in columns 4 and 5 show that while real exchange rate appreciation leads to deeper financial systems (although economically it is a very small effect), this relationship is reversed for countries with a higher share of Natural Resource Exports. This might be the clearest evidence of a Dutch disease effect, that is, a crowding out of nonresource exports through an appreciating exchange rate can also crowd out financial development. Interestingly, when controlling for real exchange rate changes and their interaction with natural resource indicators, the interaction between the natural resource indicators and GDP per capita turns insignificant, which would suggest that the resource curse in financial development does indeed work mainly through the Dutch disease effect of real exchange rate appreciation.

Summarizing, resource-based economies have smaller banking systems and less liquid stock exchanges than predicted by their level of economic development, their degree of monetary stability, and the efficiency of their contractual and informational frameworks. As resource-based economies develop economically, their financial systems deepen at a slower rate than in other countries,

although this result holds for natural resource reliance (or dependence) rather than natural resource abundance. The fact that this result holds after controlling for the contractual and information frameworks suggests that the natural resource curse in financial development goes beyond the institutional natural resource curse documented in the literature (e.g., Beck and Laeven, 2006).

The findings so far are consistent with both a demand-driven and a supply-driven story, that is, with lower demand for financial services resulting in a smaller financial system or supply constraints preventing a financial system from developing. In the next two sections, we therefore focus first on indicators derived from banks' financial statements to assess whether banks in commodity-based economies are different in their business model, efficiency, and stability, before turning to firm-level data to assess whether clients are underserved in resource-based economies.

BANKS IN RESOURCE-BASED ECONOMIES

While the previous section provides some evidence of a natural resource curse in financial development, this section digs deeper by exploring banks' business models, efficiency, stability, and asset composition to assess whether there are significant differences across banks in countries that rely on natural resources to different degrees. We use data from Bankscope[12] over the period 2000 to 2007 and construct and compare indicators of business orientation, efficiency, and stability across banks and across countries with different degrees of natural resource reliance. We only include banks with at least two observations and countries with data on at least four banks. We restrict our sample to the largest 100 banks (in terms of assets) within a country so that our sample is not dominated by any specific country. Finally, we eliminate outliers in all variables by winsorizing at the 1st and 99th percentiles.

To compare the business orientation of banks, we use four indicators suggested by Demirgüç-Kunt and Huizinga (2010): the ratio of fee-based income to total operating income; the importance of non-deposit funding to total funding; the traditional loan-to-deposit ratio; and the ratio of liquid assets to total assets. To compare bank efficiency, we use three indicators. Our first efficiency indicator is overhead cost, which is computed as total operating costs divided by total assets. Second, we use the cost-to-income ratio, which measures overhead costs relative to gross revenues, with higher ratios indicating lower levels of cost efficiency. And third, we use the net interest margin, which is net interest revenue relative to total earning assets. All three indicators decrease in efficiency, that is, higher numbers indicate less efficient banks. To compare the stability of banks across countries, we focus on the z-score, which is defined as the sum of capital-to-asset ratio and return on assets, divided by the standard deviation of return on assets. This score measures the distance—in number of standard deviations in return on assets—that separates a bank from insolvency, and so it increases as the stability of a bank

[12]Bankscope is a database owned by Bureau van Dijk.

increases. We also assess differences across banks and countries in the capital-to-asset ratio and in return on assets, two of the components of the z-score.

We average data over the sample period (2000 to 2007) and run the following regression:

$$\text{Bank (i,j)} = \alpha B(i,j) + \beta_1 \text{ GDP per capita(j)} + \beta_2 \text{ Natural(j)} + \varepsilon(i,j) \quad (5)$$

where *i* stands for bank and *j* for country. *B* is a set of bank-level control variables, including size (measured in logs of millions of USD of total assets), the share of non-loan earning assets in total assets, and the ratio of fixed assets to total assets. We control for the log of GDP per capita to avoid confounding the relationship between economic development and natural resource dependence with the relationship between natural resource dependence and bank characteristics. We apply standard errors clustered on the country level, that is, we allow for correlation between error terms of banks within countries but not across countries, in order to control for unobserved factors across banks within a country.

The results in Table 5.5 show few significant differences across banks according to the reliance on natural resources in the countries where they operate. Regarding the business model, we find no significant differences in the share of fee income, the reliance on non-deposit funding, or the loan-deposit ratio across countries with different degrees of reliance on natural resources. However, we do find that the share of liquid assets in total assets increases as we move from countries with no natural resource exports to resource-based economies. In terms of efficiency, the only dimension where the degree of natural resource reliance seems to matter is the cost-to-income ratio, which is significantly lower in countries that are more resource-based. On the other hand, there are no significant differences in the net interest margin or overhead costs across countries with different reliance on natural resources.

Finally, we find no significant differences in the stability of banks across countries with different degrees of reliance on natural resources, but we do find a significant difference in capitalization and profitability. Banks in resource-based economies are significantly better capitalized and more profitable. The higher profitability also explains why we find a lower cost-to-income ratio for banks in resource-based economies, while there are no significant differences in the other two efficiency indicators. We confirm all our findings using Subsoil Assets and the Natural Export dummy as indicators of the resource nature of economies.

Turning to the control variables, we find that banks in richer countries have higher cost-to-income ratios but lower net-interest margins, and they are more stable due to higher capitalization and despite lower profitability. Banks with a higher share of fixed assets have higher fee income and a lower loan-to-deposit ratio, and they are less efficient and better capitalized. Banks with higher non-loan earning assets have higher fee income, lower loan-to-deposit ratio, higher liquid assets, and lower net-interest margins, and they are less stable. Finally, larger banks rely more on non-deposit funding, have lower loan-to-deposit ratios, hold fewer liquid assets, are more efficient, and have lower capital-to-asset ratios and returns on assets.

TABLE 5.5

Banks' business model, efficiency, and stability across countries

	(1) Fee income	(2) Non-deposit funding	(3) Loan-deposit ratio	(4) Liquid assets	(5) Cost-income ratio	(6) Overhead costs	(7) Net interest margin	(8) Z-score	(9) Equity-asset ratio	(10) ROA
Fixed assets	1.439**	-0.0232	-0.0584***	-0.274	3.546***	0.596***	0.00269***	-0.544*	0.278**	-0.0285
Non-loan earning assets	0.192***	0.00168	-0.0159***	0.543***	0.0385	0.00125	-0.000185***	-0.0617***	0.0113	0.000809
Size	-0.408	0.558**	-0.0474***	-1.673***	-1.708***	-0.409***	-0.00286***	-0.402	-1.990***	-0.0494**
GDP per capita	0.927	-0.314	0.0248	-0.0659	2.066***	-0.0142	-0.00361***	2.288***	0.465**	-0.0989***
Natural resource exports	2.302	-1.636	0.222	16.49***	-24.86***	0.341	0.0161	-0.911	6.247***	2.277***
Observations	2,160	3,503	3,432	3,555	3,422	3,446	3,437	3,525	3,554	3,547
R-squared	0.061	0.014	0.137	0.525	0.155	0.409	0.268	0.075	0.341	0.132
Number of countries	113	114	114	114	114	114	114	114	114	114

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In a separate analysis, we compare the balance sheet composition of banks in resource- and nonresource-based economies using data from the IMF's *International Financial Statistics*. Specifically, we compare the asset shares of (i) credit to the private sector, (ii) credit to national and subnational governments, (iii) credit to state-owned enterprises, (iv) foreign assets, and (v) liquid assets, comparing between banks in countries where Natural Resource Exports make up more than 10 percent of GDP and those in countries where these exports make up less than 10 percent of GDP.

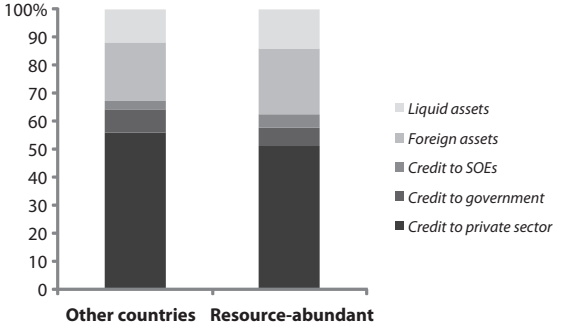
Figure 5.2 shows that banks in resource-based economies invest a lower share of their assets in loans to the private sector or government, but a higher share in loans to state-owned enterprises. They also hold a larger share of their assets in both liquid and foreign assets. These differences are consistent with the previous findings reported in Table 5.5, but they also show a weaker tendency of banks to fulfill their intermediation function.

Summarizing, comparisons of bank-level indicators suggest that the only differences between banks in natural-resource-based economies and those in other economies is that banks in the former countries are better capitalized, more liquid, and more profitable. There are no significant differences in the business model, in the overall efficiency, or in their stability. Comparisons of asset composition across these two country groups also suggest that banks in resource-based economies are less engaged in financial intermediation. We will now turn to demand-side data to complement this analysis.

ACCESS TO FINANCE IN RESOURCE-BASED ECONOMIES

While the previous sections focused on aggregate and supplier data to explore differences across countries with different levels of natural resource reliance, we now explore whether these differences also translate into differences in firms' financing patterns and financing obstacles. We rely on the World Bank/IFC

Figure 5.2
Asset composition in resource-based economies



Enterprise Surveys, which have been conducted over the past eight years in almost 100 countries with a consistent survey instrument.[13] The surveys try to capture businesses' perceptions of the most important obstacles to enterprise operation and growth, but they also include detailed information on management and financing arrangements of companies. Sample sizes vary between 250 and 1,500 companies per country, and data are collected using either simple random or random stratified sampling. The sample includes formal enterprises of all sizes, of different ownership types, and across 26 industries in manufacturing, construction, services and transportation.

We focus on several questions that capture firms' financing patterns. First, we compute the share of enterprises with a loan or overdraft facility. Second, we compute the average share of working capital that is financed through external financial source across all enterprises in a country. Finally, we compute the average share of fixed assets that is financed with external financial source across all enterprises in a country. We also focus on a demand-side question, specifically, What share of firms in each country states that financing is a severe obstacle to its operation and growth?

Figures 5.3 through 5.6 show the correlation between Natural Resources and four indicators of firm finance. We see a negative relationship between reliance on natural resources and (i) the share of firms with loans or lines of credit, (ii) the average share of working capital financed externally, and (iii) the average share of fixed asset investment financed externally. We note, however, that these negative relationships are weak and noisy and driven by countries with a high share of natural resource exports. The share of firms that rate financing as a severe obstacle for their operation and growth, on the other hand, is not significantly correlated with Natural Resources (Figure 5.6).

Table 5.6, Panel A, shows that the negative relationship between access to external finance and Natural Resources is consistent across firms of all sizes. To assess the relationship between firms' financing patterns and natural resource reliance across different size classes, we recalculate the above-mentioned indicators within each country for small firms (fewer than 20 employees), mid-size companies (20 to 100 employees), and large enterprises (over 100 employees). For each size class, we compare the indicators, averaged across countries with Natural Resource Exports of less than 10 percent of GDP and averaged across countries with Natural Resource Exports of more than 10 percent. Unlike in the scatter plots, we find significant differences between firms in resource-based economies and those in other economies, across all size groups. Firms of all sizes use less external finance in resource-based economies than they do in other economies. The fact that in resource-based economies large firms use external financing as little as small firms do is in contrast to general cross-country findings, which show

[13]See www.enterpriseseurveys.org for more details. Similar surveys were previously conducted under the leadership of the World Bank and other IFIs in Africa (RPED) and the Central and Eastern European transition economies (BEEPS) in the 1990s, and then worldwide in 2000 (World Business Environment Survey).

Figure 5.3
External finance in working capital and natural resource dependence

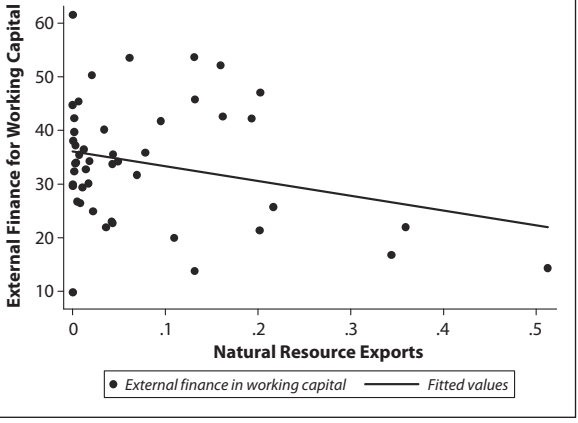
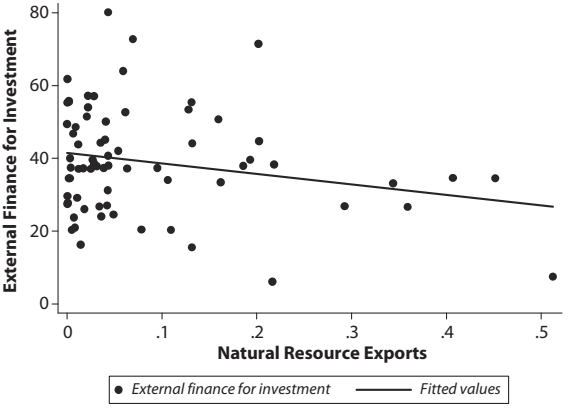


Figure 5.4
External finance in fixed asset investment and natural resource dependence



significantly less external financing by small firms than by large enterprises (Beck, Demirgüç-Kunt, and Maksimovic, 2008).

Table 5.6, Panel B, shows additional significant differences between firms in the two types of economies regarding their access to finance. Here, we dig deeper into firms' loan application process, splitting our sample again into countries with Natural Resource Exports, averaged over 2000 to 2007, below 10 percent of GDP and above 10 percent of GDP. Line 1 shows that firms in resource-based economies are significantly less likely to have a loan, consistent with Figure 5.2. Among the firms that do not have a loan, however, there is no significant difference in the

Figure 5.5
Share of firms with credit and natural resource dependence

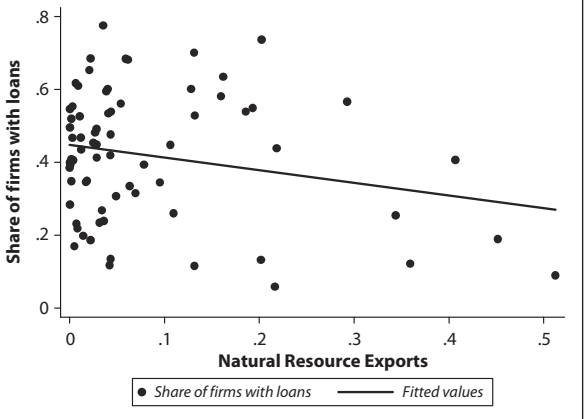
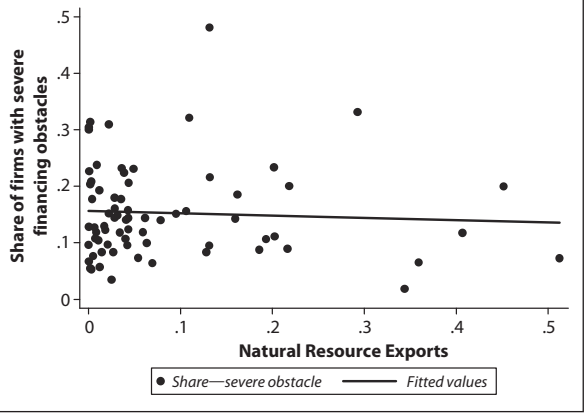


Figure 5.6
Financing obstacles and natural resource dependence



tendency to apply for a loan across countries with and without resource abundance (line 2). Among the firms that decided not to apply, however, significantly more firms in resource-based economies stated that they did not apply because of cumbersome application procedures, while a significantly smaller share of nonapplicants stated as their reason that they did not need a loan. Overall, the share of firms stating that they did not need a loan is about the same in both samples, which clearly suggests that it is not a lack of demand that drives the lower level of financial development in resource-based economies. There are no significant differences in other reasons for not applying for a loan. In summary, these data suggest that the lower use of external finance by firms in resource-based economies is not driven by demand but rather by supply-side constraints.

TABLE 5.6

Firms' financing patterns and obstacles across countries

	Resource-based economies	Nonresource-based economies	Difference	p-value T-stat
Panel A: Use of external finance and financing obstacles across different size groups				
		Small enterprises		
External finance in working capital	23.70	30.74	-7.042	0.0272**
External finance in investment	28.06	37.48	-9.424	0.0122**
Share of firms with loan	23.32	33.02	-9.709	0.0059***
Share of firms with severe financing obstacles	16.31	16.84	-0.525	0.8047
		Medium-size enterprises		
External finance in working capital	30.13	39.51	-9.377	0.0034***
External finance in investment	30.29	41.90	-11.613	0.0004***
Share of firms with loan	36.69	49.00	-12.317	0.003***
Share of firms with severe financing obstacles	13.55	12.90	0.654	0.7031
		Large enterprises		
External finance in working capital	33.05	42.82	-9.773	0.0095***
External finance in investment	34.83	43.40	-8.571	0.0216**
Share of firms with loan	49.59	59.83	-10.243	0.0243**
Share of firms with severe financing obstacles	12.14	11.16	0.983	0.6147
Panel B: The demand for loans across countries				
Do you have a loan?	30.783	42.079	-11.296	0.0066***
If you do not have a loan, did you apply for a loan?	13.271	13.395	-0.124	0.933
Why did you not apply for a loan?				
No need for a loan—establishment has sufficient capital	47.288	61.363	-14.075	0.001***
Application procedures for loans or lines of credit are complex	15.561	8.152	7.409	0.0003***
Interest rates are not favorable	14.262	13.003	1.260	0.510
Collateral requirements are too high	6.865	6.342	0.523	0.646
Did not think it would be approved	7.364	6.488	0.877	0.562

Note: The symbols ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 5.7 shows weak evidence for lower bank outreach in resource-based economies and other countries. Here, we follow the model of Table 5.3 and regress indicators of branch penetration per capita and deposit accounts per capita on (i) log of GDP per capita, (ii) time to enforce a contract, (iii) efficiency of credit information sharing, (iv) inflation, and (v) Natural Resource Exports to GDP or Subsoil Assets. We focus on branch penetration, measured as branches per capita, and account penetration, measured as deposit accounts per capita. Both Natural Resource Exports and Subsoil Assets enter negatively in all regressions, but only Natural Resource Exports enters significantly in the regression of branches per capita. Overall, this seems to be weak evidence of a lower outreach in resource-based economies. It suggests that it is not the lack of geographic outreach, nor overall lower bank penetration, that drives the more limited access to external finance by firms in resource-based economies.

TABLE 5.7

Banking sector outreach across countries

	(1) Branches per capita	(2) Accounts per capita	(3) Branches per capita	(4) Accounts per capita
Inflation	-0.668	-180.6**	-1.093	-128.8*
GDP per capita	5.175***	546.8***	5.387***	532.9***
Time to enforce contract	0.000966	-0.243	0.000662	-0.137
Information sharing	0.0824	-130.8**	-0.0671	-113.6**
Natural resource exports	-5.528	-1.267**		
Subsoil assets			-0.0532	-29.82
Observations	114	82	114	83
R-squared	0.283	0.504	0.302	0.483

Note: The symbols ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

SUMMARY AND POLICY IMPLICATIONS

This chapter tested for the existence of a natural resource curse in financial system development. We can summarize our findings as follows:

- Banking systems are smaller in resource-based economies, and stock markets are less liquid, that is, they have lower trading activity.
- Financial deepening is less income-elastic in resource-based economies, which suggests that resource-based economies invest less in their economies as they grow.
- In resource-based economies, banks are more liquid,[14] more profitable, and better capitalized, but they do not have different business models nor are they more or less efficient or stable than banks in other countries. They also engage less in intermediation with the real economy.
- Firms in resource-based economies are less likely to have a loan, and they finance a lower share of their working capital and fixed asset investment using external finance; in addition, this gap is consistent across firms of all sizes. However, this is not due to a lack of demand.
- Supply constraints, although not necessarily related to banks' physical outreach, explain the more limited access firms have to external finance and their overall lower levels of financial development.

Overall, these findings point to a natural resource curse in financial development, with negative repercussions for resource-based economies. The finance and growth relationship seems as important for resource-based economies as for other economies, so that the under-investment in the financial sector will have long-term negative repercussions for economic growth. Country characteristics and policies related to financial sector deepening—macroeconomic stability, legal

[14]Note that the concept of liquidity is a different one in the case of banks and stock markets. In the case of banks, it refers to the asset holdings, i.e., it is a stock variable, while in the case of financial markets, it refers to an activity, i.e., it is a flow variable.

system efficiency, and an effective information sharing framework—hold true in resource-based economies as much as they do in other economies. It seems, rather, that lack of investment in the necessary financial and human resources in the financial sector can explain the natural resource curse of finance.

What are the policy implications of these findings? Policymakers in resource-based economies should care about the financial sector as much as policymakers in other economies, but they will have to "make the extra effort" in order to achieve the goals of inclusive financial deepening. In addition to the medium- to long-term policies—macroeconomic stability and an effective contractual and information framework—competition seems a fruitful area for policymakers to consider, given the high profitability of banks in resource-based markets, which might be partly due to lack of competition. Additional incentives for market-based lending to the private sector might be another important area, that is, through partial credit guarantees. It is important, however, that the necessary institutional framework first be in place in order to ensure the necessary governance structure for such interventions. It is also important to note that it is not the lack of resources that constrains intermediation in these countries, but rather missing incentives.

As mentioned in the Introduction, this is a first exploratory study of the role of financial systems in resource-based economies, with many further venues open for research. It will be important to analyze the role of financial sectors in resource-led boom and bust cycles, as well as the role of government interference and bank governance in resource-based economies. Disentangling financial intermediation into different components—such as enterprise lending and household lending—seems a promising approach to better understanding the role of financial systems in the growth process of natural resource based economies. Finally, sound policy advice will also require exploring the role of the financial systems in mitigating the effects of commodity price changes and ensuing exchange rate volatility.

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CHAPTER 6

The Economics of Sovereign Wealth Funds: Lessons from Norway

THOMAS EKELI AND AMADOU N.R. SY

INTRODUCTION

While most studies of sovereign wealth funds (SWFs) focus on their wealth management functions, particularly their investment strategies, it is essential to start with the basics. After all, an SWF is a tool that must support the development goals a country has set for itself.

Norway has one of the largest SWFs in the world, with total assets reaching approximately US$0.5 trillion. The Norwegian SWF is a petroleum fund, financed by the state's share of oil and gas revenues—officially coined the Government Pension Fund Global—and it has one of the most sophisticated investment strategies and most transparent institutional set-ups among its peers.

Not surprisingly, most studies of sovereign wealth management discuss the Norwegian experience in harnessing volatile oil revenues to safeguard wealth for future generations. However, an important issue often overlooked by the burgeoning literature on SWFs is that the Norwegian oil fund and its accompanying institutional and fiscal frameworks resulted from a long process, one that started by asking the right economic questions. Perhaps the key lesson from Norway's experience is that policymakers in natural-resource-rich countries need to start the process of setting up an SWF (or deciding not to) by going back to the key question: how to achieve sustainable growth.

Other chapters in this book study these economics principles in more detail, but Norway's experience offers important and practical policy examples relevant

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to natural-resource-rich countries. First, implementing the Hartwick rule is one way to achieve sustainable growth and development, but it requires sound fiscal policy and public investment management.[1] As stressed by Hamilton and Ley's chapter in this volume, building wealth through fiscal policy involves (i) effective revenue instruments, (ii) fiscal rules to limit discretion, (iii) the operation of natural resource funds, and (iv) effective public investment management. As a result, the decision to set up (or not) an SWF, although an important one, is only one part of the much broader growth equation.

THE ECONOMICS OF SOVEREIGN WEALTH FUNDS

To borrow from the title of an influential World Bank volume, we start by asking, "Where is the Wealth of Norway?" Norway's GDP per capita is the second highest among OECD countries, and it is tempting to seek a causal link between its oil wealth and its economic wealth.

Norway offers a useful benchmark for sub-Saharan Africa's natural-resource-rich countries. Whereas in Norway oil wealth (discounted petroleum wealth and financial assets) accounts for 9 percent of wealth per capita, in sub-Saharan Africa natural wealth dominates at a whopping 50 percent of total wealth. And while the discounted value of labor accounts for 82 percent of Norwegian wealth, intangible wealth (both human and social capital) is small in sub-Saharan Africa, making up just 35 percent of total wealth. That is much lower than the 60 to 70 percent in a typical developing country (see Hamilton, 2010) and is indicative of a low return on total assets.

Norway's management of its oil revenues has been successful in many respects, but it is clear from the evidence above that Norway's affluence is due to many factors other than petroleum. The Norwegian experience highlights the importance of factors other than a sound management of natural resources revenues in establishing sustainable growth. Unlike the case in most developing countries rich in natural resources, productivity has been the key to welfare in Norway, not oil. It is also clear that the sources of growth in Norway and other OECD countries involve a number of policies, including stability-oriented macroeconomic policies, flexible and competitive product markets, a high degree of exposure to foreign trade, flexible labor markets, adequate education and training, a low level of taxation, and significant public spending on research and development.

It is therefore useful, especially for policymakers in countries where new discoveries of natural resources have been made recently, to take a step back and look at the bigger question, that is, the process that may lead to sustainable growth and which may or may not involve the establishment of an SWF. The first step is to ask how to achieve sustainable growth and development in resource-dependent economies.

[1]J.M. Hartwick (1977) showed that a simple policy rule—invest all resource rents in other assets—will yield sustainable development in countries with exhaustible resources.

One answer is the Hartwick rule, which depends on (i) effective revenue instruments, (ii) fiscal rules to limit discretion, and (iii) effective public investment management (see Hamilton and Ley's chapter). Hamilton (2010) shows that had sub-Saharan African countries followed the Hartwick rule, their hypothetical produced capital would have been higher than their actual produced capital. He further shows that the resource-rich countries in sub-Saharan Africa would have much larger per capita capital had they followed the Hartwick rule. Specifically, he estimates that under that rule, countries such as Gabon would have had (hypothetically) a 2005 per capita capital of about US$68,000, compared to its actual produced per capita capital of about US$19,000. His figures for Nigeria are about US$5,350, compared with about the actual US$1,350, and for Congo US$16,000 instead of the actual US$3,700.

THE (LONG) ROAD TO A SOVEREIGN WEALTH FUND

The Norwegian model is the result of a long and ongoing process, which shows that the decision to set up an SWF is part of a much broader issue. Harding and van der Ploeg (2009) offer a detailed account of Norwegian policy initiatives. The first oil field was discovered in Norway in 1969, and production started in 1971. During 1973–75, the Ministry of Finance and the Ministry of Industry initiated analytical work on a number of issues, including Dutch disease, the size of reserves, the likely lifecycles of oil fields, and environmental concerns. Interestingly enough, policymakers did not seem to pay much attention to long-run spending needs at that time.

In 1983, the Tempo Committee recommended that the government put its hydrocarbon revenues in a fund and spend only the real return on the assets accumulated in this fund (what Harding and van der Ploeg (2009) call the "bird-in-the-hand" approach). The Tempo Committee report also discussed how such a petroleum fund and spending rules should work in practice. It stressed the importance of converting oil and gas in the ground into financial assets in a fund and decoupling hydrocarbon income from spending. Owing to political pressures to spend, however, the Tempo Committee discounted the likelihood of such a stabilization fund being implemented and therefore recommended slow extraction of oil and gas as a way to distribute oil and gas wealth to future generations.

Five years later, in 1988, the Steigum Committee concluded that government spending should depend on the permanent income of total hydrocarbon wealth, consisting of the financial reserves plus the value of oil and gas reserves in the ground. It stressed that the calculation of total hydrocarbon wealth requires the prediction of an optimal depletion path, given expected oil and gas prices, technology, and interest rates. In contrast to the Tempo Committee, the Steigum Committee did argue for the establishment of a financial hydrocarbon fund. It stressed the importance of regarding this fund and the value of oil and gas reserves in the ground as part of the same portfolio.

The Norwegian Government Petroleum Fund was finally established in 1990, 19 years after production had started. The first net assets were accumulated in the fund in 1996, and in 2001 (30 years after production started), the 4 percent bird-in-the-hand rule was implemented. This means that four percent of the value of the petroleum fund at the end of the previous year was used as a reference for how much should be extracted from the fund and used to fund the government's non-oil deficit. The Petroleum Fund changed its name to the Government Pension Fund Global in 2006 in connection with a broader pension reform.

However, it is important to note that the whole policy approach was very gradual from the period of discovery and extraction and that institutions were carefully calibrated and adapted to the lessons learned from initial mistakes and later experiences. It is also useful to note that Norway had already experienced a period of boom and bust in oil revenues before setting up the petroleum fund. Initially, Norway had used its oil revenues to expand its welfare system rapidly and to support the expansion of public services and employment. In the late 1970s, as noted by Qvigstad (2011), the government lowered the pension age, increased agricultural subsidies, widened industrial policies, and reduced taxes. Oil revenues were not used to boost infrastructure, since the country had already reached a level of industrialization.

The initial policy choice regarding oil revenues had serious consequences on both macroeconomic and financial stability as inflation increased, credit grew rapidly, the currency depreciated, and productivity stalled. As a result, after 1986 the Norwegian government undertook corrective policy actions by reducing the fiscal deficit and increasing interest rates to slow down lending. However, higher interest rates in the aftermath of German unification led to a severe banking crisis in 1990 in Norway, and unemployment reached record levels. To resolve the banking crisis, the Norwegian government fully nationalized three of the country's four largest banks.[2] Two of the problem banks were subsequently privatized, while the government retained 34 percent of the third one.

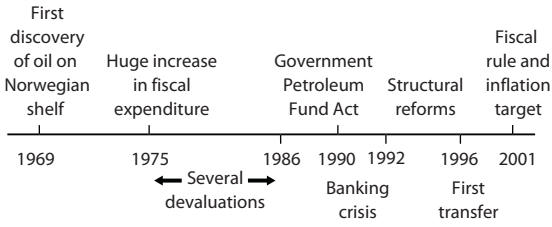
From a political economy perspective, the 1990 banking crisis provided Norwegian policymakers with an opportunity to push for structural reforms. As stressed by Qvigstad (2011), the Norwegian government leveraged the banking crisis to remove subsidies, close down government-owned enterprises, and deregulate the housing and electricity markets. It also implemented a tax reform that increased incentives to work and closed tax evasion loopholes, and reformed parliamentary budget procedures.[3]

It was only after a number of crises—the severe macroeconomic consequences of the initial choice for the use of oil revenues and of the banking crisis—that

[2]See Drees and Pazarbaşioğlu (1998) who contrast the Norwegian crisis with that in two other Nordic countries, Sweden and Finland, which also experienced a banking crisis at the same time.

[3]Norges Bank Deputy Governor Qvistad (2011) notes that "...when bad news fills newspapers and television programs, the electorate is more likely to accept necessary measures. In the long run, reforms prove to be very profitable even though they are painful in the short run."

Figure 6.1
Norway—Timeline of crises and structural reforms



Source: Qvigstad, 2011.

Norwegian policymakers implemented the key structural reforms crucial to the country's longer-term economic prosperity (Figure 6.1).

One can therefore conclude that adequate structural reforms helped the Norwegian economy take advantage of favorable terms-of-trade shocks to achieve robust economic growth and remain resilient to the global financial crisis. Over the past 20 years, Norway's income has nearly tripled following positive terms-of-trade shocks. The price of oil has increased and so did the price of other Norwegian exports (such as fish and aluminum), while the price of the most important imports has decreased.

The policy process is ongoing, since issues need to be continually addressed. Harding and van der Ploeg (2009) question whether the current fiscal rule is sufficiently taking into account the aging of the Norwegian population. The recent global financial crisis has shown how important it is to have a transparent communication strategy, given the short-term volatility and tail shocks inherent in financial assets. More generally, research in finance is still working on the issue of deriving an asset allocation for SWFs that would take into account the liability side of the fund. For instance, Amenc and others (2010) study how the optimal asset allocation strategy takes into account the stochastic features of (i) where the money is coming from (the endowment process), (ii) what the money is going to be used for (expected liability value), and (iii) what types of assets are held in the fund's portfolio.

SOVEREIGN WEALTH MANAGEMENT

A key insight of the Norwegian model is that petroleum revenues are *different*. They stem from the depletion of real wealth, they are volatile and uncertain due to price and volume changes, and they pose a number of governance challenges, including the appearance of "free money." A key policy question is therefore how to transform these volatile revenues into a smooth consumption path.

Norway's chosen solution—establishing a petroleum fund and using a fiscal rule—separates savings policy from the savings instrument. The choice of savings policy stems from the need to decouple spending from the petroleum cash flow,

and the choice of savings instrument arises from the need to address the governance of savings. As a result, large and volatile oil revenues are split between domestic spending and oil fund savings.

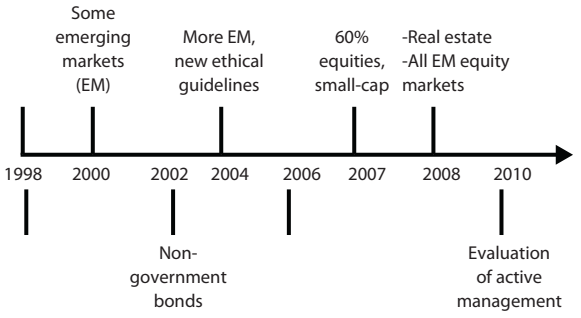
The Norwegian petroleum fund is fully integrated with the state budget and builds on existing institutions to strengthen the budget process. The government collects taxes from all sectors of the economy, including the petroleum sector, and transfers the surplus to the petroleum fund, but only after all government expenditures are paid. This means that it is only through responsible fiscal policy that reserves will accumulate in the fund, and the fund will then be a reflection of accumulated budget surpluses (and financial returns). The fiscal guideline since 2001 mandates that the government should aim to use annually the estimated long-term real return on the Government Pension Fund Global, set at 4 percent. In the past 10 years, fiscal policy in Norway has therefore been geared toward a cyclically adjusted non-oil deficit, which corresponds to 4 percent of the fund every year. The fiscal framework allows the non-oil budget deficit to deviate from the 4 percent path, that is, to undertake countercyclical fiscal policy, while the 4 percent rule remains an important medium-term anchor for fiscal policy.

The chosen spending rule aims to use the real return of the assets in the petroleum fund, as prescribed by the bird-in-the-hand approach. It is therefore more conservative than a permanent-income rule linked to the sum of financial assets and petroleum assets, and partly reflects Norway's demographics and attendant large future spending commitments. Following such a rule allows the real value of the petroleum fund to be kept stable while spending its estimated sustainable income, which is akin to perpetuity where equal amounts could be withdrawn forever. The oil fund is only invested abroad in financial assets in order to protect the domestic economy, diversify risks, and maximize returns. Together, the oil fund and the savings policy serve as a macroeconomic stabilization tool that protects the non-oil economy from overheating and deindustrialization by (i) investing fund assets abroad, and (ii) deciding on an appropriate amount of oil income to take into the domestic economy through the state budget.

The oil fund does not invest in domestic assets, either physical or financial. The Norwegian government has decided not to invest these revenues in such domestic assets as infrastructure and human capital, because it prefers to invest in them through the budget process and does not want the oil fund to be a second budget for less qualified projects. Moreover, there is no general lack of capital for private projects in Norway, and expanding domestic real investment would carry the risk of reducing the return on investment. Similarly, investing in financial domestic assets using oil revenues (which are not akin to national savings) could make the economy more cyclical. Such a process would also be at the mercy of poor governance practices.

Instead, the oil fund invests only in foreign assets, mostly financial ones. This is an efficient way of achieving capital outflows that reflect current account surpluses, and it shelters the domestic economy from overheating and deindustrialization. International financial assets, such as bonds and equities, are liquid and are traded in relatively efficient markets, which help spread risks. Foreign physical

Figure 6.2
Norway—Timeline of major changes in investment strategy



Source: Norwegian Ministry of Finance.

assets such as real estate, although less liquid and transparent than financial assets, can nonetheless offer marginal benefits from a portfolio perspective.

Of course, any investment strategy has to take into account the investor's circumstances and preferences. In the case of Norway, a starting principle is that the general accumulation of assets belongs to the Norwegian people. The finance minister is responsible for the management and strategic asset allocation (the risk and return choice). The portfolio's strong risk-bearing capacity reflects a very long investment horizon, no leverage, no claims for immediate withdrawal of funds, and no direct link to liabilities. The main risk is that political authorities might lose faith in the strategy for managing the petroleum wealth, so the investment strategy and governance arrangements need to bear this in mind.

Moreover, circumstances and preferences might change, leading to adjustments in the investment strategy. Starting with liquid and nominal assets such as investment-grade bonds, the oil fund's investment strategy has evolved over time to gradually add liquid real assets such as listed equities and less liquid nominal instruments such as high-yield and emerging market bonds, and, finally, to include less liquid real assets such as emerging-market equities and unlisted real estate. Its strategic benchmark now allocates 60 percent of assets to equities and 35 to 40 percent to fixed-income instruments, with the remainder (0–5 percent) going to real estate investments. In addition, the oil fund does not take controlling stakes in companies, capping ownership at 10 percent, and it follows ethical guidelines. (See Figure 6.2.)

The oil fund's governance structure leads to a clear mandate from political authorities. The governance of the oil fund is founded on an act passed by parliament and an investment mandate issued by the Ministry of Finance. As the fund owner, the Ministry of Finance has a separate asset management department with overall responsibility for managing the fund. It establishes its strategic asset allocation, both benchmarks and risk limits, and monitors and evaluates operation management. It is also responsible for investment practices and reports to

Parliament. In contrast, the central bank, as the operational manager of the fund, has a separate entity within its organizational structure (Norges Bank Investment Management) charged with that responsibility. It implements the investment strategy and actively manages part of the fund to achieve excess returns. It is also responsible for risk control and reporting and exercises the fund's ownership rights.

Reporting and transparency both help to build support for the management of the oil revenues. The Ministry of Finance reports to Parliament on all important matters relating to the fund and publishes all the advice it receives from external consultants in an annual white paper. Performance, risk, and costs are reported every quarter and published on a website by the central bank. The focus of these reports is on the contribution to value added in operational management. Press conferences are held on quarterly, shortly after an official meeting with the Ministry of Finance. Finally, an annual report listing all investments, both equities and fixed income, is made publicly available.

In 2010, the result of this process was a $525 billion fund with a transparent governance structure and a mechanism integrated with fiscal policy, which allows large and volatile oil revenues to be split between domestic spending and oil fund savings. This result has helped Norway in its objective of achieving sustainable financial and macroeconomic growth and stability.

CONCLUSIONS AND POLICY IMPLICATIONS

Most studies of SWFs focus on sovereign wealth management considerations, including their asset allocation and governance. That focus is motivated by the rapid growth in number and size of SWFs and by the emergence of non-oil funds, since some countries have been able to accumulate very large international reserves through their exports of non-natural resource products.

However, a number of countries are now discovering that they are endowed in natural resources while others, having benefited from the acceleration of commodity prices, are considering setting up sovereign wealth funds. Our recommendation to policymakers in natural-resource-rich countries is to go back to the key question of *how to achieve sustainable economic growth and development*. In this regard, Norway's experience in economic and wealth management is useful.

The decision to create an SWF and derive optimal asset allocations from it is only one part of a much bigger question. The first question is how to achieve sustainable growth and development in resource-dependent economies. One answer, given by the Hartwick rule, stresses the importance of effective revenue instruments, fiscal rules to limit discretion, and effective public investment management, which includes SWF management.

The key considerations for an optimal asset allocation in natural-resource-rich countries should include these:

- A country's starting point, including its stage of economic development and the strength of its public sector institutions and political culture;

- The size of petroleum assets, their impact on the real economy, and the choice of savings policy (whether a buffer fund or long-term savings fund);
- Economic and investment policy choices, which include transforming the revenues from petroleum to other assets such as human, physical, and financial assets; holding assets domestically or abroad; and diversifying assets and raising returns;
- The risks and rewards of different allocation choices and how much to spend today and save for tomorrow (discount rate); and

A governance model will need to distribute responsibilities between various organizations while considering clear lines of responsibility and applying disciplinary pressures to perform. It will require acceptance and commitment by key stakeholders, aided by consultation and transparency, to ensure that the strategy is sustainable.

As a result, policymakers, especially in developing countries, will have to look out for a number of pitfalls. First, and not surprisingly, lack of fiscal discipline does not help transform a windfall into permanent income, and can instead lead to overheating and deindustrialization rather than sustained growth. Second, poorly chosen investments can lead to large-scale industry investments and public infrastructure projects with high political prestige but vague or low economic return, often to the detriment of investment in general education, health, and other social capital that is crucial to deliver sound and sustainable economic growth. Third, a loss of focus in structural policy can reorient policymakers so they are concentrating on how to capture resource revenues, leading to slower growth in non-oil activity, falling labor supply, and disappointing productivity. Finally, resource wealth is often associated with weak government institutions, rent-seeking activities, and increased corruption as governance weakens.

With increased awareness of the double-edged sword that resource revenues represent, countries are better placed to build more robust strategies for managing those resources in a manner that supports broad and durable economic development.

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PART III

Fiscal Policy

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CHAPTER 7

Primary Commodity Price Series: Lessons for Policymakers in Resource-Rich Countries

KADDOUR HADRI

INTRODUCTION

This chapter investigates the challenges faced by policymakers when conducting a fiscal policy in resource-rich countries. These challenges become more acute in resource-rich countries in Africa, because in many of them revenues from exporting primary commodities still account for the bulk of export earnings. We shall mainly consider three challenges: (i) the possible secular decline of real commodity prices, the so-called Prebish–Singer hypothesis, (ii) the long cycles that characterize real commodity prices, (iii) the exceeding volatility of real commodity prices and the fact that this volatility is time varying.

A fourth challenge is that many of these primary commodities are exhaustible, which raises the question of equity across generations and the necessity to invest the rents from natural-resource extraction into reproducible capital in order to enjoy a constant stream of consumption, following the so-called Hartwick rule (see Hartwick, 1977; and Atkinson and Hamilton, 2003). We will not deal directly with this fourth challenge in this chapter, because an analysis of commodity prices is of little help in tackling this challenge.

We recall that the Prebish–Singer hypothesis states that real commodity prices follow a downward secular trend. Prebish (1950) and Singer (1950) claimed that there had been a downward long-term trend in these prices and that this decline was likely to carry on. The main theoretical explanations given for this adverse long-term trend are: (i) income elasticities of demand for primary commodities

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being lower than those for manufactures; (ii) absence of differentiation among commodity producers leading to highly competitive markets; (iii) productivity differentials between North and South; (iv) asymmetric market structures (oligopolistic rents for the North and zero economic profit for competitive commodity producers in the South; (v) the inability of wages to grow in the presence of an "unlimited" supply of labor at the subsistence wage in primary commodity producing countries (Lewis, 1954), which implies a zero trend, and (vi) a decline in demand from industrial countries.

The consequences of the Prebish–Singer hypothesis are very important for developing countries, because many of them depend on only a few primary commodities to generate most of their export earnings. For instance, it is estimated that around 60 percent of their export earnings are obtained from primary commodities. For approximately 40 such countries, export earnings depend on the production of three or fewer commodities. This overwhelming commodity reliance has serious policy consequences. In case of an actual long-run downward trend of the exported commodities, the concerned country might have to explore diversifying its export portfolio to include manufactures and services.

The first empirical studies revealing a downward real price assumed that y_t, the logarithm of the real commodity price, is generated by a stationary process around a time trend ($I(0)$):

$$y_t = \beta_0 + \beta_1 t + \varepsilon_t, \; t = 1,\ldots,T, \tag{1}$$

where t is a linear trend and the random variable ε_t is stationary with mean 0 and variance σ^2_{ε}. The parameter of interest is the slope β_1, which is predicted to be negative under the Prebish–Singer hypothesis. Grilli and Yang (1988), among others, employing a data set of 24 annual commodity prices found that a weighted aggregate index dropped by 0.6 percent per year. Other researchers assumed that commodity prices were generated by a so-called difference-stationary (DS or $I(1)$) model, implying that y_t is nonstationary:

$$\Delta y_t = \beta_1 + \nu_t, \; t = 1,\ldots,T, \tag{2}$$

where ν_t is stationary and invertible. Some empirical studies employing equation (2) show evidence against the hypothesis. In particular, Kim and others (2003) found that relative commodity prices behave like unit root processes (nonstationary process), and only five commodity prices among the 25 commodity prices included in the Grilli–Wang index exhibit the negative trend predicted by the hypothesis. It is well known, now, that if y_t is a DS process, then using equation (1) to test the null hypothesis: $\beta_1 = 0$ will result in acute size distortions, leading to a wrong rejection of the null when no trend is present, even asymptotically.

Alternatively, if the true generating process is given by equation (1) and we base our test on equation (2), our test becomes inefficient and less powerful than the one based on the correct equation. Therefore, when testing the Prebish–Singer hypothesis we must first test the order of integration of our relative commodity prices in

order to use the right equation. The problem might be compounded by the presence of structural breaks in equation (1) or (2). In that case, the true generating process may be a trend-stationary process with breaks:

$$y_t = \beta_0 + \beta_1 t + \delta DU_t(\omega^*) + \gamma DT_t(\omega^*) + \varepsilon_t, \quad t = 1,\ldots,T, \tag{3}$$

or, alternatively, a difference stationary with breaks:

$$\Delta y_t = \beta_1 t + \delta D_t(\omega^*) + \gamma DT_t(\omega^*) + \Delta\varepsilon_t, \quad t = 2,\ldots,T, \tag{4}$$

where $DT_t(\omega^*) = t - T^*$ when $t > T^*$ and 0 otherwise, $DU_t(\omega^*) = 1$ if $t > T^*$ and 0 otherwise $D_t(\omega^*) = 1$ when $t = T^* + 1$ and 0 otherwise, with $T^* = [\omega^* T]$ the break date with the associated break fraction $\omega^* \in (0,1)$ and [.] denotes the integer part of the argument. As shown by Perron (1989), the properties of tests for the presence of a break in trend are also highly dependent on the order of integration of the series concerned.

To increase the power of these tests we may use panel unit-root and/or stationarity tests, which are well known to be more powerful than their single-time series counter-part. However, in order to avoid the pretesting problem, we will also use the tests for the presence of linear trend and the tests for a broken trend, proposed by Harvey, Leybourne, and Taylor (2007 and 2009, respectively) which are both robust to whether shocks are generated by $I(0)$ or $I(1)$ processes. However, the knowledge that commodity prices are stationary (mean reverting) or nonstationary is crucial for conducting an appropriate fiscal policy. In the case where commodity prices are mean reverting, any shock will have only a transitory effect, whereas if commodity prices are nonstationary, shocks imprint a permanent effect on those prices.

The second aspect of real primary commodity prices that we will explore is the identification of cycles. The presence of cycles, particularly long cycles, creates booms and busts in income and unemployment, necessitating the construction of stable and sustainable budgets, that is, countercyclical budgets, also called structural budgets. The main explanations given for the presence of long-term cycles are these:

(i) Elasticities of supply and demand relative to price are low in the short term but increase with time. Therefore, prices come back to the long-run equilibrium after a peak.

(ii) For nonrenewable resources, the answer to the question, *Should we leave resources in the ground or extract them?* will depend on an arbitrage condition between the interest rate and the expected future of price increase (Hotelling, 1931). This leads to an inverse relationship between real interest rates and real commodity prices.

(iii) Speculative bubbles may drive commodity prices away from their fundamentals until they burst, pushing commodity prices back to their equilibrium (e.g., oil speculation during the recent peak).

Finally, the last challenge when trying to conduct a successful fiscal policy in resource-rich countries is that most commodity prices are found to be volatile, and this volatility is time varying (UNCTAD, 2008; Mintz, 1967). The possible causes of price volatility are these:

- Supply shocks: wars, epidemics, weather, political unrest lead to shortfalls in production and to large price variances.
- The switch to floating exchange rate regimes has increased the volatility of commodity prices (Reinhart and Wickham, 1994).

In the next section, we present the data and examine the empirical evidence of these three challenges. After that we review the possible solutions suggested in the literature to tackle these three challenges, followed by some concluding remarks.

EMPIRICAL EVIDENCE

Data

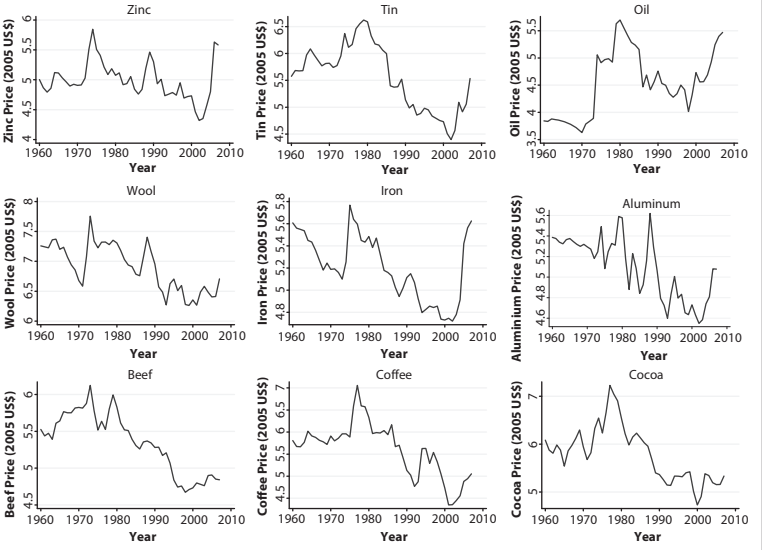
The annual data set used in this study covers the period 1960–2007 for nine primary commodities: zinc, tin, oil, wool, iron, aluminum, beef, coffee, and cocoa. Figure 7.1 plots the natural logarithm of the nine commodity prices relative to the U.S. Commodity Price Index for 2005. Looking only at these graphs, it is difficult to say whether the series are stationary (mean reverting) or nonstationary. It is also very hard to say whether they present a deterministic downward trend. We have to use appropriate tests to settle these two questions. We also present in Figure 7.2 the distributions of the nine commodity prices. It is clear that these distributions are very different from the normal distribution. They have at least two modes, which might indicate clustering of prices at different levels due to persistent cycles. Most of these distributions, if not all of them, have fatter tails than the normal distribution, suggesting the possibility of extreme values.

Testing Whether the Series Are Mean Reverting Using Panel Data Stationarity Tests

It is well known that univariate time series tests for unit root and stationarity have very low power. It has been shown through simulations that panel data tests for unit root and stationarity are far more powerful than their univariate counterpart (see Breitung and Pesaran, 2008, for a review of this literature). In this chapter, we use the recent panel stationarity test proposed by Hadri and Rao (2008). This test allows for a break in the intercept or the trend or in both. The selection of the appropriate break model for each price series, among the four possible ones, is data driven. Any serial correlation is mopped out. It also corrects for the very likely presence of cross-sectional dependence of unknown form via the bootstrapping method.

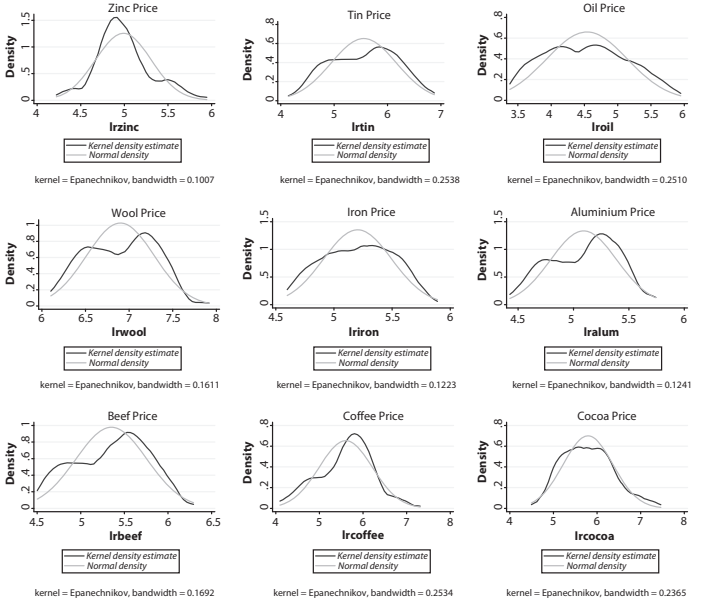
Table 7.1 shows the pairwise correlation coefficients across prices. There are positive and significant correlations between real commodity prices, except for the oil price series where the coefficients are relatively small and some are negative (but all are insignificant at the 5 percent significance level). Pindyck

Figure. 7.1
Prices of nine commodities, 1960–2007



Sources: National Bureau of Economic Research (NBER); and United Nations Trade Database.

Figure 7.2
Distribution of the nine commodity prices, 1960–2007



Sources: National Bureau of Economic Research (NBER); United Nations Trade Database; and author's estimates.

TABLE 7.1

Correlation coefficients of commodity prices (*p*-values between parentheses)

	Zinc	Tin	Oil	Wool	Iron	Aluminum	Beef	Coffee	Cocoa
Zinc	1.0000								
Tin	0.5673	1.0000							
	(0.0000)								
Oil	0.2560	0.1963	1.0000						
	(0.0791)	(0.1812)							
Wool	0.5594	0.7897	-0.0442	1.0000					
	(0.0000)	(0.0000)	(0.7653)						
Iron	0.5748	0.7305	0.1786	0.6100	1.0000				
	(0.0000)	(0.0000)	(0.2246)	(0.0000)					
Aluminum	0.5896	0.7882	-0.1067	0.8381	0.6360	1.0000			
	(0.0000)	(0.0000)	(0.4706)	(0.0000)	(0.0000)				
Beef	0.4558	0.8465	-0.1757	0.7744	0.5567	0.7911	1.0000		
	(0.0011)	(0.0000)	(0.2322)	(0.0000)	(0.0000)	(0.0000)			
Coffee	0.4546	0.8736	0.0444	0.7441	0.5879	0.7328	0.7407	1.0000	
	(0.0012)	(0.0000)	(0.7646)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
Cocoa	0.4141	0.8802	0.1662	0.7584	0.6032	0.6860	0.7610	0.8899	1.0000
	(0.0034)	(0.0000)	(0.2590)	(0.0000)	(0.0000)	(0..0000)	(0.0000)	(0.0000)	

Source: Author's analysis.

and Rotemberg (1990) noted this strong correlation in the prices of unrelated commodities, which they called "excess co-movement." They found that even after controlling for current and expected future values of macroeconomic variables, this excess co-movement remains.

By using panel we are able to account for this cross-sectional dependence. We are in a position to test jointly the null hypothesis that *all* the commodity prices are stationary ($I(0)$) against the alternative hypothesis that some of them are nonstationary or unit root processes ($I(1)$). The results of the test are given in Table 7.2.

The null hypothesis that all the commodity prices are stationary is not rejected, indicating that all the commodity prices are mean reverting (the two criteria used are for the correction for possible serial correlation; see Hadri and Rao, 2008) for more explanations). This is an important result. It means that shocks have only temporary effects on real commodity prices. The fact that the nine commodity prices are stationary will permit us to use classical econometrics tools to test the Prebish–Singer hypothesis. The latter test is presented in Table 7.3.

All commodities without a break have a significant negative trend except oil, which is positive but not significant. The commodities with a break have a significant negative trend before the break and a positive but insignificant trend after the break. The estimations after the break are not reliable because of the size of the sample (only five observations). We also employed two other tests that do not require *a priori* knowledge of whether the real price of a commodity is stationary or a unit root process. Both tests are univariate, that is, they test one price series at a time, unlike the panel data test.

TABLE 7.2

Panel stationary test results

	N	*T*	Statistic value	Bootstrap critical values	
				10%	5%
Using tsig criterion	9	48	3.913	11.164	12.617
Using tsig criterion	9	48	2.647	7.824	8.975

Source: Author's analysis.

TABLE 7.3

One-sided test for a negative trend (P-value inside brackets)

	Growth rate (%) (no break)	Before break	After break
Zinc		-0.0087	0.35078
		(.0055)	(0.993)
Tin		-0.033	0.1905
		(0.000)	(0.97)
Oil	0.0214		
	(1)		
Wool	-0.0205		
	(0.000)		
Iron		-0.0184	0.2339
		(0.000)	(0.994)
Aluminum	-0.16		
	(0.000)		
Beef	-0.024		
	(0.000)		
Coffee	-0.294		
	(0.000)		
Cocoa	-0.0254		
	(0.000)		

Source: Author's analysis.

The first test, proposed by Harvey,[1] Leybourne, and Taylor (2007), does not allow for a structural break. The second test, offered by the same authors, allows for one structural break. Both tests give mixed results when testing for the Prebish–Singer hypothesis. The results of the two tests are not reported here but can be obtained from the authors. Results from panel data tests are more reliable than tests based on single-time series, on at least three accounts: (i) panel data have been shown to be more powerful than their single series counterparts, because of the joint use of all the information in the panel, (ii) panel tests allow for cross-sectional dependence, whereas single-time series tests cannot, by construction, and (iii) our panel tests permit more than one structural break.

[1]We thank Steve Harvey for providing the GAUSS programs.

Identification of Cycles in Commodity Prices

Commodity prices are well known to have long cycles, which presents serious challenges to policymakers when they seek to devise stable budgets in order to avoid booms and busts. We employ the asymmetric bandpass filter proposed by Christiano and Fitzgerald (2003) to decompose commodity prices into three components:

$$y_t = T_t + LC_t + SC_t, \; t = 1,\ldots,T, \tag{5}$$

where is a secular trend, LC_t is a long-term cyclical element, SC_t is a short-term cyclical element, and Y_t is a real commodity price. We define the trend as all cycle elements lasting more than 30 years, the long-term cycles as those lasting from 10 to 30 years, and short-term cycles as those ranging from 2 to 10 years. These definitions depend on the length of the data we are using and therefore have a certain degree of arbitrariness. Table 7.4 provides some summary measures of the cyclical components when the bandpass filter is applied to the individual commodity prices of our data set. Column 2 shows the standard deviation of the long-term cyclical component (LC_t) and column 3 shows the ratio of the standard deviations of LC_t and the total nontrend cyclical component ($LC_t + SC_t$). The range of this ratio is from 0.414 (aluminum) to 0.854 (oil), clearly showing the dominance of the long-term component in cyclical commodity price movements.

The mean periodicity (column 4) ranges from 11.7 years (zinc) to 20 years (cocoa). This indicates that common policy initiatives to smooth either commodity prices themselves or producer or consumer incomes around a trend may require economic planning over a long time horizon. (Using longer time series, Harvey and others (2010) found mean periodicity ranging from 23.5 years to 43.3 years.)

Finally, column 5 indicates the first-order autocorrelation measure of persistence in the LC_t component of each series. The estimates are all greater than 0.89, showing extreme persistence in the long-term cyclical elements of the relative primary commodity price series. Therefore, policymakers should be aware that commodity prices may not return to equilibrium for many years and should take appropriate measures, such as adopting a structural budget as Chile has done. (Structural budgets will be explained further below.)

Volatility in Primary Commodity Prices

It is well documented both that primary commodity prices are highly volatile and that this volatility is time varying (Mintz, 1967; Reinhart and Wickham, 1994; for oil, see Dvir and Rogoff, 2009).We test for multiple breaks in commodity price volatility, employing the methods proposed by Bai and Perron (1998, 2003). Figure 7.3 provides visual evidence of this volatility and the changes in it for the nine commodity prices in our sample.

TABLE 7.4

Summary measures of 10- to 30-year cyclical components (LC_t)

		$s.d.(LC_t)$		
	$s.d.(LC_t)$	$s.d.(SC_t + LC_t)$	Mean periodicity	AR(1) parameter
Zinc	0.141	0.661	11.667	0.918
Tin	0.170	0.824	17.500	0.935
Oil	0.289	0.854	16.500	0.956
Wool	0.140	0.632	12.333	0.904
Iron	0.108	0.777	14.667	0.936
Aluminum	0.073	0.414	12.000	0.924
Beef	0.093	0.710	12.000	0.902
Coffee	0.211	0.690	16.500	0.898
Cocoa	0.178	0.643	20.000	0.952

Source: Author's analysis.

WHAT CAN POLICYMAKERS DO TO COUNTER THESE THREE CHALLENGES?

Secular Downward Trend of Real Commodity Prices

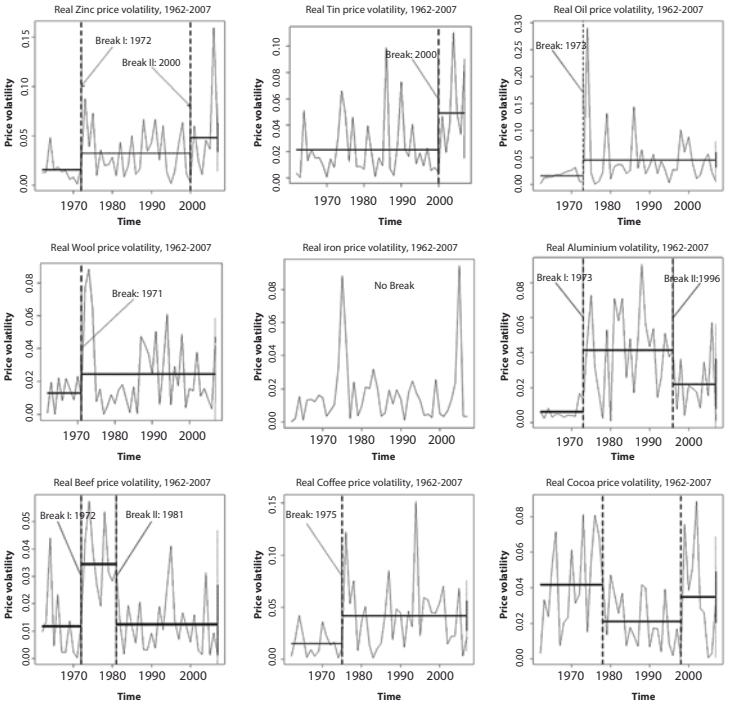
In order to offset the effect of the secular downward trend of real commodity prices, the resource-rich countries must diversify their exports by investing in well run and beneficial manufactures and services. This is more easily said than done. Some resource-rich countries embarked on ambitious diversification (industrialization) programs that were not very successful. For a program to be fruitful, certain necessary reforms must be adopted. Also, to achieve sustainability there must be an effective and judicious application of the Hartwick rule (Hartwick (1977), Hamilton and Hartwick, (2005)), which requires that any depletion of natural capital be offset by a compensating increase in other forms of capital capable of generating as much income as the natural capital they replace.

In this regard, an example of good practice is Botswana, which applied the Hartwick rule rigorously and successfully by investing the rent from its exploitation of diamonds in top-rated funds (see Lange and Wright, 2004). The Hartwick rule is generally prescribed for countries with exhaustible resources, but it is also beneficial to resource-rich countries with declining real commodities prices, even if their resources are not exhaustible, as is the case for cotton, coffee, and cocoa. The resource-rich countries may also enter into international commodity agreements to keep the real prices of their resources at acceptable levels.

Long Cycles in Real Commodity Prices

The fluctuations of real commodity prices between relatively high and low levels, often for long periods, as shown above, pose serious challenges to policymakers working to achieve price stability and maintain the financial soundness of the economy. A countercyclical policy is to be adopted to smooth the cycles of commodity prices. A rule of thumb is to save during boom times and spend during

Figure 7.3
Volatility for the nine real commodity prices, 1962–2007



Source: Author's analysis.

bust times. But—save and spend by how much, and when? The structural budget suggested by the IMF and adopted, adapted, and implemented successfully by Chile achieved a spectacular countercyclical policy.

The structural budget, unlike the effective budget, must reflect a medium- to long-term view of the economy. Roughly, it prescribes saving during economic prosperity and spending during the lean years, within structural budget limits. In a nutshell, it amounts to fixing the cyclical components at their medium/long run levels. For Chile, these were (i) output (GDP), (ii) price of copper, and (iii) price of molybdenum. In order to insulate the estimation of these three components from possible contamination by politics, in Chile the estimations are undertaken independently by expert panels (for more information on structural budget, see Rodríguez, Tokman, and Vega (2007) and Frankel (2011).

High and Changing Volatility of Real Commodity Prices

Many solutions have been proposed in the literature and practiced to protect resource revenues from the effects of the volatility of commodity prices. Stabilization funds have been suggested to insure against future shocks. Such

funds should be commodity specific. Hedging strategies using financial instruments also have been employed. Another tool used to protect credit-rationed commodity-exporting countries from volatility effects is to provide external finance facilities. Studies on this topic include those by Mintz (1967) and Reinhart and Wickham (1994). It should be noted that generally, the export of more than one commodity will not hedge the exporting country against adverse commodity price movements.

SUMMARY

In this chapter, we have reviewed the main causes of the challenges policymakers encounter in conducting fiscal policy in resource-rich countries: the secular decline of real commodity prices, long cycles, and relatively high and time-varying volatility. If real, these challenges constitute acute problems to policymakers conducting fiscal policies to realize stable and sustainable budgets over the long run (avoiding booms and busts) and across generations (to prevent inequity across generations). Investigating and testing these three characteristics through a sample of nine real price commodities observed over 48 years (1960–2007), we found that all the commodities in our sample are mean-reverting (stationary) based on a panel stationary test. We also discovered that the nine commodities are, pairwise, positively and significantly correlated except with the real price of oil. That is, the correlations between oil and the rest are not significant. The significant correlations we discovered will magnify cycles and volatilities. We also uncovered the fact that these cycles range from 12 to 20 years. As expected, it was shown that real commodity prices are relatively volatile and that the volatility is time-varying. Finally, we have summarized the successful policy solutions reported in the literature as they apply to these three challenges.

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CHAPTER 8

Sustainable Fiscal Policy for Mineral-Based Economies

KIRK HAMILTON AND EDUARDO LEY

INTRODUCTION

Economic management in mineral- and energy-based extractive economies must confront a wide range of challenges: investments in the sector are large and long-term in nature, rents from extraction are often large relative to GDP (as are potential tax revenues), the resources' extent and future prices are highly uncertain, information between producers and governments is asymmetric, and the resource deposits themselves are exhaustible.[1] The latter point—exhaustibility—raises particular concerns about the sustainability of growth and development in these economies, and this in turn is strongly linked to fiscal policy.

As noted in *Where Is the Wealth of Nations?* (World Bank, 2006), there are no sustainable diamond mines, but there are sustainable diamond-mining countries. While individual mines eventually are exhausted or cease to be economic, the country that owns the minerals being mined has the option of investing the rents from extraction in other assets that can sustain income generation beyond the life of the mine. This insight suggests an important linkage between sustaining development and maintaining wealth, an inference that is borne out by a large body of research.[2]

In this chapter, we argue that the exhaustibility of mineral resources raises two specific concerns for economic management: (i) How should we measure economic performance? and (ii) How should we design fiscal policies to sustain growth and development in the face of exhaustibility? The chapter is broken into

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[1]These issues and more are discussed in Boadway and Keen (2010).

[2]See in particular Hartwick (1977), Hamilton and Clemens (1999), Dasgupta and Mäler (2000), Asheim and Weitzman (2001), and Ferreira, Hamilton, and Vincent (2008).

two main parts to deal with these two questions. The concluding section draws the pieces together.

MEASURING ECONOMIC PERFORMANCE

While GDP growth is the canonical measure of economic performance used by finance ministries everywhere, there is good reason to question its usefulness in economies that depend on exhaustible resources, particularly smaller developing countries where resource extraction may be a very large portion of the economy. There are two main reasons for this. First, national income, rather than domestic product, is a more appropriate income measure in countries where largely foreign-operated extractive industries are substantial, since payments to foreign-owned factors are often considerable. Second, in resource-rich countries, national income must be adjusted by offsetting a part of the credits for resource extraction with the corresponding depletion costs, which are similar to capital depreciation.

This suggests using a measure of national income adjusted for resource depletion as the measure of economic performance. This *adjusted net national income* (aNNI) is defined as follows:

Net national income (NNI) = GDP + (net foreign factor income)
– (depreciation of fixed capital)

Adjusted net national income (aNNI) = NNI – (depletion of natural capital)

After adding net foreign factor income to GDP and subtracting the consumption of fixed and natural capital, we obtain the country's aNNI. This is a better measure of the available income, which can be consumed or invested to increase the nation's future consumption.

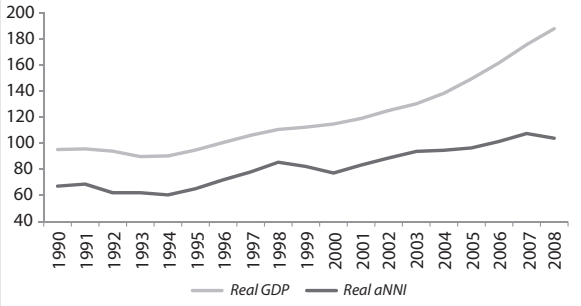
Taking mineral-dependent sub-Saharan African countries as a group,[3] Figure 8.1 plots GDP and aNNI since 1990.

As the figure makes clear, adjusting for factor payments abroad and resource depletion produces a significant difference in the level of the national accounting aggregates, more than an $80 billion difference in 2008. The annual growth rates also diverge sharply, averaging 6.4 percent for GDP but only 3.8 percent for aNNI. This reflects the resource boom that started during the early 2000s, boosting real commodity prices, levels of extraction, the value of resource depletion, and flows of profits out of these economies.

This difference in levels and growth rates indicates the scope for governments to make policy mistakes during boom times: they believe that income is much higher than it is in fact, and they believe that economic growth is much higher as

[3]Figure 8.1 plots aggregate GDP and aNNI for countries where mineral and petroleum rents are greater than 5 percent of GDP and where a sufficient time series is available. The countries are Angola, Cameroon, Chad, Congo (Democratic Republic), Congo (Republic), Gabon, Ghana, Guinea, Mauritania, Mozambique, Sudan, Togo, and Zambia.

Figure 8.1
Real GDP and aNNI in mineral-dependent African countries (in 2005 US$ billions), 1990–2008



Source: Authors' calculations.

well. Governments may be tempted to opt for expansionary policies that are at variance with the true state of the economy.

If we switch the policy focus from growth to the *sustainability* of growth—a real concern when resources are being depleted—then it is clear that aNNI alone is not going to be a sufficient indicator. aNNI is an accurate measure of current income, but it does not indicate the prospects for future social welfare. For that, it is necessary to look at the national balance sheet and at net wealth creation in particular. The appropriate measure of net creation of real wealth is adjusted net saving,[4] calculated as follows:

Gross domestic saving (GDS) = GDP – consumption

Net national saving (NNS) = GDS + (net foreign factor income) + (net transfers) – (consumption of fixed capital)

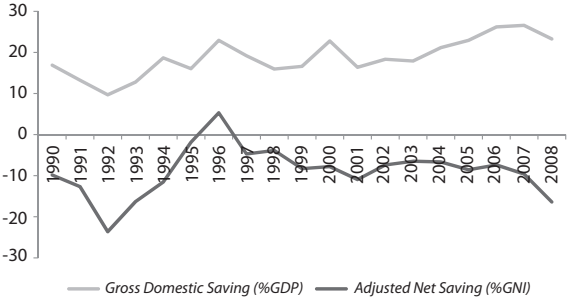
Adjusted net saving = NNS + (education expenditure) – depletion – (pollution damage)

Adjusted net saving aims to be comprehensive, classifying education expenditures as investment rather than consumption (contrary to the practice of the System of National Accounts (SNA)), deducting the value of mineral and energy depletion and net depletion of forests, and finally deducting the damage to assets associated with exposure to pollution. Figure 8.2 plots gross domestic saving and adjusted net saving for the resource-extracting African economies appearing in Figure 8.1.

As Figure 8.2 makes clear, the finance ministers in these mineral- and energy-exporting countries are almost certainly looking at the wrong numbers when it

[4]Adjusted net saving has been published by the World Bank in the *World Development Indicators* since 1999. Also termed "genuine saving," the underlying theory for it is developed in Hamilton and Clemens (1999).

Figure 8.2
Gross and adjusted net saving in mineral-dependent African countries (percent), 1990–2008



Source: Authors' calculations.

comes to wealth creation and the sustainability of development. Gross domestic saving shows an upward trend since 1990, approaching roughly 25 percent of GDP. Adjusted net saving has been negative every year except 1996, with the mean value approaching –10 percent of GNI since the year 2000.

It is important to understand what these savings figures mean for development. The discovery and development of a mineral or energy resource offers a country the opportunity to put well being, measured narrowly as consumption, onto a permanently higher plateau. The policy rule for achieving this, described below, is the Hartwick rule: invest rents from resource extraction in other forms of capital. The fact that we observe negative saving in Figure 8.2 is a straightforward reflection of the fact that the Hartwick rule is not being followed: rents are actually being consumed. Negative saving reflects an opportunity not taken, and future generations will be poorer as a result.

Government Finance Statistics and Exhaustible Resources

This discussion of adjusted national accounting aggregates as the basis for measuring economic performance has strong parallels in the development of government finance statistics in mineral-extracting economies. The IMF's *Government Finance Statistics Manual 2001* (IMF, 2001) brings the treatment of government finance in line with the 1993 System of National Accounts (SNA93) by including publicly owned commercial natural resources in the government's balance sheet account. This has potential implications for the derivation of basic government fiscal balances.

The *Government Finance Statistics Manual 2001* follows the SNA93 convention of treating the depletion of natural resources as another volume change rather than as capital consumption. As a result, the depletion of natural resources has no impact on the measured operating balance for government operations. To get a true measure of the government's fiscal stance, therefore, an adjusted measure of the operating balance is required, similar to the adjustment discussed for

the national accounting aggregate measures of income and saving. We therefore have the following:

Gross operating balance = Revenue – expense (excluding consumption of fixed capital)

Net operating balance = Gross operating balance – consumption of fixed capital

Adjusted net operating balance = Net operating balance – depletion of natural resources

For countries where fiscal revenues from taxing petroleum and mineral extraction are large, the adjusted net operating balance provides the most comprehensive measure of the government's fiscal stance. Similarly, the most general measure of the change in fiscal space in a country is the change in the government's balance sheet, which will be directly affected by the depletion of petroleum and mineral deposits.

ACHIEVING ECONOMIC AND FISCAL SUSTAINABILITY

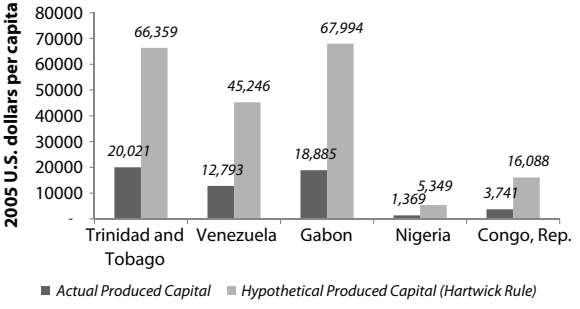
While the proper measurement of economic performance and the government's fiscal balance in mineral-extracting economies is obviously important, the central tool for achieving sustainability has to be public policy. How can government policy, fiscal policy in particular, contribute to sustainable growth and development?

The Hartwick Rule for Sustainable Development with Exhaustible Resources

In 1973, at the height of the first oil crisis, the economics profession turned its attention to the question of sustainability: If an essential resource like energy is finite in extent, can economic output be sustained indefinitely, or will output eventually begin to decline? Solow (1974) showed that consumption can be sustained even with a fixed production technology as long as the share of the exhaustible resource in production is less than that of produced capital, and there is sufficient substitutability between the two production factors. Hartwick (1977), in a justly famous result, showed that underlying the Solow finding is a simple policy rule: invest resource rents in other assets.

The Hartwick rule accords with common-sense notions of keeping capital intact, but actually implementing the rule has been a challenge for many governments. The evidence for this lies in a simple counterfactual: If resource rents had actually been invested in fixed capital over the 25 years from 1980 to 2005, we could construct a hypothetical estimate of capital stock and compare it with the observed capital stock in each resource-extracting economy. The result, drawn from *The Changing Wealth of Nations* (World Bank, 2011), is shown in Figure 8.3.

Figure 8.3
The Hartwick counterfactual: Actual vs. hypothetical fixed capital in 2005, selected countries
(in U.S. dollars per capita)



Source: Authors' estimates.

For the five major extractive resource exporters shown in Figure 8.3, there is clearly a large gap between how rich they were in 2005 and how rich they could have been if they had followed the Hartwick rule. World Bank (2011) shows this to be true for a very wide range of extractive economies, while countries like Malaysia, Tunisia, Colombia, and China featured both heavy resource dependence (where rents on extractive resources exceeded 5 percent of GDP) and a 2005 stock of fixed capital that exceeded its hypothetical value under the Hartwick rule—these countries were saving their resource rents, and more.

There is a danger in looking at counterfactuals, however, because they make the application of the Hartwick rule seem like something mechanical, something that is easily achieved by government fiat. In practice, there is a sequence of actions, mostly in the fiscal domain, that needs to be implemented if resource wealth is to be parlayed into sustainable growth and development.

Achieving Fiscal Sustainability

The Hartwick rule provides the policy prescription for achieving sustainable growth and development in exhaustible resource-based economies. Sustainability at the economy-wide level is equated to maintaining or increasing real wealth. The same principles can be applied to achieving fiscal sustainability, which can be defined to be the maintenance of real government wealth when part of the endowment consists of stocks of exhaustible resources owned by the public sector. Fiscal sustainability is therefore a pillar of macro sustainability.

For governments to achieve fiscal sustainability, a number of distinct elements of the fiscal system need to work efficiently and effectively, including these:

- Effective rent capture by government (assuming that exploitation of the natural resource is carried out by private actors)
- Fiscal rules to limit discretionary use of resource revenues

- Operation of natural resource funds, and
- Effective public investment management.

In the following discussion, each of these elements is addressed in turn.

Effective Revenue Instruments

Since the economic value of a resource asset is the present value of total resource rents, the perfect revenue instrument would capture all available rents. In practice, there are a number of constraints on government's ability to capture resource rents.[5] A key issue is information asymmetry—firms know their costs with more precision than government, so it is difficult to design the perfect fiscal instrument, one that captures resource rents (economic profits) but neither depresses after-tax profits below "normal" levels nor leaves windfall profits in the hands of firms. Firms can also distort reported profit levels by using transfer pricing.

As Sunley, Baunsgaard, and Simard (2003) note, governments tend to use a range of fiscal instruments in order to capture resource rents, including these:

- Royalties, charged either as specific taxes or at assessed-value rerates, administered on gross production. Royalties are unpopular with producers because they place all down-side market risks on them, rather than on government.
- Income taxes, typically with some restrictions on consolidation of income and tax deductions across different activities such as exploration, development, and production.
- Resource rent taxes, which attempt to tax away super-normal profits but are subject to the information asymmetry limitations noted above.
- Production-sharing agreements, which split gross income into a cost-recovery component and a profit component that is shared between producer and government according to an agreed formula—in principle, mimicking a resource rent tax.
- Indirect taxes, including tariffs, export duties, and value-added taxes.

There is a large literature on resource taxation, a considerable portion of which is summarized by Boadway and Keen (2010). They note the range of issues that make the taxation of mineral and energy resources particularly complex, including high sunk costs and long production periods (which can lead to time-inconsistency problems), uncertainty about resource extent, extraction cost, and future market conditions, and problems of market power.

Complexities abound, therefore, but the basic principle is clear: As the owner of the natural resource, a government can only realize the benefits of ownership through effective and efficient fiscal instruments to capture resource rents.

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[5]If resources are extracted by a state-owned enterprise, then in principle all rents can be captured through flows of profits to the treasury. But historical experience has not been positive—public-sector firms are often subject to political meddling, a lack of commercial orientation reduces profits, and investment finance may be limited by government capital budgets. See McPherson, 2003 and 2010.

Fiscal Rules Limiting the Uses of Resource Revenues

A defining characteristic of petroleum revenues is that they often amount to tens of percentage points of national income and correspondingly larger shares of government revenues. There is consequently a strong temptation for governments to spend resource revenues on public sector consumption. In the face of these temptations, some governments have implemented fiscal rules to limit what is quite literally capital consumption.

The best-known example of such a fiscal rule is Botswana's Sustainable Budget Index. It is calculated this way:

$$\text{Sustainable Budget Index} = \frac{\text{recurrent expenditure}}{\text{recurrent revenue}}$$

Here the definitions are important: Recurrent expenditure excludes spending on health and education, since these are defined as development expenditure, while recurrent revenue excludes revenue from the mining sector. Botswana's policy aims to ensure that the Sustainable Budget Index does not exceed 1, since that would indicate that resource revenues are being consumed. Resource revenues are invested domestically in infrastructure, health, and education, or invested in financial assets when the government feels that the domestic absorptive capacity for investment is being stretched.

As Kojo (2010) reports, government policy has generally been successful in following the Sustainable Budget Index rule, but the index did exceed 1 in 1994–95 as well as from 2000–01 to 2004–05. Kojo (2010) also notes that "diamonds are not forever"—in fact, by the mid-2020s the low-cost diamond reserves will be exhausted, and new reserves will likely have much higher extraction costs. Botswana will have to plan for a fiscal transition before that point is reached, improving tax administration, increasing non-mining revenue generation, and reducing overall government expenditures in order to ensure medium-term fiscal sustainability.

Operation of Natural Resource Funds

Even if governments are prudent and choose to invest resource revenues rather than consuming them, this raises two interlinked issues: (i) the limited capacity of developing countries to absorb large amounts of investment, and (ii) the effectiveness of public investment management systems. The latter point is discussed in the next section.

If government investments in physical and human capital are bumping into the constraints of absorptive capacity in the economy,[6] then investing in financial assets is the obvious alternative. This is typically achieved by establishing natural resource funds that invest in a variety of financial assets.

[6]Absorptive capacity constraints are generally signaled by shortages of skills, with consequent delays in implementation and rising prices of inputs.

Natural resource funds (NRFs) are a particular class of fiscal rules, or more generally of rules-based fiscal policy. In recent times, several countries—often in response to the deterioration of their public finances—have adopted rules constraining the extent of discretionary fiscal policy in order to correct for the deficit bias. A fiscal policy rule is defined as a permanent constraint on fiscal policy, expressed as a summary indicator of fiscal performance, such as the government budget deficit, borrowing, debt, or a major component thereof (Kopits and Symansky, 1998). Kopits and Symansky identify a list of characteristics for an ideal fiscal rule: it should be well-defined, transparent, simple, flexible, adequate relative to the final goal, enforceable, consistent, and supported by sound policies, including structural reforms if needed.

As Davis, Ossowski, and Fedelino (2003) note, NRFs serve to buffer the economy from the volatility of natural resource markets, can limit Dutch disease symptoms by spreading the conversion of resource receipts into domestic currency over time, and can provide a useful source of liquidity for governments concerned with running countercyclical fiscal regimes. They highlight two broad types of natural resource funds: *stabilization* funds and *saving* funds.

Stabilization funds, as the name implies, are primarily aimed at stabilizing public finances by buffering the budget from the volatility of natural resource revenues. These funds often use contingent rules for determining whether funds are accumulating or being withdrawn for use in the government budget, setting thresholds for prices or revenues above which revenues can accumulate and below which they are drawn down. While this buffering effect can obviously be important for the stability of public finances over the business cycle,[7] there is no guarantee that stabilization funds are financially sustainable, owing to significant uncertainties about whether the thresholds for accumulation and drawdown are representative of normal deviations from long-term averages. For example, if resource prices move to permanently higher or lower mean levels, the stabilization fund could either accumulate in perpetuity or eventually be driven to zero.

Savings funds generally aim to invest some specified proportion of resource revenue. Consequently, they have a potential stabilizing effect on government revenues, particularly if the funds can be drawn upon at the low point of the business cycle. But governments are still free to run deficits, which can offset these savings, so the issue is ultimately whether governments wish to run prudent fiscal policies.

The institutional setting and management of NRFs also raises a number of important questions for government. A key issue is integration with the budget: If resource funds are free to make domestic investments outside of the budget process, this undermines the integrity of the overall budgetary system. It could

[7]Davis, Ossowski, and Fedelino (2003) note, however, that there is nothing to prevent governments from running deficits during boom times, when the resource stabilization fund is in accumulation mode, thereby offsetting some or all of the stabilizing effect of the natural resource fund.

also raise questions of transparency in the use of the resource fund. There are also important questions about asset management. To the extent that fund investments, whether in physical or financial assets, are made in the domestic economy, this risks transmitting natural resource sector volatility back into the domestic economy. Investing in foreign assets may be the preferred option from this perspective, but doing so may be politically difficult if there are constituencies pushing for investing "at home."

Another objective of NRFs is to preserve the quality of spending: by setting limits on spending increases they avoid waste in boom times. As noted by Davis, Ossowski, Daniel, and Barnett (2001), the establishment of NRFs may be justified on political economy grounds, as they help the government to resist spending pressures by formally limiting the resources available to the budget during upswings. In effect, a transparent and well-managed NRF protects resource revenues from the voracity effect and preserves resources for high-quality spending—that is, for well-appraised public investments.

However, Petrie (2009a) notes that an NRF should be introduced only if it is judged likely to change the behavior of political actors in ways that reduce their incentives to spend too much too soon. If it is not likely to do so, an NRF may only succeed in reducing the transparency of fiscal policy by creating a parallel budget or, at least, making it harder to monitor the government's performance in fiscal management.

Humphreys and Sandbu (2007) suggest three general approaches to designing an NRF that could help to improve the incentives for responsible fiscal policy:

- *Rules-based design*—The NRF should operate under rules that determine which revenues will be paid into the fund and limit the discretion of the current government to determine both the size and the allocation of spending from the fund. Determining how hard the rules should be involves the familiar trade-off between commitment and flexibility.
- *Broad governance*—Governance of an NRF can be broadened beyond the government of the day by involving other actors in its decision-making, such as the legislature (as in Norway), members of opposition parties (as in Alaska), or new technical bodies that include representatives of civil society.
- *Transparency*—Transparent operation of the NRF is critical to its efficacy. Fiscal transparency is a prerequisite for good governance in general (Kopits and Craig, 1998). It should lead to better-informed public debate about the design and results of fiscal policy, make governments more accountable, and thereby strengthen government credibility and enhance public understanding of macroeconomic policies and choices.

With respect to transparency, Collier and others (2009) argue that one approach is to establish new, explicit, and transparent decision processes for natural resource revenues linked to a clear vision of long-term development. While this approach runs counter to the ideal fiscal principle of a fully integrated budget

in which all revenues are pooled, Collier and others argue that it might have superior informational properties. By spotlighting the new spending, it may make scrutiny easier and signal to citizens that a windfall will not be captured by special interests.

Concerning the design of NRFs, Collier and others (2009) note that while most of the policy attention to date has been focused on "How much should be saved?" the most important question for low-income countries is "What assets should be acquired?" They answer that, since low-income countries are capital-scarce, the assets should be accumulated by public investment within the country. Thus, for low-income countries, Sachs (2007) and Collier and others (2009) argue strongly for using the natural-resource revenues to increase public investment, spending them on public assets (human capital and physical infrastructure) with a high social rate of return.

This strategy, however, requires that countries *invest in their capacity to invest*. For public investment to deliver high returns, it must be appropriately appraised and well managed. Countries often encounter managerial and physical bottlenecks when stepping up public investment. In many cases, avoiding bad investments may be as important as identifying the best projects.

Sachs (2007) also argues that well-appraised public investment can help alleviate the effects of Dutch disease. He makes the case that Dutch disease is primarily a concern if the resource boom is used to finance consumption rather than investment. In many resource-rich developing economies, there is a serious gap in public goods. Developing public infrastructure—roads, ports, power, communications, education, and health care services—will raise the productivity of private capital and induce greater private investment. This effect can offset the negative impact of exchange rate appreciation on the nonresource tradable sector.

Resource funds can be a useful tool for stabilizing the fiscal system in the face of revenue volatility, therefore, and can ensure that the revenues from exhaustible resources are saved rather than consumed. But they are not a substitute for overall fiscal discipline and sound budgetary practices.

Examples of NRFs around the world are shown in the Appendix.

Public Investment Management

If governments choose to invest resource revenues in infrastructure and other public projects, then the quality of public investment management becomes key in determining their development outcomes. Harberger (2005) argues that an improved project evaluation system, one that significantly increases the rate of economic productivity of public investments, will have a permanent and continuing effect on a country's growth rate. This contrasts with other successful policy reforms (e.g., trade, tax, and regulatory reforms) that raise the time path of national income but whose effects on the growth rate are one-off events (that is, yielding benefits only at the time of the reform). An improved public investment management system has the potential to permanently increase the country's growth rate.

As noted by Belli and others (2001), decision makers must look at public projects from several points of view simultaneously, including these three:

- *Profitability:* From the country's viewpoint—to ensure that projects contribute more resources to the economy than they use.
- *Feasibility:* From the financial and fiscal viewpoints—to ensure that the implementing agencies will have the necessary resources to implement projects as designed.
- *Fairness:* From the viewpoint of the people who are most affected by the projects—to ensure that the distribution of costs and benefits is acceptable to society at large.

Rajaram and others (2008) identify a list of nine key must-have features in any well-functioning system for public investment management. These comprise the bare-bones institutional features that would minimize major risks and provide an effective process for managing public investments:

(i) *Investment guidance and preliminary screening.* Some measure of broad strategic guidance for public investment is often an important way to anchor government decisions and to guide sector-level decision makers. Such guidance may be derived from a national plan or another medium- to long-term strategic document that establishes economy-wide development priorities at the highest decision-making levels. A first-level screening of all project proposals should be undertaken to ensure that they meet the minimum criteria of consistency with the strategic goals of the government, as well as meeting the budget-classification tests for inclusion as a project rather than as a recurrent spending item.

(ii) *Formal project appraisal.* Projects or programs that meet the first screening test should undergo more rigorous scrutiny of their cost-benefit ratio or cost effectiveness. The project selection process needs to ensure that projects proposed for financing have been evaluated for their social and economic value. The quality of beforehand project evaluation depends very much on the quality of this analysis, which in turn depends on the capacity of the staff and their project evaluation skills. Investment in training on project evaluation techniques is an important aspect of an effective public investment system.

(iii) *Independent review of appraisal*. Where departments and ministries (rather than a central unit) undertake the appraisal, an independent peer review might be necessary in order to check any subjective, self-serving bias in the evaluation. It is crucial to kill bad projects before they develop a strong constituency—even the worst projects have groups of beneficiaries and promoters.

(iv) *Project selection and budgeting*. It is important that the process of appraising and selecting public investment projects is linked in an appropriate way to the budget cycle, even though the project evaluation and selection cycle may run on a different timetable. There is clearly a two-way

relationship between the budget cycle and the project evaluation and selection cycle. The fiscal framework and the annual budget need to establish envelopes for public investment (on an aggregate and/or sectoral basis) so that a sustainable investment program can be undertaken. Efficient investment also depends on whether the recurrent budget adjusts to reflect the impact of the capital projects.

(v) *Project implementation*. Project design should include clear organizational arrangements and a realistic timetable to ensure that institutional capacity to implement the project is available and adequate.

(vi) *Project adjustment*. The funding review process should be flexible in its disbursement profile to account for changes in project circumstances. Each funding request should be accompanied by an updated cost-benefit analysis and a reminder to project sponsors of their accountability for the delivery of the benefits. These funding mechanisms can reinforce the monitoring process, making it an active rather than a passive form of monitoring. Governments need to create the capacity to monitor implementation in a timely way and to address problems proactively as they are identified.

(vii) *Facility operation*. Asset registers need to be maintained and asset values recorded. Ideally, countries should require their operating agencies to compile balance sheets on which the value of assets created through new fixed capital expenditures would be recorded. Whether there is accrual accounting or not, agencies should maintain thorough asset registers, including legal title to property where necessary.

(viii) *Post-project evaluation*. Evaluation of completed projects should focus on comparing the project's outputs and outcomes with the objectives set forth in the project design. Good practice suggests that the project design should build in the evaluation criteria and that learning from such post-completion evaluations should be applied to improve future project design and implementation.

(ix) A further concern is the public procurement process—since investment projects will need to contract for services and purchase project inputs, it is vital that the procurement system be transparent and rules-based. Weak procurement processes open the door to political interference and waste of public resources.

Petrie (2009a, 2009b) discusses issues pertaining to public investment management in resource-rich countries. Petrie (2009a) notes that a public investment management system is an open system that impacts, and is impacted by, the broader political economy of the state. It is increasingly recognized that the key determinants of success for a resource-dependent economy are the country's overall governance framework and the political economy of rent extraction and management. Consequently, Petrie (2009b) sets the public investment management system within the context of the broader policy issues relating to natural resource extraction and the overall political environment.

CONCLUSIONS AND POLICY IMPLICATIONS

Three key characteristics of mineral and energy resources have major impacts on public finances and government development policy:

- Resource revenues tend to be large relative both to GDP and to the government budget.
- Resource revenues are volatile, closely tied to the world business cycle.
- The resources themselves are finite and exhaustible.

While natural resource abundance should be a blessing, these three characteristics complicate a government's task in ensuring sustainable growth and development: the first two characteristics potentially create a strong procyclical bias in fiscal policy, which can have destabilizing effects on macroeconomic performance; the third characteristic, exhaustibility, has implications for both how economic performance is measured and how a government leverages natural resources for development.

On measuring economic performance, two alternative national accounting measures are needed for resource-extracting economies. Adjusted net national income (aNNI) gives a true measure of income, one that will generally be much lower than GNI, and its growth rate is likely to be considerably lower than the GDP growth rate during resource booms. Tracking aNNI growth can therefore reduce policy mistakes in the form of overly expansionist fiscal policies. A second measure, adjusted net saving, gives a true measure of wealth creation, after accounting for investment in human capital, depletion of natural resources, and pollution damages—both theory and evidence show this to be a leading indicator of the sustainability of development.

Sustainable fiscal policy, essential for sustainable development in resource-extracting economies, requires a foundation built out of five essential materials: (i) tracking adjusted measures of the government's net operating balance in order to assess fiscal space; (ii) effectively and efficiently taxing the profits on resource exploitation; (iii) applying fiscal rules in order to ensure that resource revenues are saved rather than consumed; (iv) establishing a natural resource fund in order to assist with stabilization and ensure that savings are used effectively; and (v) building a strong public investment management system in order to ensure the quality of public investments financed by resource revenues.

That list of the constituents of sustainable fiscal policy is long, suggesting the size of the challenge that extractive economies face. While the Hartwick rule is easy to state, it is complex to implement, and it requires fiscal discipline. But a growing understanding by policymakers of the need to transform exhaustible resources into other forms of wealth can provide the impetus for reform and policy success.

Appendix. Examples of Natural Resource Funds

Country/ state	Name	Stated objective(s)	Date estab- lished	Accumulation rules	Withdrawal rules	Compliance with rules/ Control changes to rules
Alberta (Canada)	Alberta Heritage Savings Trust Fund	Savings (prior to 1997 economic and social devel- opment were also included)	1976	30% of resource revenues until 1983. 1984-87: 15%. Transfers discontinued thereafter.	Discretionary transfers to the budget.	Yes/Yes: Oversight Committee (Members of Parliament) and Provincial Treasurer
Alaska (United States)	Alaska Permanent Fund	Savings	1976	50% of certain mineral revenues (increased from 25% in 1980).	Principal (infla- tion-adjusted).[1]	Yes/Yes: Independent trustees, ulti- mately the governor and legislature
Chile	Copper Stabilization Fund	Stabilization	1985 (activated in 1987)	Based on discre- tionary reference price determined by the govern- ment.	Transfers to the budget (and extra- budgetary lending) based on discretion- ary reference price deter- mined by the government.[2]	Yes/No: Ministry of finance, Central Bank, and state cop- per company (CODELCO)
Kuwait GRF	General Reserve Fund	Stabilization and savings	1960	Residual budget- ary surpluses.	Discretionary transfers to the budget.	Minister of Finance, Central Bank, governor, and other officials
Kuwait RFFG	Reserve Fund for Future	Savings	1976	10% of all govern- ment revenue[3]	Discretionary transfers to the budget (with National Assembly approval).	Minister of Finance, Central Bank governor, and other officials
Kiribati	Generations Revenue Equalization Reserve Fund	Stabilization and savings	1956[4]	"When surplus permits," later apparently changed to 25% of all phosphate receipts.	Discretionary transfers to the budget with Parliamentary approval and that of other officials.	No/Yes: Minister of Finance, Secretary of the Cabinet, and other offi- cials
Norway	Government Pension Fund Global	Stabilization and savings	1990, activated in 1995	Net government oil revenues.	Discretionary transfers to the budget to finance the non-oil deficit (approved by Parliament).	Yes/No: Ministry of Finance

Appendix (continued)

Country/ state	Name	Stated objective(s)	Date established	Accumulation rules	Withdrawal rules	Compliance with rules/ Control changes to rules
Oman SGRF	State General Reserve Fund	Savings	1980	Since 1998, oil revenue in *excess* of budgeted amount.	Discretionary transfers to the budget.	Yes: Autonomous government agency
Oman CF	Contingency Fund	Stabilization	1990, abolished in 1993	Residual oil revenue after budget and SGRF allocations.		
Oman OF	Oil Fund	Oil sector investment	1993	Since 1998, market value of 15,000 barrels per day.		Ministry of Finance
Papua New Guinea	Mineral Resources Stabilization Fund	Stabilization	1974, abolished in 2001	Government mineral revenues.	Government discretion, though based on estimates of long-run prices.	Yes: Government
Venezuela	Macroeconomic Stabilization Fund	Stabilization	1998	Since 1999, 50% of oil revenue above reference values, set by decree for 1999-2004.[5]	Transfers to the budget and other state entities based on reference values; discretionary transfers also allowed.[5]	No/Yes: Parliament and the Executive.

Sources: Table 11.2 in Davis, Ossowski, Daniel, and Barnett (2001); original sources: national authorities; and IMF staff.

[1]Fixed proportion of the earnings are distributed as cash to Alaskans; earnings are also used to inflation-proof the principal (as required by the 1982 amendment) and to increase capital.

[2]If copper price reaches $0.04 per pound above reference price, no deposit is made; there is a 50 percent deposit between $0.04 and $0.06 per pound, and 100 percent thereafter. Withdrawals are symmetric.

[3]Received 50 percent of GRF assets when established.

[4]Phosphate stock became exhausted in 1979.

[5]Fifty percent (100 percent before 1999 change) of revenue above reference value to be deposited. Withdrawals, with congressional approval, if (a) oil revenues in given year are lower than reference value, or (b) the resources of the fund exceed 80 percent of annual average oil revenue in the five preceding years. Withdrawals under (b) were initially earmarked for debt repayment and capital expenditure. After 1999 these withdrawals were earmarked for social and investment spending and debt repayment. Fund balance at the end of the fiscal year must not be less than one-third of the balance at the end of the preceding year. In late 2001 the rules were modified again, and the central government and the state oil company were exempted from depositing resources in the fund in the last quarter of 2001 and during 2002.

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CHAPTER 9

Fiscal Policy in Commodity-Exporting Countries: Stability and Growth

RABAH AREZKI

INTRODUCTION

In the late 1950s, Richard Musgrave made the case for a "three-function framework" which has influenced the way economists approach fiscal policy and its objectives to this day. This framework suggests that government activity should be separated into three branches, namely macroeconomic stabilization, resource allocation, and income redistribution. The stabilization branch is to assure the achievement of high employment and price stability, the allocation branch is to see that resources are used efficiently, and the distribution branch is to achieve an equitable distribution of income. (Musgrave, 1959). The present chapter is concerned specifically with the performance of commodity-exporting countries in terms of macroeconomic stability and long-run economic growth, based on an examination of a new dataset on nonresource GDP from a panel of up to 134 countries during the period 1970–2007.[1,2]

This chapter links to the literature on the role of fiscal policy in shaping the economic performance of developing countries. There is ample evidence that fiscal policy in developing countries has achieved mixed results, in both the short run and the long run. In the short run, Kaminsky, Reinhart, and Vegh (2004),

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[1]Arezki, Hamilton, and Kazimov (2011) provide a detailed technical discussion of the results presented in this chapter.

[2]We leave the analysis of the "third function" of fiscal policy in commodity-exporting countries—namely achieving an equitable distribution of income—for further research. A nascent literature has investigated the issue (see Ross (2007) and Goderis and Malone (2008) among others).

among others, provide evidence that fiscal policy tends to be procyclical in developing countries, especially when compared to industrialized countries. Three important characteristics of commodity-exporting countries complicate the conduct of fiscal policy and are likely to make government spending more procyclical than in non-commodity-exporting countries. First, government revenues derived from the exploitation of natural resources are more volatile than other sources of government revenue. Second, the size of the revenues derived from natural resources is disproportionately large in commodity-exporting countries, notwithstanding the distinction between resource dependence and resource abundance. Third, those revenues are prone to rent-seeking behavior, as they more directly transit to government coffers.

Cuddington (1989) provides some evidence supporting the claim that fiscal policy is more procyclical in commodity-exporting countries. In the long run, there is also mixed evidence that government spending has helped boost developing countries' economic performance (Blejer and Khan, 1984; Khan, 1996). In commodity-exporting countries, Gelb and associates (1988) provide evidence that governments in those countries often embark on large investment projects following commodity price booms. They argue that those investment projects have been plagued by inefficiencies and also contributed to resource misallocation. Disproportionally large investment projects also get depreciated quickly or even become obsolete when governments become unable to cover the associated high maintenance costs due to lack of financing. Robinson and Torvik (2005) provide a political economy model in which "white elephants" may be preferred to socially efficient projects when the political benefits are large compared to the surplus generated by the efficient projects. This evidence could suggest that poor long-run economic performance in commodity-exporting countries may stem from inefficiencies in government investments rather than from underinvestment.

Further, this chapter relates to the literature on the so-called resource curse, focusing specifically on the consequences that resource endowment has on the economic performance of commodity-exporting countries. This literature has emphasized several channels through which resource windfalls may affect economic performance, including the so-called Dutch disease and a deterioration of institutions, to name a few (Frankel, 2011a). Overall, there is some evidence, albeit controversial, that commodity-exporting countries' growth performance compares less favorably with the growth performance of non-commodity-exporting countries. Among others, Alexeev and Conrad (2009) provide evidence supporting a more skeptical view of the resource curse. Using traditional cross-sectional growth regressions, they find for instance that the empirical association between resource dependence and economic performance is not robust when using samples with different starting years. In a recent attempt to reconcile this conflicting evidence regarding the existence of a resource curse, Collier and Goderis (2007) use panel cointegration techniques, allowing them to disentangle the short- and long-run effects of resource windfalls on overall GDP growth. They find that commodity price shocks have a positive effect in the short run but a negative effect in the long run.

This chapter makes two main contributions to the existing literature. First, it focuses on the effect resource windfalls have on the nonresource sector. To examine this, we use a new dataset on nonresource GDP, allowing us to avoid the noise introduced by the resource-sector contribution to overall GDP.[3] As argued by the World Bank, "There are no sustainable diamond mines, but there are sustainable diamond-mining countries" (World Bank, 2006). Hartwick (1977) provides a canonical rule for sustainability in resource-dependent economies: If genuine saving is set equal to zero at each point in time (that is, traditional net saving just equals resource depletion), then consumption can be maintained indefinitely, even in the face of finite resources and fixed technology. From a policy perspective, nonresource-sector GDP is thus the relevant measure to be used when assessing both the macroeconomic stability and the long-run economic performance of commodity-exporting countries. Indeed preserving the macroeconomic stability of the nonresource sector specifically will contribute to fostering investments in that sector and will therefore contribute to sustained economic growth after natural resources are depleted.

Second, unlike previous studies, the econometric investigation in this chapter explicitly takes into account the role of fiscal policy in the analysis of the resource curse. In commodity-exporting countries, the resource sector often lacks direct structural linkages with the rest of the economy but exercises a significant externality, mostly through the fact that a large chunk of government spending is financed from revenues originating in the resource sector (through state ownership, taxation, or export tariffs). Identifying the nature of that externality can help foster our understanding of both the short-run dynamics of the nonresource sector and the sector's long-run economic viability after natural resources are depleted.

Our main findings are twofold. First, we find that overall government spending in commodity-exporting countries has been procyclical. We also find that resource windfalls initially crowd out nonresource GDP, which then increases as a result of the fiscal expansion. Second, we find that in the long run, resource windfalls have negative effects on the nonresource sector's GDP growth but not over government spending. Both effects—of resource windfalls and government spending on macroeconomic stability and economic growth—are moderated by the quality of political institutions.

The remainder of this chapter is organized as follows. The next section describes the data. The section following that presents the estimation strategy and results, and the final section offers four concluding remarks.

[3]The next section describes the estimation of nonresource GDP, which takes into account the depletion of the stock of natural resources.

DATA

Nonresource GDP

Nonresource GDP is constructed by subtracting the real values of natural resources depletion from total GDP in 2005 purchasing power parity (PPP)-adjusted U.S. dollars.[4] Natural resources give rise to rents because they are not produced; in contrast, for produced goods and services competitive forces will expand supply until economic profits are driven to zero. An economic rent represents an excess return to a given factor of production. The value of resource depletion is therefore calculated as the total rents on resource extraction and harvest, where rents are estimated as the difference between the value of production at world prices and total costs of production, including depreciation of fixed capital and return on capital (see Hamilton and Ruta, 2008, for more details). The energy resources include oil, natural gas, and coal, while metals and minerals include bauxite, copper, gold, iron ore, lead, nickel, phosphate, silver, tin, and zinc.

Resource Windfalls

To capture revenue windfalls from international commodity price booms, the analysis constructs a country-specific index which consists of a geometric average of international prices of various commodities *using* (time-invariant) weights based on the average value of exports of each commodity as measured in the GDP of a given country. Annual international commodity price data are for the 1970–2007 period, reported in the United Nations Conference on Trade and Development (UNCTAD) Commodity Statistics; data on the value of commodity exports is from the National Bureau of Economic Research (NBER)-United Nations Trade Database. Because the time-series behavior of many international commodity prices is highly persistent, commodity price shocks are identified by the (log) change in the international commodity price.[5]

Democracy

Democracy is measured by the revised combined Polity score (Polity2) of the Polity IV database (Marshall and Jaggers, 2009). The Polity2 score ranges from –10 to +10, with higher values indicating more democratic institutions. Following Persson and Tabellini (2003, 2006) and the Polity IV project, we code countries as democracies if their Polity2 score is strictly positive and as autocracies if it is strictly negative. We further classify countries as deep democracies if their Polity2 score is higher than 6, and as deep autocracies if their Polity2 score is lower than –6.

[4]The resource depletion data are from World Bank (2011) and the GDP data are from Heston, Summers, and Aten (2009).

[5]The commodities included in the commodity export price index are aluminum, beef, coffee, cocoa, copper, cotton, gold, iron, maize, oil, rice, rubber, sugar, tea, tobacco, wheat, and wood. In case there were multiple prices listed for the same commodity, a simple arithmetic price average was used.

ESTIMATION STRATEGY AND MAIN RESULTS

Macroeconomic Stability

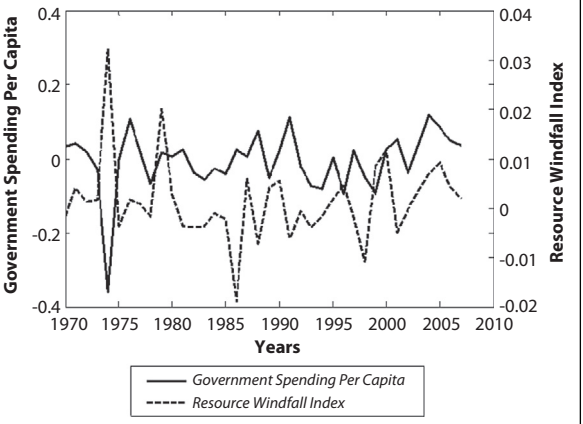
A preliminary comparison between the evolution of our resource windfalls index and government spending indicates that for most commodity-exporting countries, those two aggregates co-move, and the extent of the co-movement has been increasing during the past decade following the commodity price boom of the 2000s. Figure 9.1 illustrates such findings for the case of Venezuela. The co-movement between government spending and resource windfalls provides some evidence of the procyclicity of fiscal policy for most commodity-exporting countries. In contrast, for a limited number of commodity-exporting countries, such as Norway, government spending appears to move countercyclically with respect to resource windfalls, as illustrated in Figure 9.2. The latter evidence indicates some degree of heterogeneity in the fiscal policy of commodity-exporting countries. We now turn to a more systematic analysis of the short-run dynamics of government spending and nonresource GDP in the face of resource windfall shocks.

To do so we use panel vector autoregression (VAR) techniques, making it possible to isolate the dynamics of a statistical relationship and the interdependencies between multiple economic variables, namely resource windfalls assumed to be exogenous, and two endogenous variables, namely nonresource GDP and government spending as share of nonresource GDP.[6] Another advantage of panel VAR techniques is that they allow one to simultaneously estimate all relationships while taking into account specific country characteristics through the use of fixed effects.[7] The results of the estimations are illustrated by the impulse responses presented in Figure 9.3. These suggest that the average effect of an increase in resource windfalls is followed by a statistically and economically significant increase in government spending. This provides supportive evidence of procyclical government spending policy in commodity-exporting countries. Figure 9.3 also shows that resource windfall shocks initially crowd out nonresource GDP, which in turn increases as a result of the fiscal expansion. The intuition behind this result is that an increase in resource windfalls raises the return on investing in the resource sector, which in turn leads to a reallocation of factors away from the nonresource sector in favor of the resource sector. As government spending increases in response to an increase in government revenues following a resource windfall, the nonresource sector expands. The latter results provide empirical evidence of a resource sector externality onto the nonresource sector, stemming from resource windfalls spurring government spending.

[6]Government spending data is from Heston, Summers, and Aten (2009).

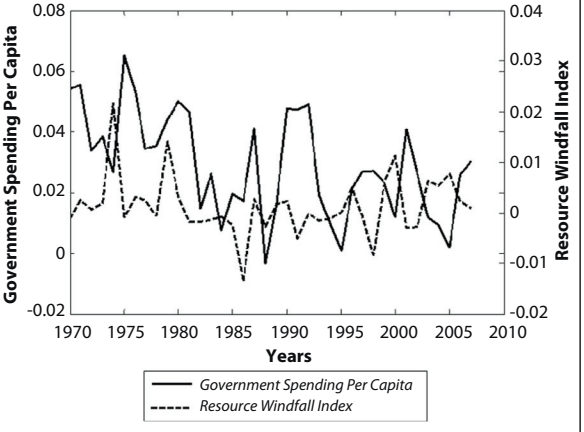
[7]All the variables used in the panel VAR are used in log-difference. This is motivated by the fact that while panel-unit root tests suggest that those series are nonstationary, panel cointegration tests (first and second generations taking into account cross-sectional dependence) reject the evidence of cointegration relationship between those variables.

Figure 9.1
Venezuela: Evolution of government spending and resource windfalls, 1970–2007



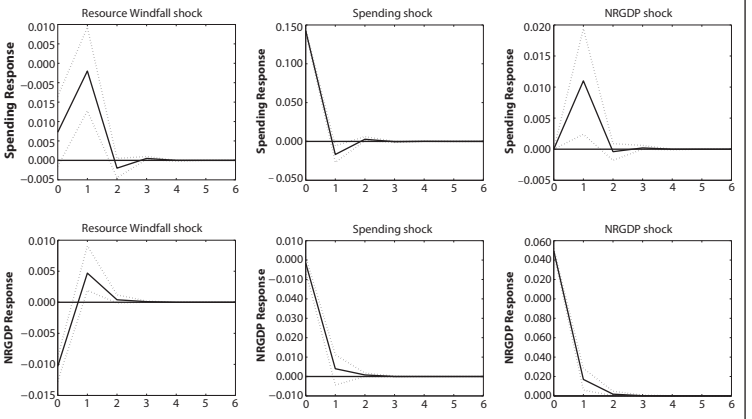
Sources: Heston, Summers, and Aten (2009); UNCTAD Commodity Statistics; NBER-United Nations Trade Database; and author's analysis.

Figure 9.2
Norway: Evolution of government spending and resource windfalls, 1970–2007



Sources: Heston, Summers, and Aten (2009); UNCTAD Commodity Statistics; NBER-United Nations Trade Database; and author's analysis.

Figure 9.3
Estimations of impulse response, panel VAR



Source: Author's analysis.

When expanding the empirical analysis to the real exchange rate and the nonresource current account, we find that resource windfalls lead to increased growth of the real effective exchange rate and to a deterioration in the nonresource current account (results not reported in tables).[8] Those results are consistent with Dutch disease. Indeed, government spending directed toward the nontradable sector, where supply is inelastic, leads to an increase in the price of nontradable compared to tradable goods. This increase leads to an appreciation of the real exchange rate, with potentially harmful effects on external competitiveness consistent with a deterioration of the nonresource current account following a resource windfall shock.

A relevant question is whether countries that have implemented fiscal rules defined as numerical targets to constraint budget aggregates differ in their macroeconomic stability. To answer this, we added to the previous VAR specification an interaction term between our resource windfall index and fiscal-rule dummies obtained from IMF (2009) (results not reported in tables). Our results indicate no evidence of a dichotomous effect of resource windfalls depending on whether a fiscal rule has been implemented. One explanation could be that it is simply too early to tell. Indeed, as documented by Ossowski and others (2008), many of those fiscal rules in commodity-exporting countries were only put in place in the early 2000s. An alternative explanation could be that fiscal rules are not necessarily effective, since they can be circumvented, especially in weak institutional environments. If that is true, the design of fiscal rules in commodity-exporting countries should perhaps be revisited to adapt them to the challenges posed by

[8]The real exchange rate data is obtained from IMF (2010a) and the current account data is from IMF (2010b). The nonresource current account is constructed by subtracting commodity exports from overall current account.

the institutional environment. One country that has successfully implemented a fiscal rule, Chile, has targeted a structural budget balance set by a panel of experts. This could certainly be a source of inspiration (Frankel, 2011b).

A related policy issue is whether fiscal rules in commodity exporters should take into account the composition of government spending. Indeed, fiscal rules may indeed impact the composition of spending, since the politically sensitive nature of some types of spending could lead to a fiscal rule's having adverse effects on long-run economic growth. Blanchard and Giavazzi (2003) provide an interesting discussion of those issues in the context of the European Stability and Growth Pact. Arezki and Ismail (2010) find that fiscal rules in oil-exporting countries have forced the adjustment on capital spending in bust times, raising some concern over the consequences on economic growth. Arezki and Alichi (2009) provide theoretical and empirical evidence of the negative effects of current spending on non-oil GDP growth in oil-exporting countries. The United Kingdom and Peru are among the few countries that have shielded the composition of their spending from the implementation of fiscal rules.

Another relevant question is whether countries endowed with mineral and energy resources have fared differently in macroeconomic stability when compared to countries endowed with agricultural resources. To answer this, we partition our sample, distinguishing countries where agricultural exports dominate from countries where minerals and energy exports dominate. We find that countries that export mostly minerals and energy commodities display a statistically significant increase of government spending following an increase in resource windfalls, whereas countries exporting mainly agricultural commodities do not display any statistically significant increase (results not reported in tables).

Those results suggest that windfalls originating from point-based resources, that is, geographically more concentrated resources (mostly minerals and energy commodities) are more likely to lead to procyclical fiscal policies than windfalls originating from diffuse resources, that is, more geographically dispersed resources (mostly agricultural commodities). Our results are also consistent with those of Isham and others (2005), who provide evidence that mineral and energy exporters are plagued with weaker economic performance and in particular weaker recovery. Point-based as opposed to diffuse resources are indeed seen as more subject to rent-seeking behavior, weakening the effectiveness of monitoring mechanisms over how much the government receives and how much it spends, both from independent institutional bodies and from the public more generally. Given the potentially higher level of rent-seeking by governments in countries endowed with point-based resources, it is plausible that those governments would spend more in boom times in order to quell the masses whose grievances in times of plenty may be conducive to social instability.

We also explore whether the quality of political institutions influences the way resource windfall shocks affect macroeconomic stability in commodity-exporting countries. To do so, we split the sample between deep autocracies and deep democracies and run our panel VAR regressions for both subsamples (results not reported in tables). We find strong evidence that government spending in

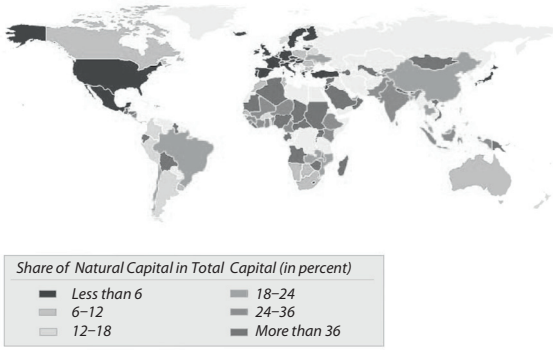
autocracies increases following a resource windfall shock. In contrast, we find evidence, albeit weaker, that government spending in deep democracies decreases on impact and then does not increase significantly following a resource windfall shock. These results suggest that deep democracies are less prone to the procyclical fiscal policies that have destabilizing effects. In the next subsection, we further elaborate on the theories that may explain why democracies, as opposed to autocracies, can experience superior macroeconomic stability and long-run growth. We also find that in both groups, resource windfall shocks initially crowd out nonresource GDP, which then increases following the fiscal expansion, although the evidence of this is weaker among deep democracies.

Economic Growth

The above-mentioned results suggest that commodity-exporting countries, on average, are subject to macroeconomic instability, which in turn can harm their long-run economic performance. In addition, one key challenge that these countries face is to reduce their dependence on commodities by rebalancing their wealth from natural capital in favor of reproducible capital and social capital, including human capital. Figure 9.4 illustrates the fact that commodity-exporting countries in sub-Saharan Africa and the Middle East hold a disproportionately higher share (over 30 percent) of their total wealth as natural capital. However, a large increase in government spending risks yielding poor efficiency in the execution of projects and misallocation of resources.

To take stock of the historical experiences of commodity-exporting countries, we now systematically investigate the impact of government spending on long-run nonresource-sector growth in the face of resource windfall shocks. To do so, we use panel cointegration techniques to separate out the

Figure 9.4
Worldwide map of natural capital as a share of total capital, 2005



Source: World Bank (2011) and author's analysis.

short-run from the long-run effects of government spending on nonresource GDP growth. The empirical model is specified so that GDP per capita growth in the nonresource sector is the dependent variable. The independent variables are our resource windfall index, the share of government spending in GDP, the change in the logarithm of the real exchange rate, and the quality of political institutions.

Table 9.1 presents the results of the Pool Mean Group estimations focusing on the long-run coefficients. On average, we find that resource windfall shocks have a statistically and economically significant negative effect on the long-run nonresource-sector GDP growth, as shown throughout columns 1 to 5. We also find that, on average, an increase in the share of government spending has a negative effect on long-run nonresource GDP growth. Those two results are in line with the existing literature, providing evidence that resource windfalls and larger governments both lead to weaker long-run economic growth. However, what is new in the findings is that resource windfalls stop having a negative effect on long-run nonresource growth when controlling for government spending, as shown in columns 3 to 5. This result suggests that government spending is an important vehicle of the resource curse hypothesis. In other words, the externality stemming from the resource sector to the nonresource sector is mainly conveyed through government spending, chiefly financed by resource-sector-related government revenues.

When controlling for the change in the real exchange rate, as shown in column 4, resource windfall shocks have a positive effect on nonresource GDP growth. This result confirms that Dutch disease is an important channel of the resource curse. When controlling for the quality of political institutions, as shown in column 5, the above results do not appear to change significantly. Given the fact that the quality of political institutions changes little even over a relatively long time period, it is hard to meaningfully assess the individual effect of democracy on long-run economic growth when exploiting within-country variation.

TABLE 9.1

Variables	(1)	(2)	(3)	(4)	(5)
Long-Run Coefficients					
Initial GDP	-0.089	-0.051	-0.074	-0.107	-0.061
	0.006	0.004	0.006	0.006	0.006
Δ Resource Windfall	-1.082		-0.804	5.399	-0.160
	0.454		0.501	0.657	0.497
Government Size		-0.049	-0.022	-0.081	-0.042
		0.018	0.020	0.022	0.017
Δ REER				0.018	
				0.005	
Polity II					0.004
					0.002
Low income interaction					
No. of Countries	108	129	94	94	94
No. of Observations	3564	4257	3102	2277	3094

Source: Author's analysis.

In Table 9.2, we explore the potential heterogeneity in the effects of resource windfalls and government spending on nonresource GDP growth. We explore first whether the quality of political institutions helps alleviate the resource curse by interacting both our resource windfall index and government spending with our measure of the quality of political institutions. We find that the impact of resource windfalls and government spending are moderated by the quality of political institutions so much that at a high level of political institutions the effect of resource windfalls on long-run nonresource GDP becomes positive, as shown in columns 1 and 2. A large share of commodity windfalls accrues to the government sector (through state ownership or taxation or export tariffs). These results suggest that democracy, by promoting accountability and consensus, reduces the perverse effect that resource windfalls may have on the nonresource sector, for instance through fewer discretionary policies that are conducive to macroeconomic volatility. Some authors have indeed stressed the importance of political institutions in achieving better policy outcomes (see for example Persson, 2002). In their seminal contribution to the growth and institutions literature, Acemoglu, Johnson, and Robinson (2001, 2002) have shown that political institutions are key determinants for long-run economic development.

Following Melhum, Moene, and Torvik (2006), who provide some evidence that good economic institutions can alleviate the resource curse using standard cross-sectional growth regressions, we also try interacting resource windfalls with the quality of economic institutions rather than political institutions. We do not find any robust evidence that economic institutions moderate the effect of resource windfalls on nonresource GDP growth, supporting the primacy of political institutions over economic institutions as a tool to alleviate the resource curse. In columns 3 and 4, we also provide evidence that the quality of political institutions moderates the effect of government spending on long-run nonresource GDP growth, suggesting that the benefit of political institutions for economic growth is channeled through better fiscal policy.

TABLE 9.2

Variables	(1)	(2)	(3)	(4)
Long-Run Coefficients				
Initial GDP	-0.080	-0.062	-0.075	-0.041
	0.006	0.005	0.005	0.004
Δ Resource Windfall	-1.866	-0.834		0.388
	0.597	0.497		0.429
Government Size		-0.030	-0.019	-0.061
		0.017	0.018	0.020
Polity2	0.004	0.003	0.003	0.005
	0.002	0.002	0.002	0.002
Polity2 x Windfall	0.072	0.160		
	0.040	0.037		
Polity2 x Gov. Size			0.002	0.001
			0.001	0.000
No. of Countries	94	94	94	94
No. of Observations	3290	3290	3290	3290

Source: Author's analysis.

Indeed, a large share of commodity windfalls accrues to the government sector (through state ownership, taxation, or export tariffs). Therefore, more accountable governments can better support the nonresource sector's long-run economic performance by reducing government spending inefficiencies and resource misallocation. This finding is consistent with Arezki and Brückner (2010a), who find that commodity price booms lead to increased government spending, external debt, and default risk in autocracies, but do not have the same effects in democracies. Arezki and Brückner (2010b) also provide evidence of dichotomous effects on sovereign bond spreads in autocratic versus democratic commodity-exporting countries.

Finally, we explore whether countries that export mineral and energy commodities are subject to weaker long-run nonresource-sector performance as compared to countries that export agricultural commodities (results not reported in tables). We find once again that minerals and energy exporters perform less favorably than agricultural exporters in the face of resource windfall shocks. This result confirms that the negative effect of resource windfalls on long-run nonresource GDP is a robust feature of mineral- and energy-exporting countries.

CONCLUSION

This chapter examined the performance of commodity-exporting countries in terms of macroeconomic stability and growth in a panel of up to 134 countries during the period 1970–2007, using a new dataset on nonresource GDP. Our main findings are twofold. First, we find that on average government spending in commodity-exporting countries has been procyclical. We also find that resource windfalls initially crowd out nonresource GDP, which then increases as a result of the fiscal expansion. Second, we find that in the long run, resource windfalls have negative effects on nonresource-sector GDP growth, but these effects are not over government spending. The effects of resource windfalls on both macroeconomic stability and economic growth are moderated by the quality of political institutions.

A policy recommendation that can be derived from the above results would consist in finding a creative way to promote government accountability in commodity-exporting countries. One could suggest to governments in these countries that they should increase their revenue mobilization in the nonresource sector, which is currently at a relatively low rate both statutorily and effectively. Indeed, Bornhorst, Gupta, and Thornton (2009) provide evidence that resource windfall shocks lower revenue mobilization. Keen and Mansour (2009) have found that a low statutory tax rate on natural-resource-sector activities and high informality are prevalent in the commodity-exporting countries in sub-Saharan African. One could explore nonresource-sector taxation as a way to generate a positive externality, while recognizing the classical argument against taxation stemming from its distortive nature. Indeed, a recent literature has emphasized the importance of taxation for state building. Grassroots taxpayer associations could exercise monitoring over the efficiency of government spending. Brautigam, Fjeldstad, and Moore (2008) provides anecdotal evidence that the imposition of a tax by the

British colonial rule on the sugar industry in Mauritius led to the emergence of grassroots tax-payer associations, which up to this day exercise a monitoring role over the way taxpayers' money is spent by the government. In addition, increasing nonresource-sector revenue mobilization would deliver other benefits, including combating volatility in government revenues by diversifying the sources of government revenues.

Further research should investigate the performance of resource-rich countries in addressing issues of income distribution. A cursory look at the data indicates that natural-resource-abundant countries are rich but unequal. Despite several authors, including Subramanian and Sala-i-Martin (2003), who have advocated direct redistribution, there are many reasons to think that it may not be a good idea to engage excessively in such action. Indeed, direct redistribution may fuel increased consumption as opposed to investment, which may infringe on the Hartwick rule. Indeed, individuals may underinvest the proceeds of resource revenues in, say, education and health, as they may not internalize the social benefits of those investments. One possibility would be to redistribute not necessarily directly, in the form of cash transfers, but rather in the form of greater information and enhanced transparency concerning the management of revenues and on the rationale behind the choice of the level and composition of spending. Citizens must take part in the major debates addressing public action. That will make it possible to improve the efficiency of government spending, which in turn will benefit the citizenry.

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PART IV

Exchange Rates and Financial Stability

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CHAPTER 10

How Can Commodity Exporters Make Fiscal and Monetary Policy Less Procyclical?

JEFFREY FRANKEL

THE PROBLEM OF PROCYCLICALITY

Countries dependent on exports of oil, minerals, and other primary commodities tend to have pronounced economic cycles. Although this cyclical variability is to some extent inevitable, some of its impact can be reduced through well-chosen regimes for monetary and fiscal policy.

That developing countries tend to experience larger cyclical fluctuations than industrialized countries is only partly attributable to commodities (Perry, 2009). It is also partly due to the role of factors that *should* moderate the cycle but in practice seldom operate that way: capital flows that are procyclical, monetary and fiscal policy that is procyclical, and the related Dutch disease. Capital flows, fiscal policy, monetary policy, and sectoral allocation each tend to be more procyclical in commodity producing countries than economists' models often assume. If anything, they tend to exacerbate booms and busts instead of moderating them. It does not have to be this way. The hope that improved policies or institutions might reduce this procyclicality makes this one of the most potentially fruitful avenues of research in emerging market macroeconomics.

The Procyclicality of Capital Flows to Developing Countries

According to the theory of intertemporal optimization, the problem of commodity volatility should be solved by international financial markets. Countries should borrow during temporary downturns to sustain consumption and investment, and they should repay or accumulate net foreign assets during temporary

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upturns. In practice, it does not always work this way. Capital flows are more often procyclical than countercyclical. (Kaminsky, Reinhart, and Vegh, 2005; Reinhart and Reinhart, 2009; Gavin, Hausmann, and Leiderman, 1996; Prasad, Rogoff, Wei, and Kose, 2006; and Mendoza and Terrones 2008). Most theories to explain this involve imperfections in capital markets, such as asymmetric information or the need for collateral.

In the commodity and emerging market boom of 2003–08, net capital flows typically went to countries with current account surpluses, especially commodity producers and Asian countries, where they showed up in record accumulation of foreign exchange reserves. This was in contrast to the two previous cycles, 1975–81 and 1990–97, when the capital flows to developing countries largely went to finance current account deficits. As developing countries evolve more market-oriented financial systems, capital inflows during the boom phase show up increasingly in prices for land and buildings, and also in prices of financial assets (Aizenman and Jinjarak,2009; Mendoza and Terrones, 2008).

One interpretation of procyclical capital flows is that they result from procyclical fiscal policy: when governments increase spending in booms, some of the deficit is financed by borrowing from abroad. When they are forced to cut spending in downturns, it is to repay some of the excessive debt that they incurred during the upturns. Another interpretation of procyclical capital flows to developing countries is that they pertain especially to exporters of commodities. We consider procyclical fiscal policy in the next subsection, and return to the commodity cycle (Dutch disease) in the one that follows it.

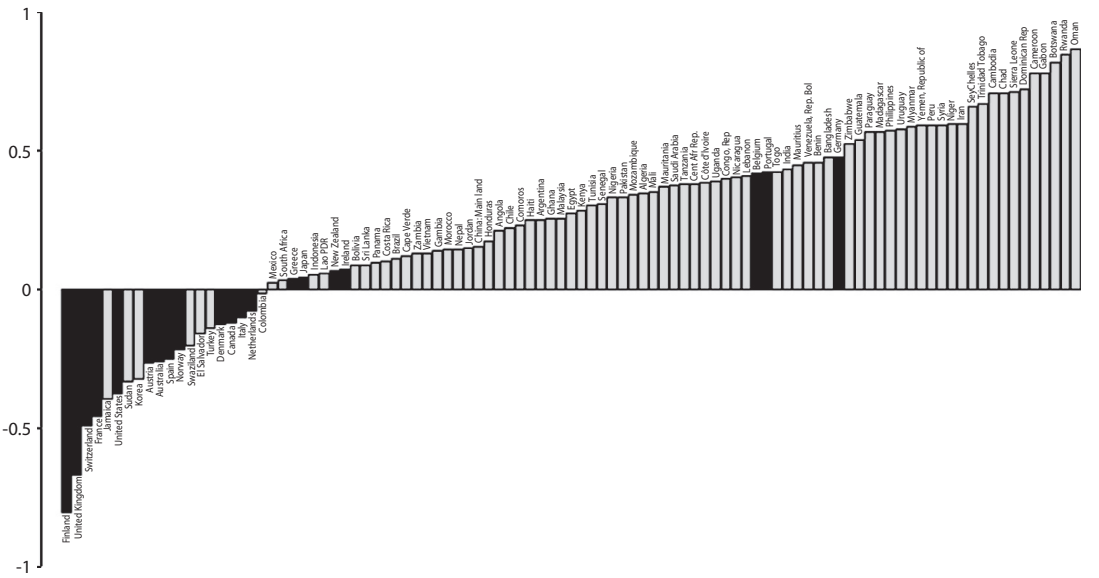
The Procyclicality of Fiscal Policy

Many authors have documented that fiscal policy tends to be more procyclical in developing countries than in industrialized countries. (Cuddington, 1989; Tornell and Lane, 1999; Kaminsky, Reinhart, and Vegh, 2005; Talvi and Végh, 2005; Alesina, Campante and Tabellini, 2008; Mendoza and Oviedo, 2006; Ilzetski and Vegh, 2008). Procyclicality is especially pronounced in countries that possess natural resources and where income from those resources tends to dominate the business cycle (Gelb, 1986; Cuddington, 1989; Medas and Zakharova, 2009).[1] Most studies look at the procyclicality of government spending, because tax receipts are endogenous with respect to the business cycle. An important reason for procyclical spending is that government receipts from taxes or royalties rise in booms, and the government cannot resist the temptation or political pressure to increase spending proportionately, or even more than proportionately.

Figure 10.1, taken from Kaminsky, Reinhart, and Vegh (2005), displays each country's correlation between government spending and GDP. They range from a correlation approaching –1 for Finland, denoting a strongly countercyclical policy,

[1]For commodity producers in Latin America in particular: Gavin, Hausmann, Perotti and Talvi,1997; Gavin and Perotti, 1997; Calderón and Schmidt-Hebbel, 2003; Perry, 2003; and Villafuerte, Lopez-Murphy and Ossowski, 2010.

Figure 10.1
Cyclical correlation of government spending and GDP



Source: Kaminsky, Reinhart, and Vegh, 2005.

to a correlation approaching +1 for Oman, denoting a strongly procyclical policy. The interesting thing about the graph is that a heavy majority of the advanced countries, which are represented by black bars, show countercyclical spending, while a heavy majority of the other countries show procyclical spending.[2]

Two large budget items that account for much of the increased spending from commodity booms are investment projects and the government wage bill. Regarding the first budget item, investment in infrastructure can have a large long-term pay-off if it is well designed. Too often in practice, however, it takes the form of white elephant projects, which are stranded without funds for completion or maintenance when commodity prices go back down (Gelb, 1986). Regarding the second budget item, Medas and Zakharova (2009) point out that oil windfalls have often been spent on higher public-sector wages. They can also go to increasing the number of workers employed by the government. Either way, they raise the total public sector wage bill, which is hard to reverse when oil prices go back down.[3]

In a boom such as that experienced in 2003–08, one does not want expansionary spending and monetary policy that exacerbate overheating, loss of competitiveness, debt, asset bubbles, and overexpansion of the construction sector, at the expense of manufacturing and other non-mineral exports.

The Macroeconomics of Dutch Disease

Dutch disease can be viewed as an example of the procyclicality we have in mind, defined as a boom in government spending, construction, and other nontraded goods and services, which arises in response to a strong, but perhaps temporary, upward swing in the world price of the export commodity. The typical symptoms include these:

- A large real appreciation in the currency (taking the form of nominal currency appreciation if the country has a floating exchange rate or the form of money inflows and inflation if the country has a fixed exchange rate[4]);
- An increase in spending (especially by the government, which increases spending in response to the increased availability of tax receipts or royalties);

[2]The data in Figure 10.1 come from 1960–2003. When Carlos Vegh updates the chart through 2009, there are some changes. Most importantly for this chapter, Chile switches from a positive correlation to a negative one.

[3]Arezki and Ismail (2010) find that current government spending increases in boom times but is downward-sticky.

[4]During the boom of 2001–08, examples of fixed-rate oil-producing countries where the real appreciation came via money inflows and inflation included Saudi Arabia and the Gulf emirates. Examples of floating-rate natural resource countries where the real appreciation took the form of nominal currency appreciation included Australia, Chile, Kazakhstan, Mexico, Norway, Russia, and South Africa. Chen and Rogoff (2003) document the sensitivity of exchange rates to commodity prices in the cases of Australia and New Zealand. Frankel (2007) documents South Africa. Admittedly, the real appreciation will take place, not just under inflation targeting or an exchange rate target, but also under my PEP or PPT proposals discussed in the third section of this chapter. Only capital controls and sterilized foreign exchange purchases have the potential to slow down the real appreciation; neither is likely to work for longer than a few years, if at all.

- An increase in the price of nontraded goods (goods and services such as housing that are not internationally traded) relative to traded goods (manufactures and other internationally traded goods other than the export commodity);
- A resultant shift of labor, capital, and land out of non-export-commodity traded goods (pulled by the more attractive returns in the export commodity and in nontraded goods and services);
- High interest rates (attracting a capital inflow); and
- A current account deficit (thereby incurring international debt that may be difficult to service when the commodity boom ends[5]).

When crowded-out noncommodity tradable goods are in the manufacturing sector, the feared effect is deindustrialization.[6] In a real trade model, the reallocation of resources across tradable sectors, for example from manufactures to agriculture, may be inevitable regardless of macroeconomics. But the movement into nontraded goods is macroeconomic in origin.

What makes Dutch disease a "disease?" One interpretation, particularly relevant if the complete cycle is not adequately foreseen, is that the process is all painfully reversed when the world price of the export commodity goes back down. A second interpretation is that, even if the perceived longevity of the increase in world price turns out to be accurate, the crowding out of noncommodity exports is undesirable, perhaps because the manufacturing sector has externalities for long-run growth from learning by doing (as in van Wijnbergen, 1984; Matsuyama, 1992; and Gylfason, Herbertsson, and Zoega, 1999).[7]

The Cyclicality of Monetary and Fiscal Policy

How can monetary and fiscal policy be made more countercyclical, or at least less procyclical? The first step is to recognize the problem. That is a real challenge. At any point in time, in any country, the debate is usually between those arguing in favor of and those arguing against government expansion. It takes a longer-term perspective to frame the case in terms of the complete business cycle: less government expansion during booms, counterbalanced by more during busts. This is especially true in commodity-producing countries, where the temptation to spend the wealth at times when the world market for commodities is booming is overwhelming and where the cut-off of funds when the market goes bust is absolute.

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[5]Manzano and Rigobon (2008) show that the negative Sachs–Warner effect of resource dependence on growth rates during 1970–1990 was mediated through international debt incurred when commodity prices were high. Arezki and Brückner (2010a) find that commodity price booms lead to increased government spending, external debt, and default risk in autocracies, and but do not have those effects in democracies. Arezki and Brückner (2010b) find that the dichotomy extends also to the effects on sovereign bond spreads paid by autocratic versus democratic commodity producers.

[6]In Gylfason, Herbertsson, and Zoega (1999), the real appreciation lowers long-term growth because the primary sector does not experience learning by doing as the secondary sector does.

[7]Nontraded goods can also have externalities, however, as Torvik (2001) and Matsen and Torvik (2005) point out.

Countries experiencing a commodity boom, especially those that have discovered oil or other resources for the first time, need to realize how many times other countries have been down this road before and how often it has ended in tears.

But it is not enough just to recognize the desirability of countercyclical policy. We have learned that simply telling a country in a boom that it should take advantage of the opportunity to save won't necessarily deliver the desired result—whether it is a small oil producer or the United States of America. Policymakers are, typically, already aware of the point. But politics is too strong, including populist attitudes among the public and politicians who too often get away with spending to further their own ends while pretending to do the opposite.

We need longer-term institutions that will help governments achieve countercyclicality in the long run, in the real world where short-term political pressures are strong and leaders are human. We need to set up regimes in advance that are more likely to deliver the right result, based on the facts, in a world inhabited by human beings, not angels.

Where to find examples of good institutions? Until recently, the answer seemed to be that developing countries should look toward the United States and other advanced countries for models of good institutions: democracy, rule of law, Anglo-American style corporate governance, securities markets, and so on. The last decade, including the global financial crisis, showed that all was not well with either American or British institutions. The United States, the United Kingdom, and other advanced countries don't have all the answers. Since 2007, this proposition has become familiar in such areas as corporate governance and banking. But the topic at hand is monetary and fiscal policy. Even here, developing and emerging-market countries can no longer rely uncritically on the institutions of advanced countries as their template.

An example in the making of fiscal policy is the role of government forecasting as an input to the process. There was a time when the major advanced countries tended, on average, to follow countercyclical fiscal policy: cutting taxes and increasing spending in recessions, followed by fiscal consolidation during booms. The last decade has been very different. The United States, United Kingdom, and other advanced countries have forgotten how to run countercyclical fiscal policies. They failed to take advantage of the 2001–07 expansion to run budget surpluses. Instead, they ran up a lot of debt. Thus, by 2010 they felt constrained by that debt to launch fiscal tightening at a time when unemployment was still very high. That describes a decade of fiscal policy that was procyclical, that is, destabilizing. Biased government forecasting played a major role in this policy mistake. The grossly over-optimistic budget forecasts made by the U.S. administration from January 2001 led directly to the adoption of long-term policies entailing massive tax cuts and accelerated government spending.

Continental European countries have not done much better. The worst cases of destabilizing or procyclical fiscal policy countercyclicality, of course, are the nations of Iceland, Greece, and Portugal. Meanwhile, in the course of the same decade, some emerging-market countries learned how to run countercyclical fiscal policy, notably China and Chile. Even many former debt-crisis sufferers (Brazil, Indonesia, Malaysia, Mexico, and South Africa) now have higher credit ratings

than some of the less fortunate advanced countries. This is part of a general historic role reversal between some emerging markets and advanced countries.

A second specific example, in the case of monetary policy, is inflation targeting. The first countries to adopt inflation targeting were rich countries: New Zealand, Canada, Sweden, and the United Kingdom. Beginning around 1999, many middle-sized middle-income developing countries followed suit. Inflation targeting became the new conventional wisdom, favored by colleagues in monetary economics, those at the IMF, and central bankers around the world. But the global financial crisis of 2007–09 pointed up some of the serious limitations of inflation targeting. Some modifications may be in order, as we will see.

The remainder of this chapter aims to present two proposals, one pertaining to fiscal policy and one pertaining to monetary policy, for specific regimes or institutions that might help achieve more countercyclicality. Both are designed especially for countries subject to volatile terms of trade, such as exporters of oil or minerals. The proposals can be phrased briefly.

For fiscal policy: I propose that many countries could usefully emulate the structural budget institutions that Chile has employed over the last decade.

For monetary policy: I propose that countries that are vulnerable to high variability in their terms of trade should adopt a different form of inflation targeting, one that I call product price targeting or PPT.

The difference between PPT and regular inflation targeting is that instead of using the Consumer Price Index (CPI) as a target, central banks use a price index that emphasizes the commodities produced at home and exported. Oil producers should target a price index that gives a weight to oil commensurate with its importance in production, which will be much larger than its share in consumption, and that does not include products that it consumes solely by import.

PROPOSAL TO MAKE FISCAL POLICY MORE COUNTERCYCLICAL: EMULATE CHILE'S STRUCTURAL BUDGET RULE INSTITUTIONS

Chile's economic growth since 1984, presumably related to several waves of serious reforms, has far outstripped that of its Latin American neighbors. Its income per capita rose from 10 percent of the U.S. level in 1984 to 14 percent in 2000 and then to 20 percent in 2010.

Since 2000, fiscal policy in Chile has been governed by a structural budget rule that has succeeded in implementing countercyclical fiscal policy. The key innovation is that the estimates of the two most important inputs in the breakdown of the budget between structural and cyclical components—trend output and the trend price of copper—are computed by independent expert panels and are thus insulated from the political process. Chile's fiscal institutions could usefully be emulated everywhere, but especially in other commodity-exporting countries.[8]

[8]For more detailed information and more references see Frankel (2011).

Chile is not the only country to have made progress in the direction of countercyclical fiscal policy in recent years. Nevertheless, it is a particularly striking case, because it has beaten the curse of procyclicality through the innovation of a set of fiscal institutions that are designed to work even in a world where politicians and voters are fallible human beings rather than angels. The proposition that institutions are key, that is, that one is less likely to get good policies in the absence of good institutions, has popped up everywhere in economics in recent years.[9] What is sometimes missing is examples of very specific institutions that countries might wisely adopt, institutions that are neither so loose that their constraints don't bind nor so rigid that they have to be abandoned subsequently in light of circumstances.

Chile's fiscal policy is governed by a set of rules. The first rule sets a target for the overall budget balance. The target surplus was originally set at a surplus of 1 percent of GDP, for three purposes: (i) to recapitalize the central bank, which inherited a negative net worth from bailing out the private banking system in the 1980s and from some sterilization of inflows in the 1990s, (ii) to fund some pension-related liabilities, and (iii) to service net external dollar debt (Rodríguez, Tokman, and Vega, 2007, pp. 5, 21). The target was subsequently lowered to ½ percent of GDP in 2007, and again lowered to 0 in 2009, since it was determined that the debt had been essentially paid off and that a structurally balanced budget was economically appropriate.[10]

The Inadequacy of Budget Rules

A budget-balance target may sound like the budget deficit ceilings that supposedly constrain members of the European Union (capping deficits at 3 percent of GDP under the Stability and Growth Pact) or like the occasional U.S. proposals for a Balanced Budget Amendment (zero deficit). But those attempts have failed. They are too rigid to allow the need for deficits in recessions, counterbalanced by surpluses in good times.

It is not always the case that tougher constraints on fiscal policy increase effective budget discipline. Countries often violate their constraints. In an extreme set-up, a rule that is too rigid—so rigid that official claims that it will be sustained are not credible—might even lead to looser fiscal outcomes than if a more moderate and flexible rule had been specified at the outset (Neut and Velasco, 2003).[11] The case of rules that are too onerous to last arises particularly in the stochastic context. A target that might have been a reasonable goal in principle, such as an

[9]In the case of fiscal policy, the importance of institutions has been emphasized by Buchanan (1967), von Hagen and Harden (1995), Alesina and Perotti (1995, 1996), Poterba (1997), Poterba and von Hagen (1999), Persson and Tabellini (2004), and Wyplosz (2005). For commodity producers more specifically: Davis and others. (2001, 2003) and Ossowski and others. (2008), among others.

[10]A team of three economists appointed by Finance Minister Andres Velasco recommended reducing the structural budget target.

[11]Certainly Euro countries large and small have repeatedly violated the fiscal rules of the Stability and Growth Pact.

unconditionally balanced budget, becomes unreasonable after an unexpected shock, such as a severe fall in export prices or national output.

This is true both in cases where an ex post shock renders a given ex ante budget target undesirable in a short-term economic sense (so that maintaining long-term credibility is the only economic argument for abiding by the rule) and in cases where the target may remain economically desirable in itself, but is up against predictably irresistible political pressures. Common examples of the first sort are rigid balanced budget rules that do not allow the possibility of fiscal deficits in bad times. Common examples of the second sort are provisions for special fiscal institutions that may have been written out to please the World Bank or IMF but without local elites' taking ownership of the reforms, let alone winning public support for them. Such institutions, which include fiscal rules and fiscal responsibility legislation, are often abandoned before long.[12]

A sensible alternative is to specify rules that mandate changes in response to changed circumstances. In particular, instead of targeting an actual budget balance of zero or setting some numerical surplus, the rule can target a number for the structural budget. This alternative may not work, however, if the determination whether a deficit is or is not structural is made within the political process. Nor does the rule necessarily succeed in imposing discipline. Politicians can always attribute a budget deficit to unexpectedly and temporarily poor economic growth. Since there is no way of proving what an unbiased forecast of growth is, there is no way of disproving the politicians' claim that the shortfall is not their responsibility.

The Case of Chile and Copper

Copper accounts for approximately 16 percent of Chile's fiscal income. Specifically, about 10 percent of income is from the revenues of the copper corporation CODELCO, which is owned by the government, and the rest (6 percent) is tax revenue from private mining companies. That the figure is only 16 percent illustrates the fact that Chile's use of copper exports has not prevented it from achieving a diversified economy. Having said that, the number understates the sensitivity of the budget to copper prices. Copper profits are much more volatile than the rest of GDP. Furthermore, the mining industry tends to have a multiplier effect on the rest of GDP. Madrid-Aris and Villena (2005) argue that copper prices drive the Chilean economy.[13] Other mineral and agricultural commodities are also important, although their prices on world markets are to some extent correlated with copper.

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[12]An econometric analysis of these special financial institutions for oil producers by Ossowski and others (2008, pp. 19, 23, 24, 38–43) finds no statistically significant effect on the actual fiscal stance. This may be partly due to econometric limitations. But it is evidently also in part due to governments that, after having adopted these institutions, subsequently find them too rigid in practice and so weaken or abandon them. Recent examples include Ecuador, Equatorial Guinea, and Venezuela (Ossowski and others, 2008, pp. 12–13, 19, 24). Also see Villafuerte, Murphy, and Ossowski (2010).

[13]Their econometrics are cointegration tests and their theory is essentially classic Dutch disease: an increase in copper prices is transmitted to the nontradable sector via appreciation of the currency.

The central rule that makes up Chile's structural balance regime is that the government can run a deficit larger than the target to the extent that: (i) output falls short of its long-run trend, in a recession, or (ii) the price of copper is below its medium-term (10-year) equilibrium. The key institutional innovation is that there are two panels of experts whose job each midyear is to make the judgments, respectively, concerning what is the output gap and what is the medium-term equilibrium price of copper. The experts on the copper panel are drawn from mining companies, the financial sector, research centers, and universities. The government then follows a set of procedures that translates these numbers, combined with any given set of tax and spending parameters, into the estimated structural budget balance. If the resulting estimated structural budget balance differs from the target, then the government adjusts spending plans until the desired balance is achieved.

Already by 2006, the structural budget policy had shown clear benefits. Between 2000 and 2005, public savings rose from 2.5 percent of GDP to 7.9 percent, allowing national savings to rise from 21 percent to 24 percent. As a result, central government debt fell sharply as a share of GDP (especially central bank debt) and the sovereign spread gradually declined (Rodríguez, Tokman, and Vega, 2007, pp. 27, 29–30). By 2006, Chile had achieved a sovereign debt rating of A, several notches ahead of Mexico, Brazil, and other Latin American peers.[14] By 2007, Chile had become a net creditor. By June 2010, its sovereign rating had climbed to A+, ahead of some advanced countries, including Israel and Korea (A), and of course far ahead of Iceland (BBB–) and Greece (BB+).

The announcement of the structural surplus rule in itself appears to have improved Chile's creditworthiness in 2000, even before it had had time to operate.[15] Even this early, better access to foreign capital may have helped the country to weather the 2001–02 crisis more easily than the crisis of 1982–83. Public spending fluctuated much less than in past decades, and less than income helping to stabilize the business cycle (Rodríguez, Tokman, and Vega, 2007, pp. 32, 33–34). According to one estimate, the structural balance policy allowed a reduction in GDP volatility of one-third in 2001–05 (Larrain and Parro, 2006). Another study suggests that the policy can all but eliminate the effects of copper price fluctuations on the real economy.[16]

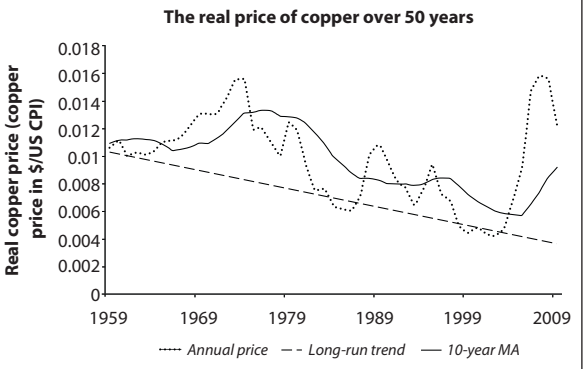
The real test of the policy came during the latter years of the copper boom of 2003–08. (See Figure 10.2.) As usual, there was political pressure to declare the increase in the price of copper permanent, thereby justifying spending on a par with export earnings. The expert panel ruled that most of the price increase was temporary, so most of the earnings had to be saved. This turned out to be wise.

[14]Standard and Poor ratings, obtained from Bloomberg.

[15]Rodríguez, Tokman, and Vega (2007, p. 30) report a turnaround in Chile's sovereign spread from the date of the announcement in early 2000. Perry (2003, pp. 13–14) also sees an immediate credibility effect .

[16]Medina and Soto (2007) find in a DSGE model that the fiscal regime is capable of reducing the effect on Chile's GDP of a 10 percent exogenous increase in the copper price from 0.70 percent to 0.05 percent.

Figure 10.2
The real price of copper relative to its trend, 1959–2009



Source: Author's estimates.

The 2008 price spike indeed partly reversed the next year. As a result, the fiscal surplus reached almost 9 percent when copper prices were high. The country paid down its debt to a mere 4 percent of GDP and saved about 12 percent of GDP in its sovereign wealth fund. This allowed a substantial fiscal easing in the recession of 2008-09, when the stimulus was most sorely needed.

Part of the credit for Chile's structural budget rule should go to earlier governments. But the structural budget rule became a true institution under the Bachelet government, which enshrined the general framework in law in 2006. Just as important, it abided by the law—and in fact took extra steps to make sure the copper bonanza was saved—when it was most difficult to do so politically. The tremendous approbation received in the public opinion polls in 2009 by President Bachelet and her finance minister, Andres Velasco, was in this sense a well-earned reward for having done the right thing.

Econometric Findings of Systematic Over-Optimism in Government Forecasts

Perhaps there is an error in officials' perceptions: A world of high commodity prices today, during the boom, is extrapolated indefinitely far into the future, whereas in reality the real price will eventually return to some long-run equilibrium. Or else the political process may override sober judgments, so that spending responds to booms more than a rational intertemporal optimization would dictate.

I have found statistical support for hypotheses regarding forecasts by official agencies that have responsibility for formulating the budget (Frankel, 2011).

(i) Official forecasts of budget deficits in a sample of 33 countries are overly optimistic on average.

(ii) Official forecasts of *GDP growth* in the sample of 33 countries are also overly optimistic on average.

(iii) The bias toward over-optimism is stronger the longer the horizon.

(iv) The bias is greater among European governments that are politically subject to the budget rules in the Stability and Growth Pact. (When the budget deficit is high, officials are under pressure to project that it will come back down in the future, even if it won't.)

(v) The bias is greater at the extremes of the business cycle, particularly in booms, when the scope for wishful thinking is the greatest.

(vi) In most countries, the real growth rate is the key macroeconomic input for budget forecasting.

(vii) In Chile, the price of copper is the key macroeconomic input for budget forecasting (as illustrated in Figure 10.3).

(viii) Real copper prices mean-revert in the long run, but this is not always readily perceived.

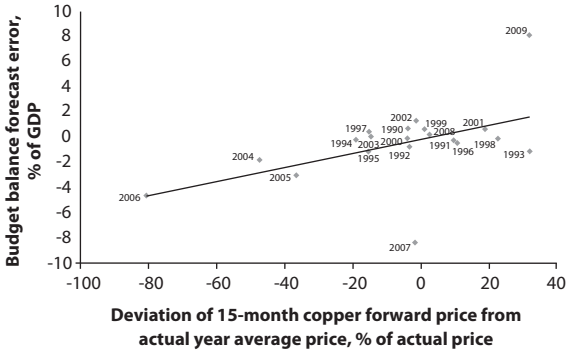
(ix) Private copper forecasters do incorporate a tendency for the real price to revert gradually to a long-run trend. (Figure 10.4 illustrates that when the price of copper goes up, neither the forward rate nor the forecasts of the Chilean expert panel rise fully in proportion.)

(x) Chile's official budget forecasts are not overly optimistic on average. (This is presumably a major explanation of how it has achieved its structural budget targets.)

Taken together, these results tell a coherent story. Among many countries, there is a tendency toward wishful thinking in official forecasts of growth and the budget. The wishful thinking appears to take the form of unrealistic extrapolation of booms three years into the future. The bias is worse among countries that are supposedly subject to budget rules (e.g., the Stability and Growth Pact), presumably because those in the government who make the forecasts feel pressured to be able to announce that they are on track to meet the budget targets even if they are not. Chile is not subject to the same bias toward over-optimism in forecasts of the budget, growth, or the all-important copper price. This evidence is consistent with the idea that the key innovation that has allowed Chile generally to achieve countercyclical fiscal policy and in particular to run surpluses in booms is not just a structural budget rule in itself, but rather the regime that entrusts to two panels of independent experts the responsibility for estimating the extent to which contemporaneous copper prices and GDP have departed from their long-run trends.

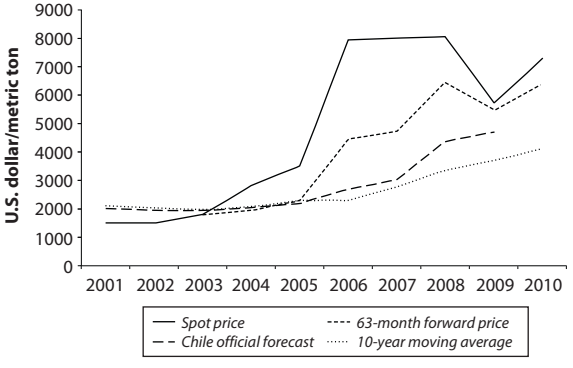
A refinement would be to give the panels formal independence, analogous to independent central banks, so that the members could not be fired. In some countries, it might be appropriate to mandate a place for foreign experts. There is nothing omniscient or magical about experts. A codified rule based on a simple 10- or 20-year moving average might do as well. The important idea is to protect budget forecasting from the inevitable political temptations.

Figure 10.3
Chile's budget balance forecast error vs. copper price forecast error



Source: Author's estimates.

Figure 10.4
Copper prices—spot, forward, and forecast, 2001–10



Source: Author's estimates.

PROPOSAL TO MAKE MONETARY POLICY MORE COUNTERCYCLICAL: PRODUCT PRICE TARGETING

Three aspects of developing countries are particularly salient when choosing how to conduct monetary policy:

- Developing countries need a strong anchor for inflation expectations, some nominal variable that the central bank commits to and can be monitored by
- They experience large supply shocks, especially fluctuations in their terms of trade, and

- They cannot depend on countercyclical capital flows to smooth out trade shocks, in the way that finance theory naively predicts.

What nominal variable should be the monetary anchor, taking into account these considerations?

The Standard List of Six Candidates for a Nominal Monetary Anchor

Of the nominal variables that could potentially anchor expectations, six candidates are familiar. Two were tried in the past in many countries, two were proposed in the past but never tried, and two are popular today.

Both of those that were tried historically encountered serious problems and are considered to have been somewhat discredited. The pre-1914 *gold standard* used the price of gold as the nominal anchor. Among its drawbacks were large shifts in the world demand and supply for gold that were needlessly translated into monetary fluctuations. Monetarism uses *M1* as the nominal anchor. It was adopted by the central banks of the largest industrialized countries in the early 1980s. It was abandoned by them when shifts in the demand for money proved too destabilizing.

Economists have made proposals to improve on each of those two regimes. A proposal to peg to a *broader basket of commodities* would have been more stable than pegging to gold alone (Keynes, 1938; Hall, 1985). A proposal for *nominal income targeting* would have avoided the velocity shocks that plagued monetarism.[17] Neither of these two candidates has ever been put into practice, however, and they are little discussed today.

That leaves the two nominal anchors that have dominated in recent years. One is the *exchange rate*, which remains an important option for many countries. Small open countries often go all the way to a fixed exchange rate or even monetary union. Middle-sized countries may follow a target zone or some other intermediate regime. Exchange rate targets lost some of their popularity, however, after the currency crises of the 1990s. The reigning champion, since that time, has been *inflation targeting*. Brazil, Chile, Colombia, Mexico, the Czech Republic, Poland, and South Africa all switched from exchange rate targets to inflation targeting around 1999–2000, followed by others.[18]

There are many different variations on the regime of inflation targeting. Some proposals target the price level, and some target its rate of change. Some require the monetary authorities to pursue annual inflation targets and nothing else, while others are flexible, allowing diversion from the long-run inflation goal in order to

[17]While many eminent economists argued the case for nominal GDP targeting in the context of advanced countries, McKibbin and Singh (2003) are among the few who have done so for developing countries.

[18]Among the authors who have examined inflation targeting specifically for developing and emerging market countries are: Debelle (2001); Fraga, Goldfajn, and Minella (2003); Mishkin (2000, 2008); Laxton and Pesenti (2003); and many of the chapters in Loayza and Soto (2002).

put some weight in the short run on stabilizing output.[19] Some make a distinction between targeting the expected CPI and targeting the actual CPI. Some target the headline CPI, while some exclude the more volatile food and energy component to focus on core inflation. Regardless, what almost all of them have in common is a focus on the CPI, rather than on some other sort of price index.

The CPI may not be the best choice of price index for a country that is subject to volatile terms of trade. For those countries, my proposal is to replace it with a measure of product prices. This could be an index covering major export commodities or a more comprehensive index of product prices. The important point is that it should give heavy weight to the country's export commodities, which the CPI does not do, and it should *not* give much weight to imported goods, which the CPI *does* do.

The Procyclicality of Both Exchange Rate Targeting and Inflation Targeting, under Trade Shocks

The concern is that monetary policy can be procyclical under either an exchange-rate–target regime or a CPI-target regime, to the extent that terms of trade shocks are important. Consider first what happens under a fixed exchange rate, when a country experiences a commodity boom. Normally this means a trade surplus—whether the boom takes the form of an increase in supply or of an increase in the dollar price of the commodity on world markets, or both. In theory, temporary trade booms and busts should be efficiently offset by intertemporally optimizing international capital flows. In practice, capital flows are more likely to flow *in* during a commodity boom than out. The overall balance of payments rises in the boom phase and falls in the bust phase.

In the boom phase, when reserves flow in, the result is likely to be excessive expansion of money and credit, overheating, and inflation, as the Persian Gulf countries experienced during the oil boom of 2000–08. In the bust phase, when reserves flow out, the result is often a currency crisis, featuring a contraction of money and credit and a recession, as was experienced by Mexico, Indonesia, Nigeria, Russia, and Ecuador when oil prices fell in the 1990s. It would be better to allow some currency appreciation during export booms and some depreciation during export busts.

This destabilizing nature of a fixed exchange rate in the presence of trade shocks is a familiar point raised in favor of floating exchange rates in the classic debate over exchange rate regimes. But if the exchange rate is not to be the nominal anchor, then some other variable must fill this role. For many countries, especially those of middle size, inflation targeting took the place of exchange rate targeting after the experience of the 1990s.

How does inflation targeting fare in the face of terms-of-trade shocks? It too fails to accommodate fluctuations in the world price of the export commodity. When the export commodity price goes up, it would be desirable to tighten

[19]Some define inflation targeting broadly this way: "choose a long run goal for inflation and be transparent." It is hard to argue with this. But something more specific is usually implied.

monetary policy just enough to allow some currency appreciation, in order to limit excess demand for goods (overheating that might otherwise show up, for example, in a real estate bubble). Symmetrically, when the commodity price goes down, it would be desirable to ease monetary policy enough to allow some currency depreciation, in order to limit excess supply for goods (which might otherwise show up, for example, in recession or a financial crisis). CPI targeting does not automatically produce this result.

To be sure, inflation targeting proponents usually admit that monetary policy *should* respond to movements in commodity prices or asset prices *to the extent that they indicate future inflation*. But this is not good enough. One thing we should have learned from experience with the credit cycle is that excessively easy monetary policy can lead to asset bubbles and an eventual costly crash, *without goods market inflation having appeared* at any stage.

Two kinds of adverse terms-of-trade shocks afflict small countries, and inflation targeting is insufficiently countercyclical in both cases. We have just seen that the first, a fall in the price of the export commodity, calls forth essentially no response from monetary policy. In this sense, inflation targeting is acyclical. The second kind of adverse terms-of-trade shock is an increase in the price of the import commodity. Here inflation targeting is actually *pro*cyclical, or destabilizing. Consider, for example, an increase in the world price of oil or food from the viewpoint of a country that must import these commodities. Energy and food occupy a substantial share of the CPI. A strict interpretation of CPI targeting, therefore, tells the central bank that it must contract monetary policy to prevent the CPI from rising. It must contract a lot, enough so that the currency appreciates by the same percentage (in terms of dollars) as the prices of food and oil have gone up (in terms of dollars). Only then will import prices stay flat in terms of domestic currency. But appreciating the currency in response to an adverse terms-of-trade shock is precisely the opposite of what is wanted; it exacerbates the economic impact of the disturbance.[20]

Many inflation-targeting central bankers understand well that appreciating the currency in response to an import price shock is undesirable. Their response is that they address this problem by targeting the core CPI, which excludes food and energy, in place of the headline CPI. Does core CPI solve the problem? Not really. For one thing, food and energy need not correspond to the list of imported commodities. More importantly, it is not easy for a central bank to explain to its population that it should not worry about headline inflation because the costs that are going up are "only" the costs of filling the fuel tank and putting food on the table. Finally, there is reason to think that even those inflation-targeting central banks that talk about core CPI in fact react to an increase in the price of imported oil by contracting and appreciating, perhaps because they feel constrained by the reputational damage that would result from headline inflation.

[20]The instability of inflation targeting in the face of trade shocks is an instance of the broader instability in the face of supply shocks (McKibbin and Singh, 2003; Frankel, Smit, and Sturzenegger, 2008).

In South Africa, the correlation between the dollar value of the rand and the dollar price of its imports is 85 percent (Frankel, 2005, Table 2). Why is this surprising? One expects a floating currency to *depreciate* when the price of its imports goes up, because this is an adverse change in the terms of trade. Yet the exchange rate moves strongly the other way. Evidently, South Africa's central bank responds to increases in the dollar price of oil by tightening monetary policy enough to appreciate the rand. Why would it do that? Because it is an inflation targeter, and it seeks to avoid an increase in the CPI *even when it can be traced solely to an increase in world oil prices*.

Perhaps there is some other explanation for the South African case. But an examination of 14 oil-importing countries in Latin America reveals an interesting pattern: every one of the inflation targeters shows correlations between dollar import prices and the dollar values of their currencies that are both positive during the period 2000–08 and greater than the correlations during the pre-inflation-targeting period (Frankel, 2010a, Table 1). The evidence supports the idea that the inflation targeters—in particular, Brazil, Chile, and Peru—tended to react to the adverse oil shocks of the decade by tightening monetary policy and thereby appreciating their currencies. The implication seems to be that the CPI which they target does not in practice entirely exclude oil price shocks. Apparently "flexible inflation targeting" is not so flexible.

Product Price Targeting

For countries with terms-of-trade volatility, I have recently proposed a new alternative, which I call PPT for *product price targeting*. The idea can be thought of as a modification of inflation targeting, with the important difference that the price index is output-oriented rather than consumption-oriented. A variety of product-oriented price indices should work. The important point is that the index should give heavy weight to commodities that are produced for export and should give little weight to commodities that are imported. The CPI handles this the other way around.

Why is the difference important? On the one hand, if the export commodity is in the index, as under PPT, then monetary policy will automatically accommodate fluctuations in the export price, a desirable property that CPI targeting unfortunately lacks. On the other hand, if the import commodity is in the index, as under CPI targeting, then monetary policy reacts perversely to fluctuations in the import price, an undesirable property that PPT fortunately lacks. Thus PPT is more countercyclical or less procyclical than CPI targeting.

One way to think of it is that PPT delivers the best of both worlds in the classic debate over exchange rate regimes: it accommodates terms-of-trade fluctuation the way floating is supposed to do,[21] and yet at the same time it provides a nominal anchor, as exchange rate targeting and inflation targeting are supposed to do.

[21]Broda (2004) and Edwards and Yeyati (2005) support the textbook proposition that floating exchange rates stabilize the economy relative to fixed rates in the presence of trade shocks.

Modest and Practical Steps toward PPT

Any monetary authorities who are sufficiently worried about terms-of-trade fluctuations and government to be intrigued by the arguments for an output-based inflation target could approach the policy in a very gradual and low-risk manner.

The first step for a government wishing to dip its toe in these waters is to compute an index of product prices and then publish it. This could simply be the GDP deflator that most countries already compute on a quarterly basis. A monthly frequency would be better, but most countries do not collect GDP accounts monthly. A monthly Wholesale Price Index or Producer Price Index (PPI) might serve. But those two indices weight sectors according to their gross sales, rather than value added, with the result that they in effect often give more weight to inputs, including imported inputs, than is desirable. The preferred *Product Price Index* could gather its component prices, much as firms' prices are gathered for the Producer Price Index, but the weights on the sectors would be based on value added, as in the national income and product accounts. There is a need for research to develop the most suitable price index for the purpose. But the administrative and computational requirements need not be a constraint in the meantime. Any government that currently gathers a monthly CPI could gather a monthly Product Price Index, with the weights taken from measures of national output rather than from household consumption surveys.

The second step would be for the central bank to announce that it is monitoring the index. The third step would be full product price targeting: each year the central bank would set an explicit target range for inflation, as measured by the index. It would operate like regular inflation targeting, except that there is no need for embarrassing departures from the announced target when terms-of-trade shocks hit.

Alternative Possible Product-Oriented Price Indices

I have in the past put forward versions of this proposal that focused exclusively on export prices, rather than including the prices of all domestically produced goods and services. The simplest and earliest of these, called *peg the export price* (PEP), was probably too crude to be practical. But a brief recounting of the idea's evolution may reinforce the intuition underlying all the proposals, because the basic argument about terms-of-trade fluctuations is the same.

The idea originated in the context of African gold producers. For most countries, to go on the gold standard would be to create needless volatility: monetary policy would loosen every time the world price of gold went down and tighten every time it went up. But for a country where gold constitutes most of the export revenue, this is just what is wanted. Simulations for such gold producers as Burkina Faso, Ghana, Mali, and South Africa have established the counterfactuals of what would have happened historically if any of them had pegged its currency to gold, as compared to whatever exchange rate path they in fact followed. Their currencies would have automatically depreciated, stimulating exports, whenever the world gold market softened, and vice versa (Frankel, 2002).

How would the PEP proposal have worked operationally? Conceptually, one can imagine the government holding reserves of gold, and buying and selling the metal whenever necessary to keep the price fixed in terms of local currency. Operationally, a more practical method would be for the central bank each day to announce an exchange rate vis-à-vis the dollar, following the rule that the day's exchange rate target (dollars per local currency unit) moves precisely in proportion to the day's price of gold on the London market (dollars per ounce). Then the central bank could intervene via the foreign exchange market to achieve the day's target. The dollar would be the vehicle currency for intervention—precisely as it has long been when a small country defends a peg to some non-dollar currency. Either way, the effect would be to stabilize the price of gold in terms of local currency. Or perhaps, since the price of gold is determined on the world market, a better way to express the same policy is stabilizing the price of local currency in terms of gold.

The PEP proposal was readily extended to other commodity producers. Nigeria and Indonesia would peg to oil, Ethiopia and Nicaragua to coffee, Zambia and Chile to copper, Guinea and Jamaica to bauxite, and so on (Frankel and Saiki, 2002; Frankel, 2003a). Simulations showed that under PEP, their currencies would have depreciated in the 1990s, when commodity prices declined. This would have been helpful. Weak commodity markets contributed to balance-of-payments crises in many developing countries in the late 1990s. Many ended up eventually devaluing anyway, but only after painful losses of reserves, output, employment, wealth, and central bank credibility.

Commentators on the early PEP proposal pointed out that if applied literally, it would imply a lot of volatility. They were right. For an oil exporter, every time the world price of oil goes up 50 percent, PEP dictates that the currency appreciates by 50 percent. Yes, this would stabilize the price of oil in terms of domestic currency, wages, and nontraded goods; but it would also destabilize the prices of *other* tradable goods, such as manufactured products. They would have to fall 50 percent in terms of domestic currency, given that oil shock. Such volatility would undermine attempts to diversify out of oil. Even if the qualitative argument is sound, the quantitative outcome is excessive.

Over time, I have moderated the proposal in response to such critiques. One version arises in the context of a Persian Gulf oil exporter contemplating diversifying its peg away from a simple peg to the dollar. Kuwait, for example, decided in May 2007 to switch from a dollar peg to a currency basket.[22] It was reacting to a depreciating dollar and rising inflation. But when the price of oil rises in terms of both dollars and euros, it can still face the problem of excessive monetary inflows and overheating. Gulf countries might consider pegging to a basket that puts 1/3 weight on the dollar, 1/3 on the euro, and 1/3 on oil (Frankel, 2003b, 2003c, 2008). That way, when the price of oil rises or falls 30 percent against major currencies, the dinar automatically rises or falls by 10 percent against major currencies.

[22]Like many basket peggers, Kuwait does not reveal what is in the basket. But the dollar and euro almost certainly constitute most of it.

Most countries are not as heavily concentrated in oil exports as the Persian Gulf producers, and even the latter wish to be more diversified. Accordingly, the next version of the proposal is to set the value of the currency in terms of a basket of exports. PEPI stands for *peg the export price index*: set the value of the currency by reference to an index of prices of major exports (Frankel, 2005). For example, the index in the case of South Africa could consist of its four leading export commodities: platinum, gold, iron ore, and coal. In that case, the index could be computed on a weekly basis, or even daily. But the spirit of diversification suggests computing as broad an index of export prices as possible, including manufactured goods as well as primary products. In that case, it would only be computed monthly. And the central bank would announce a target range—just as with inflation targeting or PPT—because it is not possible to hit such an index precisely, as it is if the anchor is gold or a foreign currency. The intervention vehicle could be either foreign exchange or domestic assets, as with other anchors.

A simple theoretical model in Frankel derives parameter conditions under which PEPI delivers more stability than an exchange rate target.[23] It also derives parameter conditions under which PEPI delivers more stability than a CPI target.[24]

The Argument for Product Price Targeting Restated

All these versions have in common targeting a price index that puts substantial weight on the export commodity, not on the import commodity. One should not muddy the waters with too many proposals. The most practical proposal, again, is PPT: target a comprehensive index of domestically produced goods. The argument is that PPT is more robust with respect to terms-of-trade shocks than targeting either the CPI or the exchange rate.

To illustrate, assume the shock of a sharp increase in world oil prices. Consider first the situation of oil exporters. Under PPT, the currency appreciates automatically (in terms of dollars) along with the price of oil (in terms of dollars). To hit the target range may require a slowing in money growth and an increase in interest rates—fully appropriate when there is danger of overheating from a commodity boom. That is countercyclical monetary policy. Of course, under a free-floating regime, the currency also has a tendency to appreciate during an export boom. But we know that countries need some sort of long-term anchor for expectations, to prevent chronic inflation. What is the alternative against which to

[23]See Frankel (2010a, Appendix 2). One conclusion is that high variability in export markets makes it more likely that PEPI dominates a pegged exchange rate. Another sufficient (but not necessary) condition for PEPI to dominate an exchange rate target is if the traded commodity sector is larger than the nontraded goods sector.

[24]See Frankel (2010a, Appendix 2). If stabilizing the CPI receives top priority in the objective function, then CPI targeting dominates by construction: terms of trade and exchange rate shocks hurt more under the PEPI rules than under inflation targeting. But trade shocks destabilize output in the nontraded and export sectors under the CPI rule, while PEPI better insulates the real economy from relative price changes. Thus if the weight in the objective function on stabilizing the CPI is small, relative to the weight on stabilizing sectoral output, then PEPI dominates.

compare PPT? The two leading alternatives are the CPI, under inflation targeting, and the exchange rate.

A fixed exchange rate has advantages. But it produces a destabilizing monetary policy in commodity booms. In response to the balance of payments surplus, the central bank must allow reserves to flood into the country. (Sometimes countries can sterilize, but this becomes increasingly difficult after a year or two.) The money supply increases. Easy liquidity boosts private spending. The result is inflation, particularly in prices of nontraded goods and services and sometimes excessive increases in the prices of assets (such as real estate) and construction. Think of the Persian Gulf countries over the past decade. This is procyclical monetary policy.

What about CPI targeting? If the shock is an increase in the world price of oil, and oil constitutes a small share of the CPI, then the outcome in theory is the same as an exchange rate target. Although CPI targeting usually goes with floating, if it follows the rule the central bank will be obligated to resist what would otherwise be a strong appreciation of the currency, because that would imply falling import prices. It must loosen monetary policy enough to prevent import prices from falling, which means enough to prevent the currency from appreciating. Thus, we get the same procyclical outcome as under a fixed exchange rate: easy liquidity, rising spending, and perhaps an asset bubble.

The conclusion is that PPT may dominate targeting either the CPI or exchange rate, when an oil exporter faces an increase in world oil prices.

Now continue to assume that the shock is an increase in the world price of oil, but consider the situation of an oil importer. If the country is a conventional inflation targeter and takes seriously the rule to target the CPI, it will have to respond to a 10 percent increase in the dollar oil price by contracting monetary policy enough to appreciate the currency 10 percent. Why? Otherwise, the price of oil will go up in terms of domestic currency, and so will the CPI. But responding to a worsening in the terms of trade by appreciating the currency is precisely the wrong direction to move. It exacerbates the adverse shock and worsens the possible recession. It is procyclical. PPT, by contrast, has the advantage that because oil does not appear in the index of that country's export prices or producer prices, no monetary contraction or appreciation is required. Thus PPT avoids the procyclicality of the CPI target.

SUMMARY

Volatility in developing countries arises both from foreign shocks, such as the fluctuations in the price of the export commodity, and from domestic macroeconomic and political instability. Although many developing countries in the 1990s brought under control the chronic runaway budget deficits, money creation, and inflation that they tended to experience in the preceding two decades, most are still subject to monetary and fiscal policy that is procyclical rather than countercyclical. Macroeconomic policies tend to be expansionary in booms and contractionary in recessions, thereby exacerbating the magnitudes of the swings. The aim should instead be to moderate the swings—the countercyclical pattern that the

models and textbooks of the decades following the Great Depression originally hoped discretionary policy would take.

This chapter has examined the pitfalls of procyclicality with respect to fiscal policy, first, and monetary policy, second. For each policy area it has proposed a specific institution or regime that might help deliver more countercyclical results: emulation of Chile's institutions with respect to fiscal policy, and product price targeting for monetary policy.

The tendency to under-save mineral wealth is pronounced during booms. The temptation to spend the windfall from high world prices is sometimes irresistible. When the price of the mineral eventually goes back down, countries are often left with high debt, a swollen government sector and nontradable sector, and a hollowed-out nonmineral tradable goods sector. They may then be forced to cut back on government spending, completing the perverse cycle of countercyclical saving. The advice to save in a boom is standard. And there are other examples of governments that have had the courage to take away the fiscal punch bowl. What makes Chile's institutions particularly worthy of study is that they may constitute a template that other countries can adopt, a model that can help even in times and places where the political forces to follow procyclical fiscal policy would otherwise be too strong to resist.

Specifically, Chile appears to have avoided a pattern common elsewhere of overly optimistic forecasts from the fiscal agency in boom times. Official forecasts, if not insulated from politics, tend to be overly optimistic, and the problem can be worse when the government is formally subject to a budget rule such as the Stability and Growth Pact. The key innovation that has allowed Chile generally to achieve countercyclical fiscal policy, and in particular to run surpluses in booms, is not just the structural budget rule in itself. Rather, it is that Chile entrusts to panels of independent experts the responsibility for estimating the extent to which contemporaneous copper prices and GDP have departed from their long-run averages. Even though specifics differ from country to country, there is no reason why a version of Chile's institutions cannot be emulated by other commodity-producing developing countries.

Monetary policy sometimes operates procyclically in the face of terms-of-trade shocks, under either of two popular regimes: an exchange rate peg or CPI targeting. Neither regime entails currency movements that accommodate fluctuations in the world price of the export commodity. Worse, when the price of the imported commodity rises on world markets, CPI targeting requires an appreciation of the domestic currency, which is the opposite of accommodating the terms of trade.

The new proposals discussed in this chapter are PEPI (peg the export price index) and PPT (product price targeting). Export prices are included in the price index, so the currency appreciates during commodity booms and depreciates during commodity busts. Further, there is no pressure to appreciate when the price of the import commodity rises, because it is not in the basket. An easy first step toward exploring these ideas would be for monetary authorities to collect, publish, and monitor product-oriented price indices, rather than relying exclusively on any version of the CPI.

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CHAPTER 11

Natural Resources Management and Financial Stability: Evidence from Algeria

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INTRODUCTION

After two decades of investment efforts financed primarily through external debt and domestic bank loans, Algerian economic development has remained dependent on hydrocarbon resources. As a result of "managed" resource allocation and petroleum price volatility, the economy registered persistent financial instability through the first half of the 1990s, despite the stabilization and adjustment programs and related exceptional financing arrangements. The Algerian economy remained highly vulnerable to external shocks until the beginning of the 2000s—a period characterized by restored macroeconomic equilibrium.

Prudent macrofinancial policymaking and steering during the 2000s, based on more effective management and allocation of the resources generated by the hydrocarbons sector, have paved the way for macrofinancial stability. Substantial public investment efforts during the past decade, supported by a new financing scheme registering surplus savings over investment, have been accompanied by financial stability and resilience against external shocks. The stability of Algeria's banking system was decidedly confirmed during 2008–09, and in 2010 the legal framework for financial stability was strengthened.

The next section of this chapter discusses the lengthy process of financial instability that led, during the late 1980s and early 1990s, to serious domestic and external financial disequilibrium. After a brief analysis of the period of drastic economic and financial recovery, the chapter focuses on the framework for financial stability gradually and resolutely developed during the 2000s. The emphasis in this chapter is primarily on the management and allocation of the financial resources generated by the hydrocarbon sector.

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EXTERNAL SHOCKS AND FINANCIAL INSTABILITY

Natural resources, substantially hydrocarbons, have played and continue to play a vital role in the Algerian economy, since the revenue generated by the exploitation of these resources constitutes the bulk of the country's export revenue and a substantial share of its budget revenue. Accordingly, the mechanism for managing and allocating such resources is a decisive factor in Algerian economic trends and development.

During the 1970s, most export revenue from hydrocarbons was used to cover the substantial import component of massive public investment and end consumption, in a context of major monetary and budget expansion, managed domestic prices, and insufficient stringency in the choices and management of public investment projects. Careless resource allocation and management, which was widespread until the mid-1980s, promoted the emergence of latent domestic imbalances and increased economic dependence on hydrocarbon exports. Heavily dependent on hydrocarbon resources, the Algerian economy registered a lengthy period of financial instability following the external shock of 1986, which accentuated the investment-saving imbalance.

The decline in hydrocarbon exports (–39 percent) in 1986, following a 46 percent drop in petroleum prices in a situation of high import propensity, began that year to generate an external current account balance of payments deficit. This deficit severely eroded the country's foreign exchange reserves (US$0.72 billion at end-1990, as compared with US$2.5 billion at end-1985), despite increased recourse to domestic debt. In this context, outstanding external debt reached the excessive level of US$26.1 billion at end-1989, as against approximately US$17 billion at end-1985, with a substantial share of short-term maturities. As a result, the external debt service-to-export ratio shot up to 80 percent in 1988, as compared with 35 percent in 1985.

This drastic deterioration in external debt indicators continued until the end of 1993, despite exceptional external financing contributions in the form of balance-of-payments support from the International Monetary Fund (IMF) (the 1991 stand-by arrangement) and the World Bank (public enterprise and financial sector restructuring program) and the program to restructure some of the country's external debt.

During the first quarter of 1994, Algeria's vulnerable external financial position peaked when its external debt-service ratio rose to 100 percent, while hydrocarbon prices underwent another downward shock and the country's foreign exchange reserves representing only 1.3 months' worth of imports.

With the backing of stabilization and structural adjustment programs (IMF and World Bank) staggered over four consecutive years (1994–98), external debt rescheduling, which had become inevitable, made it possible for Algeria to reduce its external financing constraints substantially. However, outstanding medium- and long-term external debt increased to US$33.2 billion by the end of 1996 (which equaled 71 percent of GDP), as compared with US$26.1 billion at the end of 1989 (47 percent of GDP), as a result of the external debt service payment deferrals.

Algeria's substantial external financial instability resulting from the 1986 shock led to accentuated fiscal imbalances. Petroleum tax revenue dropped by nearly 50 percent in 1986, although the rate of government expenditure remained constant. As a result, the overall budget deficit reached record levels in 1986 and again in 1988 (13 percent and 13.7 percent, respectively, as a share of GDP), financed substantially through monetary creation. Expansionary monetary policy was also fed by substantially automatic central bank refinancing of medium-term bank loans used to finance investments planned during the 1970s and 1980s in a situation of structurally insufficient domestic savings. Until the beginning of the monetary reform of the 1990s, financial stability was undermined by highly accommodating monetary policy and the passive role played by the central bank.

The macroeconomic policy shortcomings were so persistent that, despite the 1991 adjustment program (stand-by arrangement), the overall budget deficit widened once again to nearly 8.5 percent of GDP in 1993, while fiscal vulnerability to hydrocarbon price volatility was substantial. Moreover, financial instability was ignored, despite the build-up of nonperforming public enterprise bank loans and the persistence in saving-investment imbalances. As a result, the vulnerabilities accumulated, particularly in the public enterprise and banking sectors which, at the same time, also faced the repercussions of the 1991 exchange rate adjustment.

In addition, the first year of the adjustment programs, which ran from 1994 to 1998, was characterized by a deep devaluation of the dinar (in April 1994) followed by successive exchange rate adjustments reflecting trends in the economic fundamentals. At the same time, a substantial price liberalization was applied. As a result, previously repressed inflation surged to 29 percent and then 30 percent in 1994 and 1995, respectively.

Fiscal rehabilitation in 1994–95 led to an overall budget surplus in 1996 and 1997, supported by the exchange rate adjustment and contraction in the ratio of capital expenditure to GDP (7.3 percent in 1997 as against 10.1 percent in 1989). Simultaneously, the financial rehabilitation of public enterprises continued, in which nonperforming bank loans were bought back, primarily in connection with the bank-enterprise mechanism. In fact, as a result of the public enterprise restructuring and public bank rehabilitation program in the early 1990s, the scope of efforts to restructure these banks' nonperforming claims broadened during the latter half of the decade, supported in particular by a monetization of the rescheduling resources. This approach helped reduce liquidity problems for some of these public banks.

Despite these major adjustment efforts, the Algerian economy's vulnerability to external shocks remained severe. In fact, the impact of the 1998 drop in hydrocarbon prices led to an overall balance of payments deficit of US$1.7 billion and US$2.4 billion in 1998 and 1999, respectively, once again eroding the country's foreign exchange reserves, which declined from US$8 billion at the end of 1997 to US$4.4 billion at the end of 1999.

At the same time, 1998 was marked by the return of fiscal disequilibrium. After an overall budget surplus in 1996 and 1997, 1998 showed a deficit of 3.8

percent of GDP, despite a sustained capital expenditure-to-GDP ratio of 7.5 percent. Rigorous measures to balance the public accounts (such as not using part of the capital budget) and the necessary exchange rate adjustment led to a balanced budget in 1999.

ADOPTION OF PRUDENT MACROECONOMIC MANAGEMENT FOR INCREASED RESOURCES

Macroeconomic equilibrium was restored in 2000. It was followed by the emergence of surplus savings over investment, which became characteristic of the Algerian economy during the period 2001–08, and was supported by a substantial improvement in the terms of trade as a result of the increase in hydrocarbon prices on the international markets.

The surplus savings over investment increased in relation to GDP, peaking at 24.7 percent in 2006, as against 16.3 percent in 2000. In absolute value, this surplus savings peaked at US$34.45 billion in 2008, in the midst of the international financial crisis. Although the 2009 drop in hydrocarbon prices led to a sharp contraction in hydrocarbon export revenue and the first budget deficit in a decade, the country's sound financial position, due to the prudent macroeconomic management of its increased hydrocarbon revenues, helped consolidate the Algerian economy's resilience against external shocks.

In 2000, the government instituted a new rule on budget savings by establishing the revenue regulation fund (*Fonds de régulation des recettes*—FRR), a stabilization fund in dinars and liquid assets designed to absorb any increase in petroleum tax revenue above a benchmark price of US$19 per barrel. The same year, the overall budget surplus amounted to 9.7 percent of GDP, consolidating a sustained accumulation of financial savings for the government in order to preserve medium-term fiscal sustainability. Resources accumulated in the FRR increased sharply during the period 2001–08, with crude oil prices exceeding the benchmark price despite their adjustment to US$37 per barrel in 2008.

This prudent budget stance provided essential support for the economic recovery, which began in 2001 with the implementation of a series of substantial public investment programs (2001–04, 2005–09, and 2010–14) that had a considerable infrastructure component. Despite the relatively significant level of resources absorbed in implementing these programs, funds accumulated in the FRR increased from 5.6 percent of GDP in 2000 to 24.4 percent in 2005 and to 43.1 percent in 2009. This stock of financial savings is deposited with the Bank of Algeria in a separate dinar account from the treasury current account and is subject to special monitoring. It is a sterilization mechanism that supports monetary and financial stability. This was particularly clear in 2009 when domestic public debt represented only 8.1 percent of GDP.

From the standpoint of the necessary synergies between fiscal and monetary policies, the Bank of Algeria reviewed the framework for the latter beginning in April 2002 to absorb the surplus liquidity that appeared on the money market

during the early months of that year. This constituted a departure from the lengthy period of bank refinancing requirements. It has ensured that since 2002, excess liquidity has been effectively mopped up through a flexible, orderly conduit of indirect monetary policy instruments, such as liquidity absorption mechanisms (market instruments), the marginal deposit facility, and the reserve requirement (non-market instruments). This regulatory monetary policy framework was strengthened in 2009 to consolidate the policy's contribution to financial stability.

Moreover, this financial stability, and therefore the economy's resilience to external shocks, were both strengthened by the allocation of some of the accumulated budget savings to substantially reducing external public debt and to external debt relief for enterprises with financing capacities, primarily in the hydrocarbon sector.

All things considered, the conduct of prudent macrofinancial policies based on more effective management and allocation of hydrocarbon resources during the 2000s broadly contributed to Algeria's robust economic and financial performance, judging in particular from the following indicators:

- Sustained non-hydrocarbon growth reaching the level of 9.3 percent in 2009, after levels in the range of 5 to 6.3 percent during the entire period 2002–08, indicative of the substantial contribution from public investment programs to this growth;
- Controlled inflation, even in 2008, a year of sharp increases in world food and inputs prices;
- Consecutive balance of payments surpluses, leading to a sustained accumulation of foreign exchange reserves (36 months of goods and services imports), despite the substantial reduction in medium- and long-term external debt, for which the outstanding balance as a share of GDP amounted to only 2.8 percent in 2009, as against 25.1 percent of GDP in 2004 and 57.9 percent in 1999; and
- A sustained accumulation of resources in the FRR (43.1 percent of GDP in 2009).

FINANCING FOR THE ECONOMY IN A CONTEXT OF PRUDENT RESOURCE MANAGEMENT

The sustained increase in domestic savings since 2000, particularly in the country's surpluses in budget savings and hydrocarbon sector components, was the cornerstone of the mechanism to finance the economy during the past decade.

Investment Financing and Saving

During the past 10 years, most investments were made by two main economic players with large financing capacities: the government and the hydrocarbon sector, both of which depend on hydrocarbon-sector revenues for their financing capacity.

Beginning in 2001, the government undertook the first public investment program (2001–04) followed by a second program that ran from 2005 to 2009. Progress in this area provided great stimulus for gross fixed capital formation, and the share of such investments in gross investment reached 47.9 percent in 2009, as against 40.8 percent in 2004. During 2005 to 2009, public investment, including economic and social infrastructure, housing, agriculture, and water systems, came to a total of US$96.77 billion out of US$188.13 billion in total gross investment, equivalent to a relative share of 51.3 percent. The level of public investment reached 18.2 percent of GDP in 2009, as against 7.5 percent in 1998, corresponding to two years of external shocks. Budget savings accumulated during this period enabled the government to self-finance all its investments, despite the extent of the 2009 external shock, which led to a 42 percent contraction in oil tax revenue.

The national hydrocarbon enterprise has contributed greatly to gross fixed capital formation through the implementation of ambitious annual investment plans during recent years. In fact, investments by this enterprise increased from US$3.7 billion in 2004 to US$14.9 billion in 2009. For the past five years, investments by the national hydrocarbon enterprise averaged 21 percent of total gross investment, including 28.3 percent in 2009. Between 2001 and 2004, the national hydrocarbon enterprise covered its investment financing largely with its own financial resources. Since 2005, the enterprise has self-financed all its investments while generating an appreciable stock of savings.

Cycle of Credit to the Economy and Financial Stability

The government's and the national hydrocarbon enterprise's self-financing of their investments during recent years has led to a total absence of the crowding-out effect in the rest of the economy in terms of domestic financing in the banking system. Further, surplus revenues from the national hydrocarbon enterprise have yielded substantial funds that can be used for lending in the banking system, while surplus budget resources have been sterilized in support of macrofinancial stability.

During the period 2005–09, the availability of substantial liquidity in the banking system made it possible to finance 49.1 percent of investments in the rest of the economy, with the balance of the financing covered by their own resources (46.8 percent) and through bond market issues (4.1 percent). The share of cumulative investments in the economy out of total gross investment was 27.8 percent for the period 2005–09, with high rates of increase in investments (19.4 percent in 2008 and 11.5 percent in 2009).

In general, the investment finance structure for these years has shown a very high level of self-financing (85.2 percent), with the balance financed primarily by domestic bank loans, constituting a clear departure from earlier financing patterns.

The 2000s have been characterized by strong developments in bank intermediation, from the standpoint of collecting resources, distributing credit, and modernizing payment systems. This has led to an appreciable improvement in basic banking services for clients. Credit to the economy in fact registered an

average annual growth rate of 8.4 percent during the period 2000–09, with 21.2 percent of loans going to the private sector and a deposit coverage rate of 135.3 percent, derived largely from hydrocarbon resources.

We should bear in mind that the lack of prudence in allocating and managing financial resources during the 1970s and 1980s led to a high level of outstanding debt distributed by public banks, relative to non-hydrocarbon GDP. This debt was equivalent to 80 percent of non-hydrocarbon GDP for the period 1985–90, when hydrocarbon-sector enterprises had little recourse to domestic credit. The high level of this ratio can be attributed to the lengthy period of monetary expansionism following the phenomenon of "financial repression" that characterized bank intermediation during these two decades. The ratio declined steadily to reach 47.6 percent in 2009, primarily as a result of operations to reschedule nonperforming bank claims on public enterprises, at an average cost of 2.6 percent of GDP during the 1990s and 0.9 percent of GDP during the 2000s.

Trends in credit to the economy during the 2000s were characterized by a large increase in credit to the private sector (private enterprises and households). The distribution of credits to this sector were particularly dynamic during 2000–05, reflecting a relative relaxation in lending criteria, and this led to the emergence of nonperforming claims by public banks against this sector and to a substantial risk concentration. Accordingly, credit flows to the private sector decreased from 6.4 percent of cumulative value added in the sector during 2002–05 to 4.8 percent for the period 2006–09. Beginning in 2006, the cycle of credit to private enterprises and households shows that reduced bank credit flows were accompanied by greater wealth creation in the private sector. It is useful to note that the nonperforming claims on the private sector did not involve home mortgage loans, as there was no acceleration in the cycle for this type of loan. Home mortgage loans represented only 8.3 percent of the relevant deposits at end-2009.

From the standpoint of monetary stability, during the period 2000–08 the increase in credit to the economy constituted only a modest source of monetary expansion, the main source being aggregate net foreign assets. With the exception of 2009, the structural expansion in net foreign assets from hydrocarbon export revenue presented a challenge in monetary policy steering. The ratio of net foreign assets to M2 reached an unprecedented 1.473 at end-2008, stabilizing in 2009, as against 1.027 at end-2005. Very low levels of monetary growth (3.1 percent) were registered in 2009, and liquidity underwent a contraction (–14 percent) correlating with the external shock, following the high rates of monetary expansion in this area during 2005–08. Accordingly, the monetary growth rate peaked at 24.2 percent in 2007, followed by a reversal in the cycle (16 percent in 2008 and 3.1 percent in 2009).

Moreover, consistent with recent developments in the operational framework for monetary policy at the international level, in 2009 following the financial crisis Algeria strengthened its monetary policy framework. A new regulation from the Money and Credit Council gave the Bank of Algeria monetary instruments meeting international standards, enabling it to continue to cover the structural liquidity surpluses that had prevailed since 2002 and to

contain inflationary pressures. This regulatory framework covers bank refinancing operations, operations to mop up excess liquidity on the money market, and facilities (loans and deposits) at the banks' initiatives. This approach reinforces the contribution of monetary policy to financial stability, with the stabilization of the real effective exchange rate for the dinar around its equilibrium level.

The progress made in the area of monetary stability and the resilience of the banking sector have further consolidated financial stability. Stability has been sustained by the 2008-09 improvement in the operational framework for banking activity, which included an increase in minimum regulatory capital, new accounting regulations meeting international standards applicable since 2010, and assessments of risk in connection with new financial instruments.

Specifically, both the large increase in bank capital (DA 76 billion) during the latter half of 2009, in conformity with the increase in the minimum capital level, and the upgrading of capital in certain public banks (DA 42 billion) helped consolidate the overall solvency ratio, which reached 21.78 percent in 2009, as against 16.54 percent in 2008 and 12.85 percent in 2007. In terms of core capital and capital, the solvency ratios were 17 percent and 9.7 percent, respectively, in 2009.

The other indicators show increased soundness in the banking system during the latter half of the 2000s. Despite the relative contraction in 2009 due to the external shock, the liquidity surplus persisted, as shown by the high ratios of two indicators: liquid assets to total assets and liquid assets to short-term liabilities. Further, returns on capital and reserves were still substantial, amounting to 24.8 percent in 2009. The rate of return on banks' assets was situated at 1.4 percent for 2009. This rate is similar to those registered in certain emerging countries, such as Turkey, Indonesia, Malaysia, Brazil, Chile, South Korea, and South Africa.

While these indicators show the stability and resilience of Algeria's banking sector in light of external shocks, the level of nonperforming claims, primarily against the private sector, is still a challenge for public banks, which must continue to improve their mechanisms for credit risk management. In this context, the strengthened financial stability that is based on progress in monetary stability primarily entails a sustained improvement in the surveillance of banks and financial institutions. To that end, microprudential supervision instruments will be strengthened, particularly by establishing a new liquidity ratio and by intensifying off-site and on-site supervision.

STRENGTHENING THE FRAMEWORK FOR FINANCIAL STABILITY: OUTLOOK FOR THE MACROPRUDENTIAL APPROACH

New legislative provisions (Order 10-04 of August 26, 2010) consolidate the legal framework governing the banking sector in Algeria and strengthen the legal basis for financial stability as an explicit mission of the Bank of Algeria, primarily from the standpoint of systemic risk surveillance. This approach supports the regulatory measures applied in recent years to address certain observed vulnerabilities.

The Bank of Algeria now has broader prerogatives to launch investigation of banks and financial institutions. This permits more effective follow-up of banks and financial institutions and enhances the Bank of Algeria's capacity to detect vulnerabilities early. Intensified microprudential supervision will contribute to the orderly development of the banking system, particularly since systemic risk surveillance is derived primarily from the Bank of Algeria's payment system surveillance. The central bank now has broader powers in this area, including in operations, surveillance, and security of payments systems.

The finalization and implementation of the bank rating system during the first half of 2011, along with the effective operation of a new risk reporting center at the end of 2011, will give risk-based supervision an operational focus. In addition, the powers of the monetary authority (the Money and Credit Council) have been expanded to new areas—specifically new saving and credit instruments, production of standards, operation and security of payments systems, and rules of conduct and ethics. Further, the Bank of Algeria will submit liquidity risk management regulations to the Money and Credit Council by end-2010, in accordance with the new rules of the Basel Committee.

In the short term, the Bank of Algeria's Financial Stability Committee will complete a review of financial soundness indicators for the 11 minimum indicators. This review will subsequently be expanded to further proposed indicators. The committee will conduct further analyses of the macroprudential approach to address the structural liquidity surpluses that now characterize the Algerian banking system and the need to improve allocation of credit to the economy to support national economic diversification.

In terms of crisis prevention and resolution, the intensification of information exchanges among the various authorities in the financial sector, which aims to refine and strengthen knowledge of the financial system's level of resistance to cyclical phenomena, will make it possible to detect any threats against financial stability. For that purpose, the use of stress tests, in particular for periodically assessing the stability of the banking and financial system, will receive special attention.

Last, the new legislative measures of August 2010 provide a legal underpinning for price stability as an explicit monetary policy objective. This approach will support the 2009 consolidation of the regulatory framework and instruments for monetary policy, which now provide a forward-looking orientation. The contribution of monetary policy to financial stability is therefore being reinforced. In addition, prudent management of official exchange reserves at a sufficient level to cover any external shocks that may occur is part of the strategic objective to consolidate financial stability. Economic diversification efforts must still be intensified to sharply reduce the vulnerability inherent in the economy's dependence on the hydrocarbon sector.

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CHAPTER 12

Copper, the Real Exchange Rate and Macroeconomic Fluctuations in Chile

JOSÉ DE GREGORIO AND FELIPE LABBÉ

INTRODUCTION

Chile is rich in natural resources. The mining sector has been very important historically, and today Chile is the largest producer of copper in the world. But while Chile reaps the benefits of abundant copper, the metal also represents many challenges for macroeconomic management and long-term growth.

The abundance of natural resources has been an important area of discussion in development economics for a long time. A few decades ago it was thought that developing countries should move away from natural resources because of the declining price trend. This view was argued to support a development strategy based on import substitution. The facts have shown that this view was based on a wrong assumption. Nevertheless, the relationship between development and natural resources has again become a highly debated issue. A large body of research has examined the question of whether natural resources are a blessing or a curse from the point of view of economic growth.[1]

Natural resource abundance has also been discussed in the context of macroeconomic models of small open economies. The purpose of these development models has been to analyze the impact of commodity price fluctuations on the

José De Gregorio is governor and **Felipe Labbé** is economic advisor to the governor, both at the Central Bank of Chile. This chapter is based on the authors' presentation at "Natural Resources, Finance, and Development: Confronting Old and New Challenges," a high-level seminar organized by the Central Bank of Algeria and the IMF Institute, which took place in Algiers, on November 4 and 5, 2010. The authors wish to express their gratitude to Pierre-Olivier Gourinchas, Enrique Mendoza, Sergio Rebelo, Claudio Soto, and Tatiana Vargas, for insightful comments on previous versions of this chapter. The authors can be contacted at jdegrego@bcentral.cl and flabbe@bcentral.cl.

[1]Interestingly, most of this research has been based on the impact of natural resource abundance on economic growth, without taking into account that although it may slow down growth transitorily, the increase in income makes it welfare improving (Bravo-Ortega and De Gregorio, 2006). For a classical reference on the economic consequences of natural resources abundance, see Sachs and Warner (1999). For the role of institutions and human capital on overcoming the resource curse, see Robinson, Torvik, and Verdier (2006) and Bravo-Ortega and De Gregorio (2006), respectively.

economy, in particular the business cycle and the composition of growth. An important question these models seek to answer is, What is the appropriate framework for monetary and fiscal policy in order to mitigate the potential costs of commodity price fluctuations?

This chapter discusses the case of copper in Chile from the perspective of macroeconomic management. Although the long-run implications of Chile's abundance of copper for the country's economic growth are related to the impact of copper on the business cycle, because a volatile business cycle may reduce growth potential, our focus is on macroeconomic performance.[2] In particular, this chapter shows that the fluctuations in copper prices have less impact than they used to have on aggregate fluctuations in Chile and that this is the result of the macroeconomic policy regime in place. Indeed, the stability that comes from being more resilient to the international environment should foster long-run economic growth.

The analysis in this chapter finds that the Chilean economy is not excessively dependent on copper, as it may have been in the past. Moreover, the impact of copper on the economy has diminished over time thanks to macroeconomic policies.

A recurrent concern during periods of rising commodity prices is the so-called Dutch disease, which has short- and long-term implications. The concern has been about the impact on economic performance of the exchange rate appreciation that comes with a commodity price boom. During the last decade, copper prices reached both their highest and lowest values since the Great Depression. Despite this volatility and other severe international shocks, real exchange rate (RER) fluctuations have been more moderate than what would have been expected in the past.[3]

The reduction in Chile's output volatility since the 1990s and 2000s has been previously documented in De Gregorio, Betancour, and Medina (2008) and Larraín and Parro (2008). The first of these papers shows that indeed volatility has decreased and this has been the result of the macroeconomic policies implemented in the last decade; however, the study's estimations do not allow one to separate the different components, that is, the fiscal, monetary, and exchange-rate policies applied during this period. The second paper performs regressions for volatility controlling for a dummy since the fiscal rule based on a target for the structural budget was implemented together with an index of exchange rate intervention. The authors attribute about 60 percent of the decline in volatility to the fiscal rule and the flexibility of the exchange rate. In contrast to that previous research the focus of this chapter is on the changing, and diminishing, contribution that copper price fluctuations make to economic performance.

Carrying out an integrated assessment of the different factors reducing output volatility, in particular the role of copper price fluctuations, would require a full model describing channels through which the external conditions transmit to the domestic economy. However, such a task is beyond the purpose of this chapter, and

[2]During the last 25 years Chile has enjoyed its highest rate of economic growth ever, and hence the proposition that copper may be detrimental for economic growth is easily dismissed. For further discussion, see De Gregorio (2009).

[3]For recent discussion on exchange rate and Dutch disease see Magud and Sosa (2010).

with current models it would be very difficult to undertake, since the comparison would have to be made with policy regimes that are particularly difficult to formalize. We use a general equilibrium model for the last decade in the next to last section ("Simulation of a Copper Price Shock"), but that model cannot be used for previous periods, because pre-2000 macroeconomic policies had many features that are complex to model, such as the exchange rate band, capital controls and a monetary policy based on setting an indexed interest rate. On the fiscal side there was fiscal prudence but no explicit rule. For this reason, we use a more eclectic approach to focus on the impact of copper prices on Chile's business cycle.

First, we review the evidence on fiscal policy. Then we examine the determinants of both output volatility and RER. The evidence of this chapter shows that indeed the output response to copper has declined and that the RER has played a shock absorber role since the inflation target regime and the floating exchange rate policy were adopted. In addition, long-run RER volatility has recently declined slightly despite sharp copper price fluctuations.

This chapter proceeds with a brief discussion of the importance of copper in Chile; the next section discusses fiscal policy, followed by a presentation of the evidence on copper price fluctuations and the business cycle. It is shown that output volatility in Chile has declined substantially since the early 1990s. Both the volatility and the response of the economy to copper have declined further in the last decade, which has featured a flexible inflation target and a floating exchange rate. The application of these policies has benefited from a predictable fiscal rule. The fifth section of the chapter ("Terms of Trade Shocks") presents evidence on the long-run RER dynamics. We show that after permanent terms-of-trade shock, the RER stabilized at its long-term value more quickly during the period after 1999, that is, after the implementation of the flexible exchange regime. Moreover, the effects of terms-of-trade shocks have been less persistent during the latter period. The sixth section of this chapter ("Macroeconomic Fluctuations") presents evidence that nominal exchange rate and short-run RER volatilities have increased. However, long-run RER volatility has remained stable. In fact, nominal exchange rate and RER have played a shock absorber role in the Chilean economy since the implementation of the fully flexible exchange regime. The next-to-last section of the chapter simulates the effects of a copper price shock on the Chilean economy using a standard dynamic stochastic general equilibrium model estimated under different policy rules. The chapter closes with some concluding remarks.

COPPER IN THE CHILEAN ECONOMY

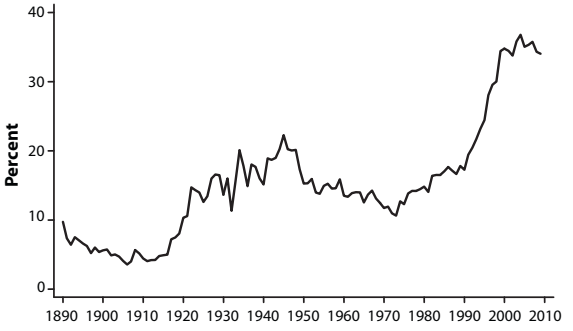
Chile has become increasingly important in the world copper market. Since the late 1960s the Chilean economy has increased its share of global production, to somewhat more than a third (Figure 12.1).

The share that mining represents both in Chile's GDP and in its exports has also been historically large. In the late nineteenth century, Chile was an important producer of nitrates, an industry that collapsed some decades later when cheaper

synthetic nitrate was created. Then copper started taking off. The mining sector's share in total GDP declined substantially in the middle of the last century but, unsurprisingly, it has fluctuated with the price of copper since then. Those copper prices have experienced sharp fluctuations. The previous period of very high prices was in the mid 1960s. The price of copper declined sharply in the early 1990s only to again reach new historical highs since (Figure 12.2).

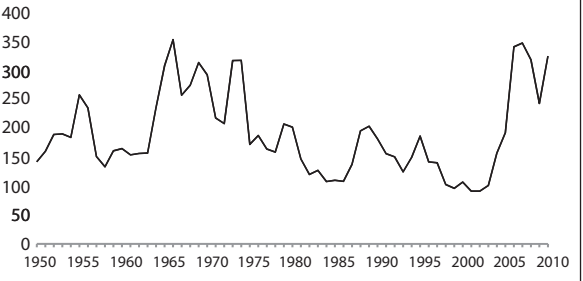
Figure 12.3 shows the share of the mining industry in GDP measured at both current prices (A) and constant 2003 prices (B). With the low prices of the early 2000s, the share of mining in nominal GDP was slightly above 5 percent, but with the most recent very high prices this share rose above 20 percent in 2006–07. Measured at 2003 prices, this share has declined slightly to 6 percent of GDP in 2009.

Figure 12.1
Chilean copper production as share of world production
(production is measured in metric tons)



Sources: Díaz, Lüders, and Wagner (2010) and the Chilean Copper Commission (CoChilco).
Note: Shares are obtained dividing Chilean production by world production; values are all expressed in metric tons.

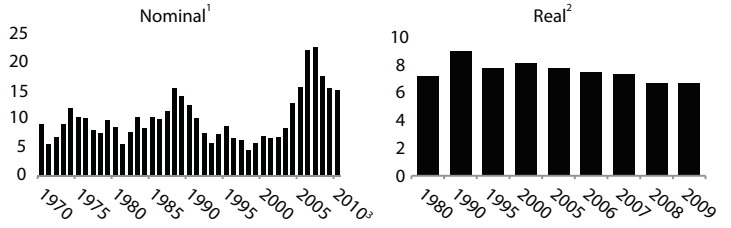
Figure 12.2
Real price of copper
(U.S. cents per pound, measured at 2010 prices)



Source: The Chilean Copper Commission (CoChilco).

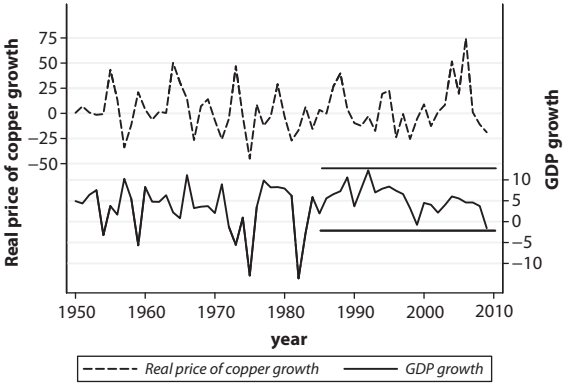
Given the size of the Chilean mining sector, there has been serious concern about the implications of volatile copper prices for economic activity. Indeed the Chilean economy saw significant growth when copper prices were high (Figures 12.2 and 12.4). During the period of high copper prices in 1979–80, the economy grew at 8.1 on an annual basis. Similarly, during the boom of 1988–89 growth was 8.9 percent, and in 1995 it was 10.1 percent. However, during the most recent copper-price boom, which started in late 2005, the economy grew more moderately. Indeed, in 2006–07, before the Great Recession, the economy grew at an annual rate of 4.6 percent. At the same time, the reaction of the economy to lower copper prices has also moderated. Before

Figure 12.3
Mining as a share of total GDP
(percent)



Source: Central Bank of Chile.
[1]At current prices.
[2]At 2003 prices.
[3]Considers forecasts for 2010 of total GDP growth and Mining, included in the September Monetary Policy Report.

Figure 12.4
GDP and price of copper growth, 1950–2010
(percent)



Sources: Díaz, Lüders, and Wagner (2010) and Central Bank of Chile.

2000, the Chilean economy generally went into recessions when the copper price collapsed. However, in the three years from 2000 to 2002, when the copper price dropped to its minimum triennial real price since the Great Depression, the economy grew at 3.3 percent. This is very suggestive evidence that the Chilean economy has become much more resilient to copper price fluctuations.

Before discussing in more detail the decline in volatility of output, we would like to discuss qualitatively the direct channels through which copper prices affect the economy. What we would like to show is that, in principle, there is no reason to believe that the business cycle should be affected significantly by copper price movements.

First, the mining sector accounts for only about 1.5 percent of total employment, down from 2.6 percent in the early 1980s. This is direct employment, but in the north of Chile, where most mining production takes place, a large fraction of economic activity is linked directly or indirectly to mining. However, the share of the total population living in the mining regions is only about 7 percent. This fact shows that the direct effect of copper activity is limited. This contrasts with agricultural commodities which, where abundant, represent a larger fraction of GDP and employment.

Second, about two-thirds of copper production is owned by foreign companies.[4] The rest is produced by a state-owned company, CODELCO. Overall, when including taxes paid by foreign investors, about half of the income from copper is foreign, and the rest is public, in the form of profits from CODELCO and tax revenues. But as is well known, fiscal policy in Chile operates under a rule that sets expenditure on the basis of long-term copper prices, so the fiscal impact of high copper prices is dampened significantly by the fiscal rule.[5]

Of course, in a Ricardian world, whether the income is public or private would be immaterial. However, the evidence on Ricardian equivalence is limited, in particular in a developing economy such as Chile where a large fraction of people are without full access to credit markets (Céspedes, Gali, and Fornero, 2010). Anyway, the country becomes richer with a higher copper price, and this should have some impact on private demand. However, given the improvements in the Chilean policy framework, it is difficult to imagine that the effects are of such a magnitude as to induce recession when the copper price falls and acute booms

[4]There are important Chilean investors in some mining companies, but they are incorporated as foreign companies. There are also some small- and medium-sized companies that are owned by Chilean residents, but they make up a small fraction of copper production.

[5]The copper price that enters on the fiscal rule formula corresponds to the expected copper price from $t + 1$ to $t + 10$. Therefore, there is some impact, while very limited, of current prices on the current fiscal budget since forecasts tend to be highly persistent. In fact, Magendzo (2010) estimates that only 10 percent of the last year's copper price changes are incorporated into the long-term copper price used in the fiscal rule.

when it rises, as was historically observed in Chile.[6] For more discussion on the public finance channel, we review the role of fiscal policy in the next section.

FISCAL POLICY AND COPPER

It can be argued that the fiscal rule, which was launched in 2000, is what has produced the greater resilience of Chile's economy to copper prices. Indeed, the introduction of the fiscal rule was a big step toward institutionalizing prudent fiscal policy, although fiscal prudence had been in place for a long time already. When introduced, the fiscal rule established the target of a structural surplus of 1 percent of GDP. The structural surplus is estimated using a cyclical adjustment for revenues and a long-term copper price. The parameters for both variables are established by two expert committees. In particular, for copper prices the experts are asked to forecast the average price for the next 10 years, and this is the price used to compute the structural revenues from copper.

For 2007, the rule moved transitorily to a target of 0.5 percent surplus of GDP, then in 2008 to a 0 percent balance, and it was changed to a deficit of –1 percent during the 2009 recession. The current administration has announced that it will return to a structural deficit of –1 percent by the end of its term, in 2014, amid the needs of reconstruction stemming from the earthquake of 2010.

The introduction of the fiscal rule was a very important development in macroeconomic management. It provides a predictable path for fiscal policy. Monetary policy in the context of an inflation target is greatly benefited by this rule. The models that are used to forecast inflation for the policy horizon of two years take this rule into account, and without the rule much weaker assumptions would have to be made in order to forecast inflation throughout the entire policy horizon and beyond. The adoption of this explicit rule has also contributed to eliminating the uncertainty induced by fiscal revenues linked with copper price fluctuations. Therefore, it is difficult to separate the effects of the fiscal rule from the effects of the inflation target regime, because the latter has been positively influenced by the predictability and transparency of fiscal policy.

The fiscal rule also played an important role in the run-up of copper prices in the last years, in particular before the subprime crisis developed. Indeed, with a copper price averaging US$3.4 per pound in 2006–07, the fiscal surplus was on average 8.2 percent of GDP. It is difficult to fathom how a windfall of such magnitude could have been saved without the rule. This allowed Chile to accumulate

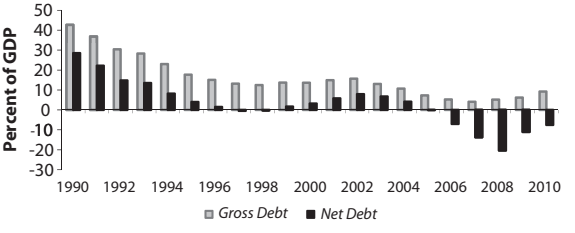
[6]Calvo and Mendoza (1999) and Spilimbergo (1999) both report a high sensitivity of the business cycle in Chile to the copper price. However, their samples do not include the sharp drop of the early 2000s and the later high rise, with moderate output fluctuations. Moreover, Calvo and Mendoza (1999) focus more on inflation, and their estimations for terms of trade use the price of copper divided by the price of oil, with the former also having important effects on the economy. In turn, Caballero (2002) argues that sensitivity of the business cycle to copper prices is due to the fact that copper is used as collateral for foreign borrowing. This channel could have been relevant when Chile had limited access to international financing.

a sovereign wealth fund that reached 19.5 percent of GDP in 2008,[7] while gross public debt was 5.2 percent that same year. The government became a net creditor to the rest of the world (Figure 12.5), which allowed Chile to implement one of the largest fiscal expansions (relative to the size of the economy) in the world during the Great Recession. Toward 2010 the government's net creditor position declined, since it used part of its sovereign wealth fund to finance the fiscal expansion.

However, to attribute a major stabilization effect solely to the introduction of the fiscal rule would be questionable. Indeed, Chile had run a prudent fiscal policy since the mid-1980s. Figure 12.6 shows that from the mid-1980s to the Asian crisis in the late 1990s, Chile had an effective fiscal surplus every year, although in the late 1980s there was a deficit in structural terms. The structural surplus had been very stable until the Asian crisis, when it did become negative, and then again when it became negative during the Great Recession. A countercyclical fiscal policy is expected to reduce a structural balance during recessions and to increase it during expansions, so most of the time the fiscal policy was fairly acyclical, except in the two recessionary periods of the last 25 years.

To look more closely at the cyclical properties of fiscal policy, Figures 12.7 and 12.8 present correlations of the cyclical component of government expenditure with the cyclical components of output and copper prices, respectively. Although the correlation—for ten- and twenty-year rolling windows—between the cyclical components of GDP and government expenditure is not stable, its value started declining to negative magnitudes around the early 1990s. On average, for the 1990s, the correlation decreases to half of its historical value. Despite a positive comovement toward 1997–98, since the second half of the 1980s the correlation shows a downward-sloping trend. It is worth mentioning the dramatic decrease

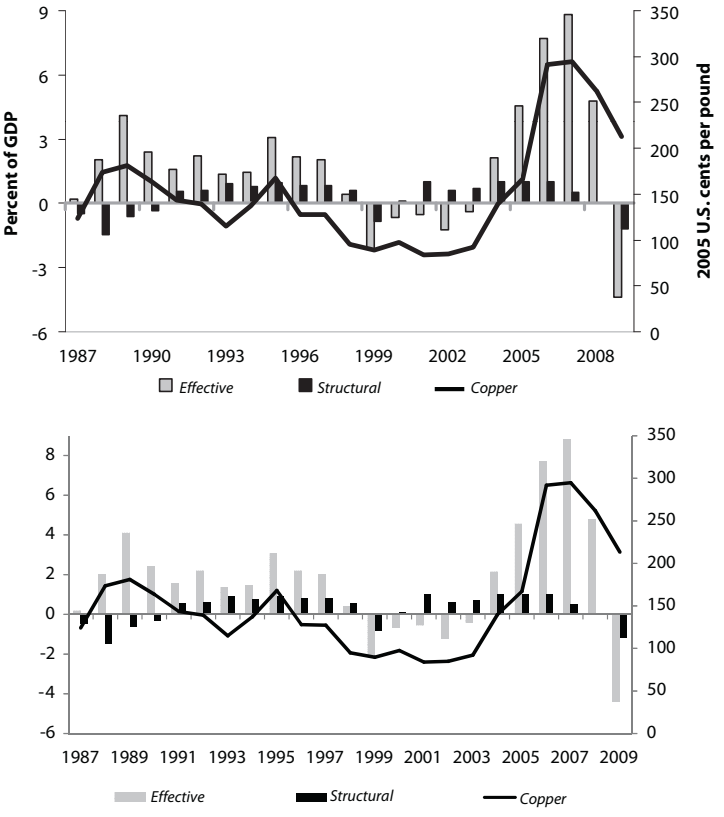
Figure 12.5
Public debt,1999–2010
(central government)



Source: Budget agency, Ministry of Finance (DIPRES).
Note: Gross debt corresponds to total financial liabilities (external and internal) of the central goverment. Net debt corresponds to the gross debt minus total financial assets (external and internal) of the central goverment.

[7]Two funds were created: the reserve fund for pensions and the economic and social stabilization fund. We refer two both as the sovereign wealth fund. There are also two additional, smaller funds, the oil stabilization fund and the infrastructure fund.

Figure 12.6
Fiscal balance and real price of copper, 1987–2008



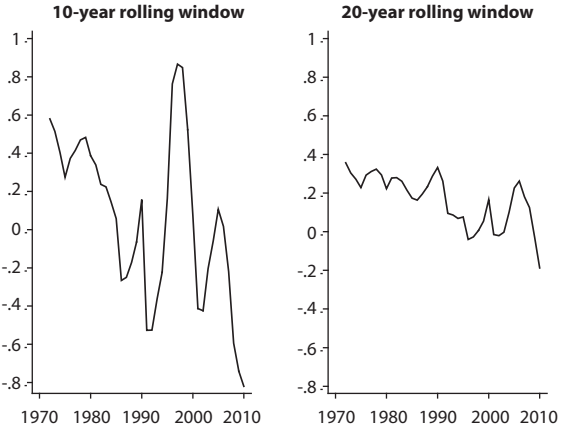
Sources: The Chilean Copper Commission (CoChilco); Ministry of Finance, Chile.

during the last years of the sample—close to –0.8 for the period between 2001 and 2010—this is mainly associated with the fiscal expansion during the global crisis. As Frankel, Végh, and Vuletin (2011) highlight, Chile has successfully implemented a countercyclical fiscal policy since it has been able to overcome the historical procyclicality. For the period 2000–09 these authors find a negative correlation close to –0.7, which contrasts with the 0.3 correlation found for the period 1960–99.

During the 1990s there was no explicit rule for fiscal policy, despite the fact that the policy generated surpluses almost every year. In order to contain a large expansion of government expenditure, especially during the transition from the military regime to democracy, the budget was designed with an implicit commitment to expand government expenditure no more than the expected growth in output. This may have induced some moderate procyclicality in government expenditure.

What is interesting about this evidence is the negative correlation between government expenditure and copper prices. This evidence implies that fiscal policy

Figure 12.7
Correlation between the cyclical components of real GDP and real government expenditure



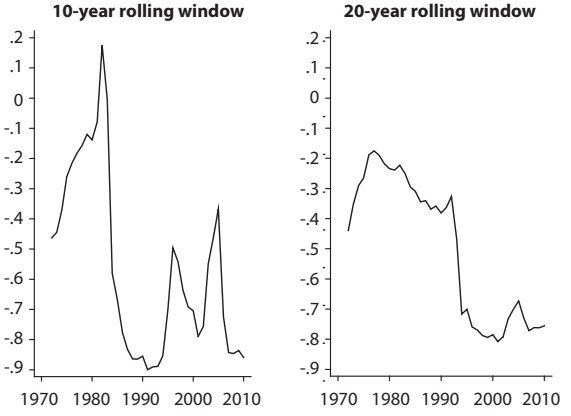
Sources: Díaz, Lüders, and Wagner (2010); and IMF, *World Economic Outlook* (April 2011).
Note: For each year, the graphs show the resulting correlation with the data contained in a window bounded by the current year and the k – 1previous years, bounds included. Cyclical components are calculated by first transforming the variables in log and then subtracting the trending component which is defined by an HP filter. Real government expenditure corresponds to the nominal total central government expenditure deflated by the GDP deflator. For trend estimate purposes, by using projections from the World Economic Outlook, the data is projected until 2016. During the second half of the 1990s, output and total government expenditure have a short period of positive co-movement which attains its maximal value for the years 1997–98.

leans against the wind regarding copper prices (Figure 12.8). In moments of rising copper prices, fiscal expenditure tends to slow down. This negative—or zero—correlation has been in the data even for periods prior to the 1980s, although to a lesser extent. In 1985, a copper stabilization fund was introduced in the context of an IMF program that was implemented after the debt crisis. Historically, the negative correlation was oscillating—from a long-term perspective—between values from –0.4 to –0.2 until the early 1990s, and then it becomes increasingly negative with the run-up of the copper price to its current record levels.

The existing empirical evidence showing the fiscal rule's strong stabilization effect is based on a comparison with a counterfactual exercise of a balanced-budget rule. Indeed, if there were a balanced budget rule the business cycle would be substantially more volatile (as shown in Medina and Soto, 2007a, and Céspedes, Gali, and Fornero, 2010). However, the counterfactual has never been the actual framework used for fiscal policy, and it is at odds with the negative correlation between copper prices and government expenditure.

Other evidence has used a dummy to separate the periods with the rule from those without the rule (Larraín and Parro, 2008), but the evidence on fiscal prudence reported here shows that there was no significant break in the actual

Figure 12.8
Correlation between the cyclical components of real price of copper and real government expenditure



Sources: Díaz, Lüders, and Wagner (2010); and IMF, *World Economic Outlook* (April 2011).
Note: For each year, the graphs show the resulting correlation with the data contained in a window bounded by the current year and the k − 1previous years, bounds included. Cyclical components are calculated by first transforming the variables in log and then subtracting the trending component which is defined by an HP filter. Real government expenditure corresponds to the nominal total central government expenditure deflated by the GDP deflator. For trend estimate purposes, by using projections from the *World Economic Outlook*, the data is projected until 2016.

behavior of fiscal policy in the early years of this century. Indeed, by that time there were also important changes in monetary policy. A full inflation target was introduced, monetary policy became instrumented with the nominal interest rate, the capital account was open, and the exchange rate was allowed to float. There were important changes in the whole macroeconomic regime.

Overall, despite a historically conservative fiscal policy, the budget rule of the 2000s was central to avoid an extreme expansion associated with soaring copper prices. Fiscal revenues were, on average, 21 percent of GDP during 2000–04 and went up to 26 percent, on average, in 2007–08. At the same time, the average contribution of CODELCO to fiscal revenues was only 5 percent during 2000–04, rising to 19 percent in 2007–08. In this latter period, the contribution of private copper companies was 12 percent of total revenues. Thus, copper accounted for almost a third of total revenues. Contrary to the experience almost a hundred years ago, when most taxes were replaced by the windfall of nitrates, fiscal responsibility was reinforced with the fiscal rule applied in the last decade.

ECONOMIC FLUCTUATIONS AND THE COPPER CYCLE

The copper price was historically an important driver of the business cycle in Chile, although its effects have changed over time. It is an important component of the terms

of trade, with consequent income and substitution effects on demand, and it also plays an important role in public finances. Therefore, it remains one of the driving forces of the Chilean business cycle. In the late 1980s, the Chilean economy entered into a regime characterized by moderate fluctuations, and it is important to examine whether this new regime has also changed the way copper affects the economy.

In this section we present empirical evidence on the relationship between copper prices and the business cycle. In particular, we show evidence on the volatility (standard deviation) of inflation, GDP, and RER. This evidence suggests that since the adoption of the inflation-targeting full flexible exchange rate regime in 1999, the response of the Chilean economy to copper price fluctuations has diminished.

The volatility of output and inflation in the Chilean economy from a long-term perspective is presented in Table 12.1. Figure 12.9 shows volatility of GDP growth since the 1960s. The figure shows that volatility has sharply declined since

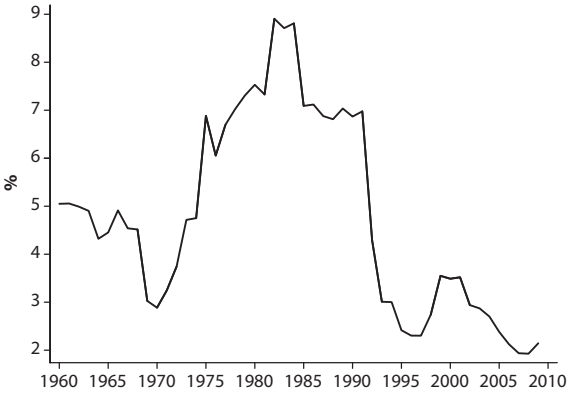
TABLE 12.1

Volatilities (percent)

Period	1950–2009	1950–1990	1990–2009
Inflation			
Average standard deviation	102.9	119.5	6.5
Average coefficient of variation	2.1	1.7	0.9
GDP growth			
Average standard deviation	5.0	5.6	3.2
Average coefficient of variation	1.2	1.6	0.6
GDP gap			
Average standard deviation	5.1	5.9	2.9
Average coefficient of variation	-85.0	-20.3	15.2

Sources: Díaz, Lüders, and Wagner (2010); and Central Bank of Chile.

Figure 12.9
GDP growth volatility, 1960–2010 (10-year rolling window)

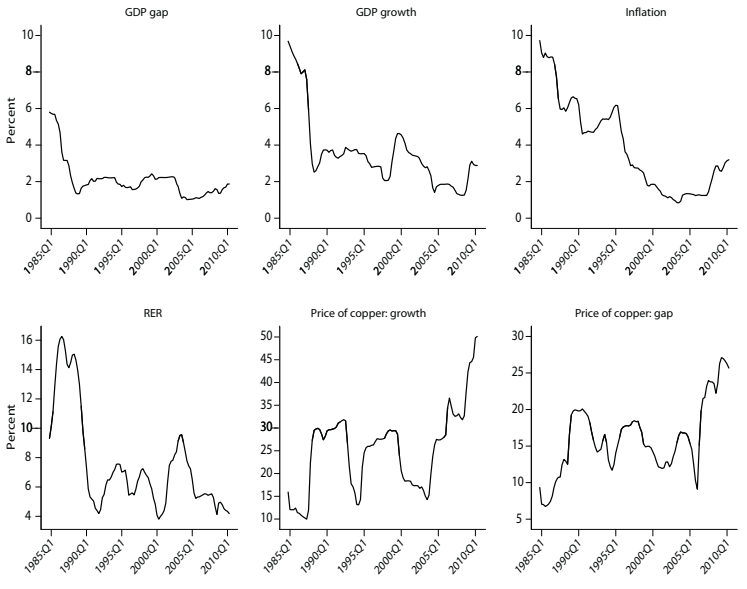


Sources: Díaz, Lüders, and Wagner (2010); and Central Bank of Chile.

1990. That year marks the beginning of the central bank's autonomy and the first implementation of an inflation-targeting regime, but where the inflation target was set on an annual basis in a path consistent with reducing Chile's historical two-digit inflation rates to normal international levels. In addition, during the 1990s the exchange rate regime was based on a band with infrequent adjustment of the central rate. For the case of inflation, its evolution may be contaminated with the very high inflation of the early 1970s, but the decline in volatility is confirmed by looking at the coefficient of variation. In addition, the decline in output volatility is also remarkable and consistent with what would be expected in a credible inflation targeting regime. It is worth highlighting the decline in volatility in the 1990s, but what we show in what follows is that the response of the economy to copper prices diminished further in the last decade.

Volatility measures based on quarterly figures are presented in Figure 12.10. All volatilities are computed using five-year rolling windows. Due to data availability, the sample starts in 1985. This figure shows the sharp decline in inflation and GDP volatility from 1990 onwards. In addition, it shows the volatility of the RER, which does not display a clear pattern during the last twenty years. This is not surprising, since a flexible exchange rate regime increases the volatility of the RER in order to act as a shock absorber. Regarding copper prices, the two

Figure 12.10
Volatilities
(percent, 5-year rolling window)



Sources: Central Bank of Chile; and IMF, *International Finance Statistics.*
Note: Gap corresponds to a percent deviation from an HP trend. Growth corresponds to 12-month percent changes. Inflation corresponds to 12-month CPI percent changes.

measures presented in Figure 12.10 show a sharp increase in volatility since the mid-2000s, which coincides with the rapid rise in copper prices.

Regarding GDP and inflation, the data show that the volatility of both variables declined during the 2000s, but at the end of the sample there is a significant increase. This recent period coincides with the shock of commodity prices that started in 2007 and the subsequent slump caused by the subprime crisis.

Indeed, Chile is one of the countries that experienced the sharpest increases in inflation among emerging economies in the run-up of commodity prices but also the largest decline since the crisis erupted (De Gregorio, 2010). The most remarkable component of the inflationary process of 2007–08 was how strongly the increase in international food prices was transmitted domestically. Inflation rose from a year-over-year rate of 2.6 percent in December 2006 to 9.9 percent in October 2008, and then declined to –2.3 percent in November 2009. This was largely due to Chile's high degree of commercial openness. There are practically no barriers to imports, no widespread protection of agriculture, or any large-scale distortions in the market pricing mechanism, so changes in external prices are quickly reflected in the domestic market. In fact, at least during the greater part of 2007, growing inflation was mostly caused by increasing food prices, rather than by a widespread inflationary process. Then the inflationary process spread to other prices, which subsequently fell sharply.

Of course, the issue is whether the rise in the volatility of output and inflation toward the end of the last decade was due to the greater volatility of copper prices or to general international conditions. To explain the inflation, it is easy to discard the impact of copper prices, but for output volatility more evidence is needed.

It is immediately clear from Figure 12.4 that GDP growth and real annual copper price changes display some co-movements. Since the late 1980s, the amplitude of economic activity has substantially decreased compared to the previous experience. Moreover, for similar amplitude of copper price shocks over the whole sample, we observe a break in growth amplitude. In fact, as previous figures show, growth volatility started decreasing in the early 1990s.

In order to explore the relationship between the price of copper and real GDP volatility, we calculated the standard deviation of annual growth over a 10-year rolling window of real GDP $\left(\sigma_{\text{gy}}\right)$, real price of copper $\left(\sigma_{Pcu}\right)$, and U.S. real GDP $\left(\sigma_{gy}^{US}\right)$. Controlling for the degree of trade openness, we estimated the following equation:[8]

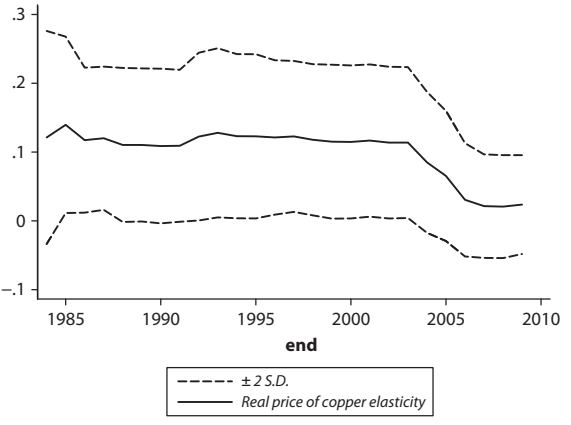
$$\sigma_{gy,t} = \beta_0 + \beta_1\sigma_{gy,t-1} + \beta_2\sigma_{gy,t}^{US} + \beta_3\sigma_{Poil,t} + \beta_4\sigma_{Pcu,t} + \beta_5 x + \varepsilon_t \quad (1)$$

[8]Using 5-year rolling volatilities does not change the results.

Variable x is an indicator of openness, measured as the share of exports plus imports in GDP.[9] The regression was estimated using an expanding window that starts in 1960. This strategy allows measuring the marginal impact of years added to the sample rather than changes in the results due not only to new data, but also to data that are being eliminated, which belong to a period with higher volatility.[10]

The results for the parameter β_4 are presented in Figure 12.11. It corresponds to the short-term impact of the volatility of copper prices on output volatility. The results for the long-run coefficient $\left(\beta_4 / \left(1-\beta_1\right)\right)$ are similar. The figure shows that indeed the fluctuations of copper prices in the 2000s have reduced their effects on output volatility.[11] The point estimate indicates that a 10 percent increase in copper price volatility increases output volatility by 1 percent. The increase in volatility observed more recently has the result of increasing the volatility of foreign output and oil prices, rather than increasing the response of the business cycle to copper fluctuations. Figure 12.12 shows actual and fitted volatility of output under two alternatives. The first one uses the values estimated with the fitted regression until 1999, and the second one with the full sample. The figure shows that the implied volatility of GDP in Chile would have been much larger with the estimations before the implementation of the inflation-targeting full flexible exchange rate regime.[12]

Figure 12.11
Impact of copper price volatility on GDP growth volatility, 1985–2010



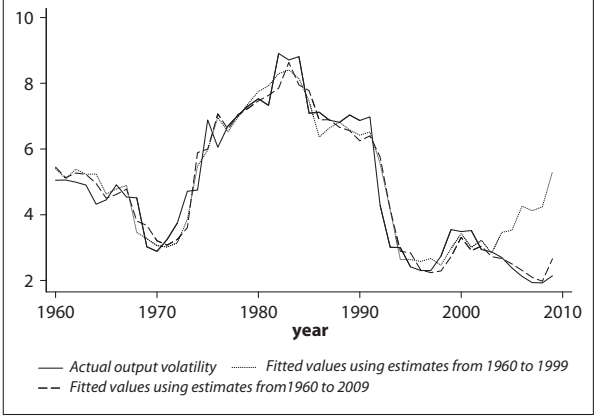
[9]Other controls were included, such as mining GDP as a share of real GDP and real exports; results hold including these variables. We also included the volatility of government expenditure and it was not significant.

[10]Results using a rolling regression are very similar and do not change the conclusions.

[11]Results are basically the same when the volatility of terms of trade is used instead of the volatility of the copper price.

[12]Larraín and Parro (2008) show that exchange rate flexibility reduces output volatility. They use an index of exchange market intervention using the change in reserves, and show that the lower this index is, the lower is output volatility.

Figure 12.12
Actual and fitted output volatility, 1960–2010



The evidence presented in this section suggests that after the implementation of the inflation-targeting full flexible exchange rate regime, the economy has become less volatile and more resilient to copper price fluctuations.

TERMS-OF-TRADE SHOCKS, REAL EXCHANGE RATE, AND LONG-RUN DYNAMICS

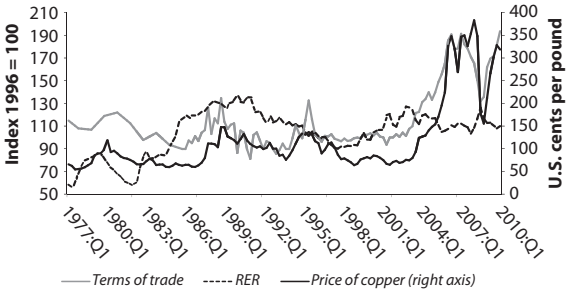
In this section we study the impact of terms of trade on the RER. This price is measured as the ratio between the prices of foreign goods (in domestic currency) and the prices of domestic goods. Hence, it represents the cost of foreign goods in terms of domestic goods; a rise in this relative price is a real depreciation. Figure 12.13 shows the evolution of the price of copper, terms of trade, and the RER. It is clear that the terms-of-trade shocks have been particularly sizable in the last decade, mainly driven by copper price movements; while the RER has fluctuated but moderately with respect to export price shocks.[13]

There are many approaches for studying RER dynamics, and a model that considers the entire macroeconomic environment would be most desirable. However, here we follow an eclectic approach; we use a vector-error correction model introduced by Johansen (1988). This modeling strategy allows estimating a reduced-form representation of the dynamics and interactions between the RER and its fundamentals.

This type of model has been used by, among others, Clark and MacDonald (1998) for analyzing RER movements and misalignments from the RER's long-run fundamentals, Céspedes and De Gregorio (1999) used a similar approach for the period before 2000. The approach supposes both a short-run and a long-run relationship between RER and a set of fundamental variables (Table 12.2).

[13]Over the sample period, the price of copper and terms of trade have a correlation in levels slightly above 0.9, and were equal to 0.67 in quarterly percent changes during the period post-2000.

Figure 12.13
Real exchange rate, terms of trade, and price of copper, 1977–2010



Source: Caputo, Núñez, and Valdés, 2010.

TABLE 12.2

Cointegration rank test

Null hypothesis	Eigenvalue	Trace-Statistic	Critical Value	p-val
None *	0.33	97.97	69.82	0.00
At most 1	0.17	46.69	47.86	0.06
At most 2	0.09	21.72	29.80	0.31
At most 3	0.06	9.33	15.49	0.34
At most 4	0.01	1.42	3.84	0.23

Note: The VECM has no trend and an unrestricted constant, the underlying VAR has 3 lags. (*) means rejection of the null hypothesis at 95% of confidence.

The long-run cointegrating relationship implicit in this approach is interpreted as the fact that these variables move together in the long run. The adjustment of the RER to changes in fundamentals is gradual. The relationship implied by economic theory does not necessarily hold at short frequencies, but in the long term RER moves according to its fundamentals.

Hence, in this framework the RER is consistent with a long-run equilibrium condition on the balance of payments, which is determined by a set of fundamental variables. These fundamentals could be listed by domestic and foreign key variables. Following Faruqee (1995), these variables can be summarized according to the two different channels through which they affect the RER. One set of fundamentals includes those related to the current account (according to trade conditions) and the other is related to the capital account (according to the net foreign assets position). Regarding trade, the variables are relative productivity between tradables and nontradables (according to the well-known Balassa–Samuelson effect), government expenditure, and terms of trade. Regarding the capital account, the variable we use is the net foreign assets position, which summarizes the country's propensity to be a net lender or a net debtor.

The variable *TNT* is the productivity ratio between the tradable and the nontradable sectors. This ratio summarizes the Balassa–Samuelson effect, and has a negative impact on the RER. With labor mobility, equal wages across sectors, and

purchasing power parity (PPP) for tradable goods, an increase in the productivity of the tradable sector induces an increase in wages in the nontradable sector (De Gregorio, Giovannini, and Wolf, 1994). This increase in wages in the nontradable sector leads to an increase in costs (and relative prices) in the nontradable goods. Hence, with such a mechanism the RER tends to appreciate.

The variable *ToT* has a negative impact on the RER, that is, it generates a real appreciation. An increase in *ToT* produces an income effect and raises demand for both tradable and nontradable goods. Since prices of tradable goods are externally determined, an increase in the terms of trade raises the relative price of nontradable goods. The variable (*G/Y*) is the ratio of government expenditure to GDP, which has also a negative impact on the RER under the assumption that most of government expenditure goes to nontradable goods. Finally, as a stock variable, we include the net foreign asset position as a percentage of GDP (*F/Y*). This variable has a negative impact on the RER. In fact, an increase in foreign assets is consistent, from an intertemporal point of view, with a lower sustainable level of net exports, which induces an RER appreciation. Hence, we estimate the following equation:

$$\log\left(RER_t\right) = \beta_0 + \beta_1 TNT + \beta_2 ToT_1 + \beta_3 \left(G/Y\right)_t + \beta_4 \left(F/Y\right)_t \varepsilon_t \tag{2}$$

We follow the traditional vector-error correction model procedure and estimate a vector error correction representation with one long-run relationship and two lags, as described by this equation (3):[14]

$$\Delta y_t = c + \alpha\beta y_{t-1} + \sum_{i=1}^{p=1} \delta_i \Delta y_{t-i} + u_i \tag{3}$$

where y_t is a vector, such as $y_t = \left(ToT\ TNT\ (F/Y)\ (G/Y)\ RER\right)'$, and all variables are in log except government expenditure and net foreign assets. We estimate the system represented in equation (3) using data from 1977:Q1 to 2010:Q3. This type of reduced-form model allows us to analyze the path of the RER after a permanent terms-of-trade shock.

We then estimate equation (3) splitting up the sample period in 1999 (see Table 12.3). September this year corresponds to the beginning of the inflation-targeting full flexible exchange rate regime. By that time, the inflation-targeting framework in Chile had been operating for almost a decade, though with a yearly target, there were capital controls, there was a currency regime based on exchange rate bands. Since 2000 the peso has floated according to a flexible regime where interventions have occurred sporadically, according to a rule-based scheme, to preserve monetary policy independence.

Results presented in Figure 12.14 show the response in levels of the RER to an orthogonalized permanent terms-of-trade shock. As the RER is in log and multiplied by 100, the level attained after the shock can be directly interpreted as a percent change from the initial equilibrium. The contemporaneous effect is

[14]For further details see Appendix A.

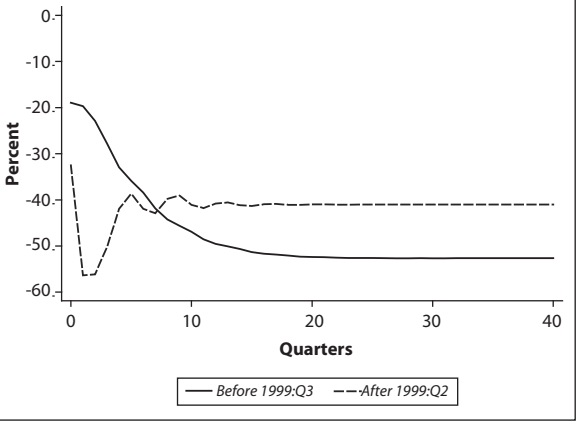
TABLE 12.3

VECM estimates

	1977:Q1–1999:Q2					1999:Q3–2010:Q3					
	D(ToT)_t	D(TNT)_t	D(F/Y)_t	D(G/Y)_t	D(TCR)_t		D(ToT)_t	D(TNT)_t	D(F/Y)_t	D(G/Y)_t	D(TCR)_t
Z(t-1)	-0.06	-0.06***	0.30***	-0.03**	-0.06**	Z(t-1)	0.95***	0.04	1.07**	-0.13***	-0.37*
	(0.04)	(0.02)	(0.06)	(0.01)	(0.03)		(0.26)	(0.10)	(0.44)	(0.03)	(0.22)
D(ToT)_t-1	-0.22**	0.05	-0.43***	-0.02	0.12*	D(ToT)_t-1	-0.44	-0.12	-1.18**	0.09***	0.08
	(0.10)	(0.06)	(0.15)	(0.04)	(0.06)		(0.29)	(0.11)	(0.48)	(0.03)	(0.23)
D(ToT)_t-2	-0.22**	0.05	0.60***	-0.02	0.05	D(ToT)_t-2	-0.99***	0.04	-0.07	0.07**	0.21
	(0.10)	(0.06)	(0.16)	(0.04)	(0.07)		(0.30)	(0.11)	(0.50)	(0.03)	(0.24)
D(TNT)_t-1	-0.05	-0.21**	-0.43	-0.10	0.11	D(TNT)_t-1	0.41	-0.32*	0.02	-0.02	0.42
	(0.18)	(0.10)	(0.27)	(0.07)	(0.11)		(0.43)	(0.17)	(0.73)	(0.04)	(0.35)
D(TNT)_t-2	-0.03	0.15*	-0.41*	-0.08	-0.08	D(TNT)_t-2	-0.44	-0.20	0.10	-0.00	0.51
	(0.16)	(0.09)	(0.24)	(0.06)	(0.10)		(0.43)	(0.17)	(0.73)	(0.04)	(0.35)
D(F/Y)_t-1	-0.03	0.03	-0.30***	0.01	0.04	D(F/Y)_t-1	0.04	0.03	0.24	-0.03**	-0.08
	(0.08)	(0.04)	(0.12)	(0.03)	(0.05)		(0.12)	(0.05)	(0.21)	(0.01)	(0.10)
D(F/Y)_t-2	0.35***	-0.04	-0.12	-0.00	0.02	D(F/Y)_t-2	0.31**	-0.06	0.32	-0.01	-0.08
	(0.07)	(0.04)	(0.10)	(0.02)	(0.04)		(0.13)	(0.05)	(0.22)	(0.01)	(0.11)
D(G/Y)_t-1	0.07	0.78***	-0.01	-0.60***	0.30	D(G/Y)_t-1	-0.87	-0.99**	-1.16	-0.04	-0.42
	(0.29)	(0.17)	(0.43)	(0.11)	(0.18)		(1.24)	(0.48)	(2.08)	(0.13)	(1.01)
D(G/Y)_t-2	0.52	0.10	0.30	-0.16	0.03	D(G/Y)_t-2	0.57	-0.53	2.83	0.17	-0.68
	(0.32)	(0.19)	(0.48)	(0.12)	(0.20)		(1.22)	(0.47)	(2.04)	(0.13)	(0.99)
D(TCR)_t-1	-0.18	-0.02	0.27	0.03	0.45***	D(TCR)_t-1	-0.24	0.02	-0.13	0.04*	-0.05
	(0.18)	(0.10)	(0.27)	(0.07)	(0.11)		(0.22)	(0.08)	(0.37)	(0.02)	(0.18)
D(TCR)_t-2	0.38**	-0.20**	0.38	-0.20***	0.02	D(TCR)_t-2	-0.12	-0.14*	0.36	0.05**	-0.41**
	(0.17)	(0.10)	(0.26)	(0.06)	(0.11)		(0.21)	(0.08)	(0.35)	(0.02)	(0.17)
Constant	-0.00	0.00	-0.00	-0.00	-0.00	Constant	0.00	0.01	0.00	0.00**	0.01
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)		(0.01)	(0.00)	(0.02)	(0.00)	(0.01)
Coint vector	0.57	1.07	0.25	-0.50	1	Coint vector	3.83	-0.81	-1.57	21.17	1
SE of CV	0.22	0.22	0.04	0.51	----	SE of CV	0.54	1.22	0.22	3.01	----
N	87	87	87	87	87	N	45	45	45	45	45
R^2	0.36	0.44	0.48	0.56	0.39	R^2	0.46	0.40	0.42	0.65	0.35

Note: Z(t-1) denotes the lagged cointegration residual. CV denotes the cointegration vector, and SE denotes standard errors. *, **, and *** indicate significance at 5%, 10%, and 1%, respectively.

Figure 12.14
Log RER response to 100 percent orthogonal terms-of-trade shock



larger in the period post-1999; it varies from –20 to –30 percent, respectively. This result is consistent with the expected response of a flexible exchange rate regime where external shocks are directly absorbed by the nominal exchange rate. In the model with pre-1999 estimates, the RER starts appreciating sharply three quarters after the shock. After two years, the real appreciation is greater than the one that resulted from the post-1999 estimates. When the effect of the shock stabilizes, the equilibrium RER reached with pre-1999 estimates is more overvalued than this one reached with post-1999 estimates.

This result points out that during the period of inflation-targeting full flexible exchange rate regime, terms-of-trade permanent shocks have more immediate effects on the RER but are smaller in the long run. During the period of exchange rate bands the effects of copper price shocks are more gradual, but deeper. In fact, as we can see in Table 12.3, the adjustment parameter of long-run RER disequilibrium has increased (in absolute terms) from –0.06 to –0.37 during the period post-1999. That means that a higher share of lagged RER disequilibrium is corrected every period in the vector-error correction model system. RER fluctuations converge more quickly to the RER's long run equilibrium after a permanent shock.

These results show that in a flexible exchange rate regime, the exchange rate acts as a shock absorber. Of course, it is not free of costs when the exchange rate adjustment is faster, but the final level is less affected. This evidence points toward a more efficient mechanism for transmission of external shocks. External shocks are primarily absorbed by the nominal exchange rate and then directly transmitted to the RER. A fully flexible nominal exchange rate regime is sometimes associated with higher short-run volatility, although that volatility does not necessarily imply greater long-run uncertainty. Hence, nominal exchange rate flexibility need not always be associated with long-run real costs related to

more volatility.[15] In the next section we analyze more deeply the issue of volatility of the RER at different horizons.

Short-term volatility can be hedged with developed forward markets, while price signals are transmitted more quickly to the economy. Moreover, as discussed in De Gregorio and Tokman (2005), the implementation of the floating exchange rate regime has motivated the proliferation of a deeper exchange rate derivative market. At the onset of the flexible currency regime in 1999, the total amount of both local and foreign-derivative contracts represented 1.7 times GDP, and 10 years later this ratio increased to nearly 3.7. Additionally, there has been a reduction in balance sheet vulnerabilities. The corporate sector has eliminated its exposure to nominal exchange rate fluctuations. A flexible exchange rate reduces financial imbalances stemming from exchange rate fluctuations.

MACROECONOMIC FLUCTUATIONS AND REAL EXCHANGE RATE VOLATILITY

Since the peso has been allowed to float its volatility has increased.[16] External shocks are in part directly transmitted to the Chilean economy through nominal exchange rate fluctuations which affect, among other variables, the RER and economic decisions. Since the RER is a relative price that in the long run leads allocation of resources, it is important to examine how RER volatility has been affected.

A fully flexible nominal exchange rate policy implies a rise in the speed and number of channels through which the economy is hit by external shocks. Moreover, in a sticky-prices world we can argue that a considerable part of RER fluctuations are caused by nominal exchange rate movements, at least in the short run.

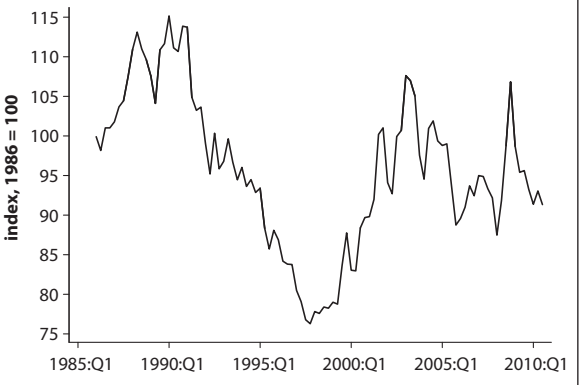
Nominal exchange rate flexibility contributes to smooth external fluctuations. In fact, when external shocks hit the economy this price moves freely instead of staying fixed and generating imbalances, misalignments, or further costly real adjustments. Thus, corrections occur through the price mechanism and not through quantities. Real effects should be reduced, as a traditional Mundell–Fleming analysis would imply.

However, the RER absorbs real shocks and as a relative price it moves in order to convey information that, in part, leads to changes in the allocation of resources between the tradable and the nontradable sectors. In the economy, for the sake of minimizing real costs, it is a crucial condition that relative prices must not be distorted. It is not entirely clear whether the increased nominal exchange rate volatility that we have been experiencing since the early 2000s is not distorting and inefficiently transmitted to the RER, a key relative price. To answer this

[15]In the context of an appreciation due to a boom in the price of natural resources, welfare costs are different across sectors. The stabilization of the exchange rate generates welfare gains in the tradable goods sectors, but with costs of inefficiency that in general may outweigh the gains. For a formal analysis and calibration of this problem see Lama and Medina (2010).

[16]During the 2000s, the standard deviation of four quarter percent changes has more than doubled compared with its average during the 1990s; it has increased from 2 percent to 4.6 percent.

Figure 12.15
Real exchange rate, 1985–2010



Source: Central Bank of Chile.

question, it is fundamental to understand how nominal and real shocks are transmitted to the RER. Since short- and long-run RER movements have different implications, a central question is how short- and long-run RER volatility have behaved in the face of higher nominal exchange rate volatility.

For the 1990s, Soto (2003), using a Blanchard–Quah approach, estimated that 30 percent of the short-run variance of RER forecast errors is explained by nominal shocks. However, it remains unanswered how short- and long-run RER volatility have been affected during the last 25 years.

Short-run RER fluctuations do not have the same implications that long-run fluctuations do. In fact, short-run RER volatility induced by temporary external fluctuations would be consistent with RER playing a shock absorber role in the short run. As long as fluctuations are temporary, long-run reallocations and major adjustments are not needed. Hence, it would be inefficient if in the presence of temporary external real fluctuations, we observed contemporaneous increases in the long-run RER rate volatility. Consequently, this situation could be interpreted as a source of instability and welfare costs.

In order to analyze this question, we need to decompose RER dynamics into long- and short-run fluctuations. There are not many straightforward frameworks for doing this, because long- and short-run RER components are not observed variables.

Stock and Watson (2007) developed the unobserved components and stochastic volatility framework for analyzing time-varying stochastic volatilities of the permanent and transitory components of inflation in the United States. This framework is well suited to studying persistent processes with stochastic breaks. Thus, it allows modeling a variable such as the RER and decomposing it into two unobserved variables: permanent and transitory components. Hence, it could help in disentangling different aspects of our question.[17]

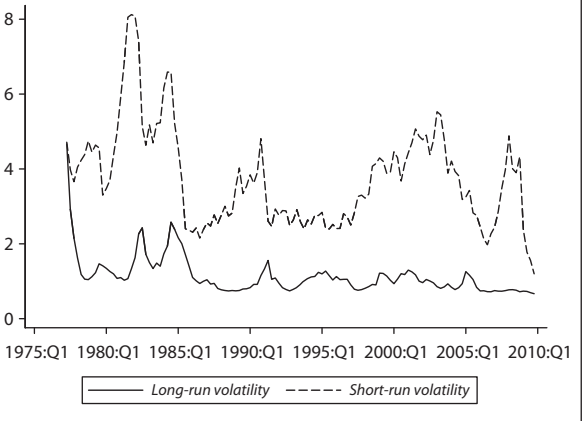
[17]Further details of the model are explained in Appendix B.

The results presented in Figure 12.16 show short- and long-run stochastic volatilities for the Chilean RER at quarterly frequency. Compared to the level experienced during the 1990s, evidence points toward an increase of average short run volatility during the 2000s. However, long-run volatility has remained stable since the late 1980s. Hence, the increased exposition of the RER, through the channel of the flexible exchange rate, has been mostly reflected by rising short-run RER fluctuations. This is consistent with the argument that in the short run the floating nominal exchange rate framework has worked as a shock absorber mechanism without necessarily increasing long-run RER volatility.

Moreover, it is worth noting that during the late 1970s and early 1980s both kinds of RER volatility, and especially long-run RER volatility, fluctuated more than during the recent period. In fact, the early 1980s corresponds to a period of external and internal imbalances and a strong real adjustment. At this time, the nominal exchange rate was fixed and RER was strongly appreciated. This generated a severe balance-of-payments and financial crisis that led to a strong devaluation with very large real losses in output and employment.

Besides, during the late 1990s, early 2000s, and late 2000s, the Chilean economy was affected by worldwide turbulent episodes. During the late 1990s the Asian and Russian crisis hit emerging economies generating strong devaluations and high volatility. For the Chilean economy, these episodes represented sizeable external shocks that generated high volatility in the nominal exchange rate. As we can see, these shocks did not severely affect long-run RER volatility. However, short-run RER volatility stayed high for a long period during the early 2000s. To some extent, exchange rate flexibility helped absorb external shocks, minimizing the real effects by increasing short-run RER volatility.

Figure 12.16
Chilean RER stochastic volatilities, 1975–2010



Source: Author's calculations.
Note: Results were obtained with a Stock and Watson (2007) UC-SV model; for details see Appendix B.

However, in some cases excessive nominal exchange rate volatility could be incoherent with fundamentals and thus could be a source of macroeconomic instability. Therefore, even in a fully flexible exchange rate regime the central bank may intervene in the foreign exchange market. Interventions in a fully flexible exchange rate regime did occur in Chile in 2001, 2002, 2008, and 2011 (De Gregorio, 2011).

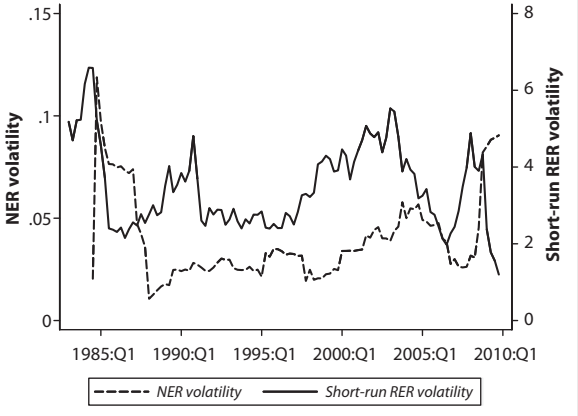
Overall, the main implications we can draw from the evidence make clear that since the implementation of fiscal prudence and especially during the fully flexible exchange rate regime, long-run RER volatility has remained stable. Moreover, since the early 2000s, short-run RER volatility has fluctuated more. However, it has not reached extremely high levels in spite of systematic increases in nominal exchange rate volatility (see Figure 12.17).

Along the same line, sharp external fluctuations that directly hit the Chilean economy, such as copper price shocks, have had a particular impact on the short-run RER volatility (see Figure 12.18). However, these recent sharp spikes do not produce excessive volatility in the RER, either in the short or the long run.

The evidence reported in Figures 12.17 and 12.18 shows that the macroeconomic policy framework applied in Chile has been able to mitigate both the excess of volatility implied by external shocks, in particular by copper price shocks, and the effects of fluctuations in the nominal exchange rate on the volatility of the RER, and hence on competitiveness.

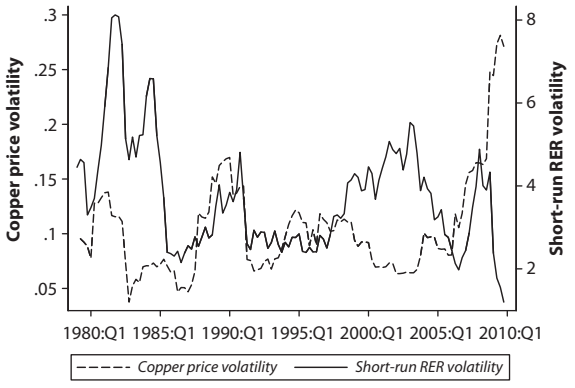
We may conclude that the Chilean policy framework as a whole, and in particular the country's currency regime, have operated as shock absorber devices. In fact, in the face of sharp external shocks, evidence shows that stabilizing mechanisms are at work making the Chilean economy much more resilient than in earlier periods.

Figure 12.17
Short-run RER and nominal exchange rate volatilities, 1985–2010



Note: NER volatility corresponds to the standard deviation of quarterly percent changes estimated on a 10-quarter rolling window.

Figure 12.18
Short-run RER and copper price volatilities, 1980–2010



Note: Copper price volatility corresponds to the standard deviation of quarterly percent changes estimated on a 10-quarter rolling window.

SIMULATION OF A COPPER PRICE SHOCK USING A DSGE MODEL

To further analyze the effects of the current policy framework on economic performance after a commodity (copper) price shock, we simulate a dynamic stochastic general equilibrium model on a small, open emerging-market economy. The model has been estimated for the Chilean economy with data from 1986 through 2007.[18]

The size of the temporary shock is 40 percent, which corresponds roughly to the actual size of commodity-price shocks observed before the financial crisis.

Three alternatives for the monetary policy are considered: (i) a Taylor policy rule under which the central bank responds to changes in output and core inflation;[19] (ii) a Taylor-type policy rule where the monetary authority not only responds to output and inflation but also to RER fluctuations;[20] and (iii) a Taylor rule like that in (i) but coupled with a successful exchange rate intervention that keeps the RER unchanged for two quarters.[21] The results of these simulations are presented in Figure 12.19.

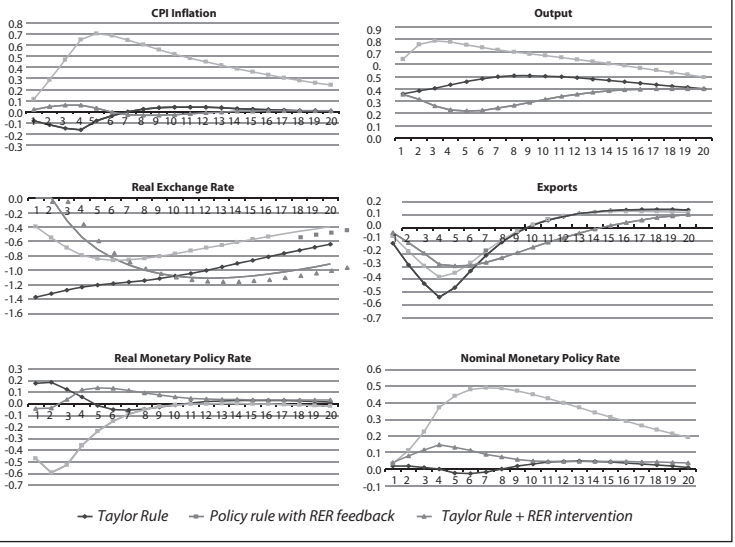
[18]For details, see Medina and Soto (2007b).

[19]The simulations use core rather than CPI inflation in the policy rule in order to capture the forward-looking behavior of the central bank in Chile. In small open economy models, like the one utilized in our exercise, it is often the case that a forward-looking policy rule leads to indeterminacy. To avoid this problem, we assume that the central bank considers *core* inflation a good predictor of future inflation and responds to fluctuations in this variable.

[20]This type of rule mimics the behavior of the Central Bank of Chile during the 1990s when, alongside a target for inflation, there was an explicit exchange rate band.

[21]The exchange rate intervention is modeled as a shock to the uncovered interest rate (UIP) condition in order to keep the real exchange rate fixed for two periods (quarters). The shock converges back to zero with a persistence of 0.85.

Figure 12.19
Impulse-response to a copper price shock



The copper price shock leads to a mild real appreciation of the currency. The extent of the appreciation is smaller than the one reported in the estimations for the long-run RER, since in this case the shock is smaller—it is only to the price of copper, which is only a part of the terms of trade. The estimations also take into account policy reaction, and the change in the copper price is assumed to be transitory, contrary to cointegrating regressions that estimate the effects of permanent shocks. In addition, the small effect on the RER is explained in part by the fact that the model assumes that the government follows a structural balance targeting rule, under which most of the proceeds from a higher copper price are saved. The shock also generates a fall in exports, due to the real appreciation, and a boost to other domestic sectors that leads to an increase in total output.

The effect on inflation of the copper price shock depends crucially on the monetary policy. Under the Taylor policy rule (i), although there is an expansion in total output, the appreciation of the currency is such that inflation decreases marginally after the shock. On the other hand, when the central bank systematically responds to fluctuations in the RER—under policy rule (ii)—the real interest rate falls in response to the shock, which leads to a more muted appreciation of the currency and generates a larger expansion in output. As a result, inflation increases and the nominal policy rate rises. Notice that policy rule (ii) reduces the volatility of exports, but it increases the volatility of overall output and of inflation, and therefore it reduces welfare.

If the central bank is able to successfully avoid RER fluctuations in the short run (two quarters in the simulations that fade away slowly) by using an alternative instrument other than the policy rate (e.g., by intervening in the foreign currency

exchange market), the result is a more muted initial response of exports to the shock and a slight increase in inflation. Contrary to the other policy rules, this policy results in a reduction of output in the short run due to the impact on the nontradable sector. Notice, however, that in order to contain inflation pressures, in this case the policy rate—both nominal and real—needs to increase after some quarters. This in turn results in a delayed appreciation of the currency and precludes exports from returning quickly to their steady-state level.

Overall, this model shows that letting the exchange rate fluctuate may result in smaller welfare losses, in particular considering that inflation falls and output rises. Of course, in this model the exchange rate intervention is assumed to be successful and the intervention is used only as a short-run stabilization tool. In addition, this model does not allow for bubbles or extreme deviations of exchange rates that may justify certain forms of intervention (De Gregorio, 2010).

CONCLUDING REMARKS

The impact of natural resources on the business cycle and economic development has been an important topic in economic research and policy. Chile is an economy that has been able to grow quickly and build a stable macroeconomic environment while at the same time it is rich in natural resources, in particular copper. Therefore, Chile has suffered from neither the curse of natural resources nor the excessive volatility in terms-of-trade fluctuations. Compared to other countries abundant in natural resources but unable to take advantage of them, Chile has relatively strong institutions, high levels of human capital, and a stable macroeconomic environment, all of which help in avoiding the natural resource curse. On the other hand, the reduced impact of copper price fluctuations on the business cycle is due to macroeconomic policies.

This chapter has focused on how increasingly resilient the Chilean economy has been to copper price fluctuations. Trying to disentangle all of the underlying factors is a difficult task and may involve subjective judgment. Indeed, even recent evidence is inconclusive about what proportion of the external conditions drives output instability in developing countries.[22] For this reason, in this chapter we use evidence from different areas to examine the impact of copper prices on economic fluctuations. The evidence shows that having a flexible exchange rate, a rule-based fiscal policy, and a flexible inflation-targeting regime have all contributed to this resilience. Chile has followed prudent fiscal policies since the mid-1980s, which is an important factor in explaining the reduction in the volatility of output observed since the 1990s. In addition, the further decline in volatility and more limited impact of copper are due to the implementation of monetary policy with an inflation-targeting framework and a floating exchange rate.

[22]See for example Raddatz (2007) and Castillo and Salas (2010). While the former reports that external conditions explain a small fraction of output fluctuations on low-income economies, the latter argues for the case of Chile and Peru that the commodity price boom of the mid-2000s is a main driver of the economic expansion of recent years.

The operation of the fiscal rule since the early 2000s has provided predictability to pursue the inflation target based on a two-year horizon. Thus, fiscal and monetary policies have complemented to reduce the amplitude of the business cycle and provide sound basis for long-term growth, while reducing the dependence of Chile's economic performance to copper price fluctuations.

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APPENDIX A

We follow the traditional *vector-error correction model* literature and estimate a VAR(p) in levels in order to select the optimal lag length of the underlying unrestricted VAR. Following standard criteria, we find that three lags adequately represent the dynamics contained in the data. Traditional cointegration tests, trace, and eigenvalue statistics (see Table 12.2 in the text) and economic theory suggest one long-run relationship among the mentioned set of variables. Then, we use a Johansen (1988) technique and estimate the following vector-error correction representation:

$$\Delta y_t = c + \alpha\beta y_{t-1} + \sum_{i=1}^{p-1} \delta_i \Delta y_{t-i} + u_t \qquad \text{(A1)}$$

Where y_t is a (5 × 1) vector such as $y_t = (ToT\ TNT\ (F/Y)\ (G/Y)\ RER)'$, all the variables are in log except government expenditure and net foreign assets, the matrices δ_i (5 × 5) contain short-run parameters and β is a (1 × 5) vector of cointegration, α is a (5 × 1) vector with long-run disequilibrium coefficients, and c is a (5 × 1) vector with intercepts. The innovations are represented by the vector u_t which has mean zero and a variance-covariance matrix $\Omega = \Sigma\Sigma'$ which is assumed to have a structure described by a Cholesky decomposition, such as Σ is lower triangular and has the same ordering of exogeneity as the one shown by vector y_t. Hence, terms-of-trade innovations are the most exogenous elements in the system, and so

TABLE 12A

Unit root tests

		Augmented Dickey-Fuller		Phillips-Perron	
Lags	**Variable**	**Zt**	**p-val**	**Zt**	**p-val**
1	F/Y	-1.21	0.67	-1.09	0.72
2	F/Y	-1.34	0.61	-1.15	0.69
3	F/Y	-1.22	0.66	-1.17	0.69
1	G/Y	-2.41	0.14	-3.12	0.02
2	G/Y	-2.02	0.28	-3.07	0.03
3	G/Y	-1.87	0.34	-3.00	0.03
1	RER	-3.09	0.03	-2.66	0.08
2	RER	-2.59	0.09	-2.66	0.08
3	RER	-2.21	0.20	-2.66	0.08
1	ToT	-0.73	0.84	-0.92	0.78
2	ToT	-0.32	0.92	-0.74	0.84
3	ToT	0.06	0.96	-0.55	0.88
1	TNT	-1.51	0.53	-1.47	0.55
2	TNT	-1.56	0.50	-1.50	0.53
3	TNT	-1.77	0.40	-1.51	0.53

Note: Tests assume that under the null hypothesis the variables have a unit root, Zt, which represent the test statistic, and p-val corresponds to the p-value.

on. We estimate the system represented in equation (A1) using data from 1977:Q1 to 2010:Q3 (see Table 12.3 in the text).

APPENDIX B

We follow the framework developed by Stock and Watson (2007) for decomposing the RER into a permanent component τ_t and a transitory one η_t. The permanent component τ_t, and the variances of ε_t and η_t follow a random walk:

$$RER_t = \tau_t + \eta_t, \quad where \quad \eta_t = \sigma_{\eta,t}\xi_{\eta,t}$$
$$\tau_t = \tau_{t-1} + \varepsilon_t, \quad where \quad \varepsilon_t = \sigma_{\varepsilon,t}\xi_{\varepsilon,t}$$

where $\xi_t = \left(\xi_{\eta,t} \quad \xi_{\varepsilon,t}\right)$ iid $N(0, I_2)$ are independently distributed and stochastic volatilities are modeled as:

$$\ln \sigma^2_{\eta,t} = \ln \sigma^2_{\eta,t-1} + \upsilon_{\eta,t}$$
$$\ln \sigma^2_{\varepsilon,t} = \ln \sigma^2_{\varepsilon,t-1} + \upsilon_{\varepsilon,t}$$

where $\upsilon_t = \left(\upsilon_{\eta,t} \quad \upsilon_{\varepsilon,t}\right)$ iid $N(0, I_2)$ are independently distributed. The model is written in a state space form and can be estimated using a Kalman filter and solved numerically through a Gibbs sampler. Results are shown in Figure 12.16.

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PART V

Governance and Institutional Aspects

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CHAPTER 13

The Political Economy of Reform in Resource-Rich Countries

RAGNAR TORVIK

INTRODUCTION

Since the 1950s and until recently, economists have argued that countries with a comparative advantage in production based on their natural resources would suffer from declining terms of trade. The price of raw materials relative to industrial goods would decline over time, according to the argument, making specialization in natural-resource-based production unattractive. Paradoxically, recently economists have argued that specialization in natural resources is unattractive for exactly the opposite reason: such specialization is so economically beneficial that in fact it may turn into a curse. Led by Sachs and Warner (1995, 1997), many have argued that on average, resource-abundant countries have slower growth than resource-poor countries. But asking what the average effect of oil is in Norway and Nigeria, or the average effect of diamonds in Botswana and Sierra Leone, might not be the most interesting or most relevant question. Rather than the average, it is more important to understand the variation. Why has oil induced prosperity in some countries but stagnation in others? In this chapter, I argue that the main reason for this is that different political incentives map into different political outcomes.

Economic institutions and economic reform are the main drivers of economic and political development after the discovery of valuable natural resources. At least two questions arise: How *do* countries reform when they receive resource rents? and How *should* countries reform when they receive resource rents? In the next section, I provide a short discussion of the first question.

The second question is more difficult, being normative rather than positive. Nevertheless, to shed at least some light on that question I start out in the

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subsequent section by comparing the economic responses to resource abundance between two kinds of countries: those where institutions allow new income opportunities to benefit a broad segment of the population and those where this does not occur. As will be seen, the economic response to resource abundance can be either more pessimistic or more optimistic than standard economic theories suggest. In turn, in the fourth section I describe in more detail the kinds of differences in institutional design that can be decisive. In the fifth section I move further into details, comparing the political incentives built into petroleum funds and the differences in performance they have led to. The last section offers conclusions.

HOW DO COUNTRIES REFORM WHEN THEY RECEIVE RESOURCE RENTS?

During development, most countries undertake reforms that substantially change the private and political incentives built into the system. Current reforms are initiated by those with current political power. And since reform is likely to change incentives—indeed this is often the main reason for reform—those who decide to initiate reform will face different incentives after the reform than they did before it. In turn, this may influence the type of reform that is undertaken.

When countries get new economic opportunities, such as the discovery of valuable natural resources or an increase in the price of resources already known to exist, they may reform in very different directions. If the current political system ensures that the interests of the population at large are well represented, resource abundance may generate reform that ensures that the resource wealth is managed in a way that benefits broad segments of society. On the other hand, if the current political system is not checked in such a way that it represents the interests of the general population, reform may be undertaken with the aim of preserving and strengthening old privileges. In this way, new economic opportunities may generate types of reforms that vary greatly across countries. In turn, as we will see below, the type of reforms will decide to what extent the new opportunities increase or decrease welfare.

There are many examples in which institutions have been reformed in a direction that allows the broad population to take advantage of new economic opportunities, and they range from the 1862 Homestead Act in the United States to allocate frontier land to a broad segment of the population, to the 1990 establishment of the Norwegian Petroleum Fund to manage the resource wealth of the country. However, there are also many examples in which new economic opportunities have led politicians to reform in a direction that *limits* the possibilities for the population to take advantage of the opportunities.

Ross (2001a) shows that in countries like the Philippines, Indonesia, and Malaysia, the existence of timber from the rainforests and increased timber prices contributed to the deliberate dismantling of state institutions by politicians. The rainforests provided the basis for opportunities to pocket large sums of money through exploitation of the forest—but for this to be possible, the state institutions

established to counteract abuses and overexploitation had to be undermined. Politicians had incentives for dismantling institutions rather than building them—and the reason was the abundance of valuable natural resources. Ross (2001b) also finds that countries with large oil deposits become *less* democratic. In such countries, democracy can represent a cost for politicians because it hinders them from using the large public income as they please. Large income from resources can therefore create political incentives for weakening democracy.

Collier and Hoeffler (2009) show how "checks and balances," institutional rules that limit the political abuse of power and balance political power, enhance growth. However, they find that, particularly in countries where such rules are important—for example because the country has substantial public income from natural resources—the institutional rules are undermined by politicians.

Acemoglu, Robinson, and Torvik (2011) develop a model of equilibrium checks and balances. If checks and balances limit political rents, why would voters support their removal, as they have done for example in Bolivia, Ecuador, and Venezuela? The authors find that from the poor voters' point of view, checks and balances are a double-edged sword. Although checks and balances limit political rents, they also make it cheaper for the rich elite to influence politics through nonelectoral means, such as bribing and lobbying. By dismantling checks and balances from the constitution, poor voters make the politicians more powerful and the elite less powerful. This is particularly advantageous for the poor when the rich are well organized, when income distribution is unequal, and when it is easy to tax. Thus, the typical characteristics of resource-abundant countries, in particular those where natural resources are stationary and therefore easily taxed, make it more likely that the equilibrium constitution does not contain checks and balances. Such countries end up with economic reform that strengthens the power of the political elite.

HOW *SHOULD* COUNTRIES REFORM WHEN THEY RECEIVE RESOURCE RENTS?

Most of the literature to date on the resource has been positive rather than normative, but this does not mean that the literature is without normative implications. Below I present an extremely simple positive theory to shed light on the different effects resource abundance may have. In turn, this has normative implications for economic and political reform.

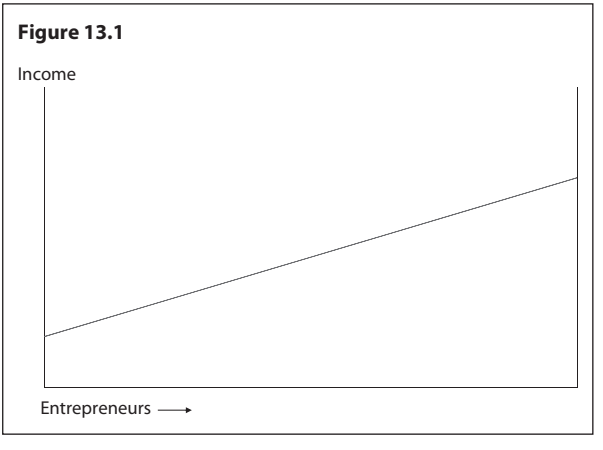
A traditional argument would be that when a country accesses more natural resources, the income in the country increases, but it increases by less than the isolated value of the resources, since their exploitation is likely to draw resources out of alternative, less profitable activities in the economy. Recently, however, a theoretical and empirical literature has argued that this may either be a too optimistic or a too pessimistic prediction. Moreover, the prediction may depend on the political system in place.

How More Can Become Less

Let us consider a country with a high crime rate, widespread corruption, poor quality in the public bureaucracy, and a political system where politicians do not face checks and balances. In such a society, it will be relatively attractive for entrepreneurs to engage in political rent seeking, destructive banditry, and corruption rather than to establish and operate productive enterprises. For such an economy, more natural resources may make such economic activities more profitable, which in turn will have unfavourable general equilibrium consequences for the rest of society. In fact, these negative general equilibrium effects may outweigh the initial effect of more natural resources. The theory presented in the following is a simplification based on Torvik (2002) and Robinson and Torvik (2010b).

It seems intuitive that the higher the number of entrepreneurs who choose to engage in productive activity, the higher the income of each entrepreneur will be. There are many reasons for this. More private entrepreneurs engaged in production means fewer entrepreneurs engaged in political rent seeking to transfer resources from the productive to the rent seeking part of the economy. Fewer transfers of income away from the productive entrepreneurs in turn increases the profitability for each entrepreneur. More entrepreneurs engaged in productive activity means fewer engaged in destructive activity, and thus less crime and corruption. In turn, a reduction in crime and corruption makes it more profitable to engage in productive economic activity. A higher number of entrepreneurs in productive activity also yields higher production and higher income, and thus creates greater demand. Greater demand in turn increases sales and profitability. A higher number of entrepreneurs in productive activity gives higher tax income, greater public income, and thus better public services and infrastructure. Good public services and infrastructure in turn increase the profitability of private industrial activity.

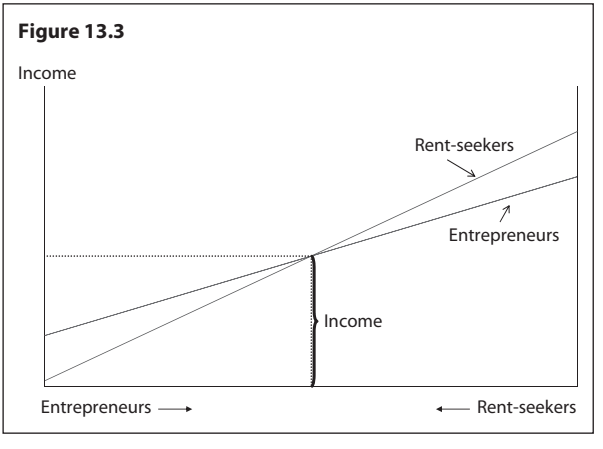
Figure 13.1 illustrates this relationship. We measure the number of entrepreneurs in productive activity along the horizontal axis and the income of each entrepreneur along the vertical axis. The rising curve shows that the income for



each entrepreneur increases with the number of other entrepreneurs engaged in productive activity.

Figure 13.2 shows how the number of entrepreneurs who choose to engage in unproductive or destructive rent-seeking activity influences the income for each and every one of them. We measure the number of entrepreneurs in such activity from left to right, and the income for each of them on the vertical axis. An increase in the number of entrepreneurs in unproductive activity, that is, a movement from the right to the left in the figure, implies a lower income for each of the unproductive entrepreneurs. There are several reasons for this. A large number of rent seekers that aim to transfer income toward themselves means that there are fewer productive entrepreneurs to transfer income from and more competitors to share it with. In turn, this reduces the income for each rent seeker. A large number of criminal competitors means that more resources are used to protect oneself against other criminals, and less to obtain income. In turn, income is reduced for each single criminal.

Figure 13.3 shows how the country's entrepreneurs are distributed between productive and unproductive activity. Where the curves intersect, the incomes for

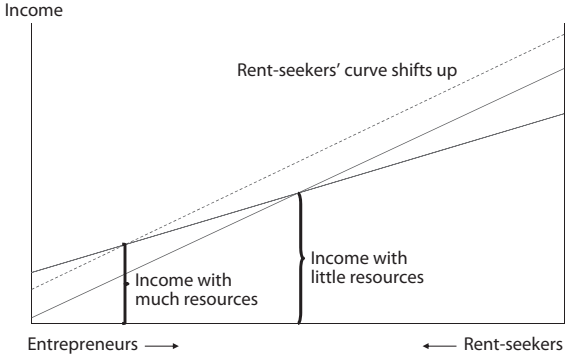


entrepreneurs in productive activity and in unproductive activity are equal, and no entrepreneur has an incentive to switch between productive and unproductive activities. If the distribution of entrepreneurs is not at the intersection in the figure but to the left of it, income from productive activity will be higher than income from unproductive activity. In that case, entrepreneurs will have an incentive to switch from unproductive to productive activity. The number of entrepreneurs in productive activity will then rise, and the number in unproductive activity will decline, until we are back at the intersection.

If we are in a situation to the right of the intersection, we will see the opposite movement. Here, the income of the unproductive entrepreneur is higher than the income of the productive one, and entrepreneurs will switch from productive to unproductive activity until we are back in the intersection, where the income of an entrepreneur is equal in unproductive and in productive activity. The intersection and the distribution of entrepreneurs between productive and unproductive activity implies, and therefore represents, a situation of stable equilibrium. In the continuation, we assume that the curve for rent seekers is steeper than the curve for productive entrepreneurs, implying that in equilibrium we have a positive number of both rent seekers and entrepreneurs. If the curve for rent seekers is less steep than the curve for productive entrepreneurs we have two stable equilibria; one where all entrepreneurs are rent seekers and one where no entrepreneurs are rent seekers.

The next question is how resource abundance influences the equilibrium. This is shown in Figure 13.4. Resource abundance represents improved income opportunities for those who are engaged in political rent seeking, destructive banditry, and corruption. When there are more natural resources up for grabs, and when the political system allows such grabbing, it becomes relatively more attractive to be a rent seeker. The curve that represents income opportunities in rent seeking thus shifts upward in the figure, as shown with the dotted curve in Figure 13.4. The conclusion is surprising: Better income opportunities for every entrepreneur cause the income of every entrepreneur to fall.

Figure 13.4



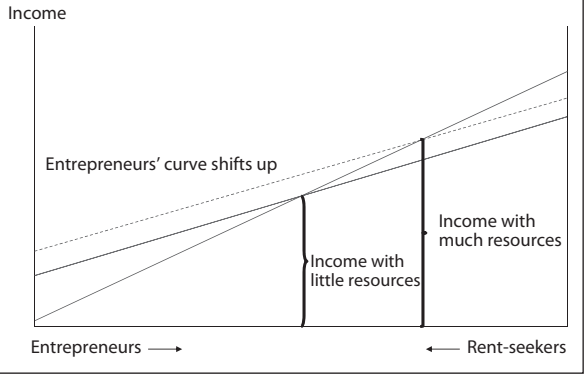
The intuition behind this result is as follows: More natural resources make it more profitable to be a rent seeker, and thus more people choose rent seeking and fewer choose productive activity. The combination of a greater number of rent seekers and a smaller number of productive entrepreneurs reduces the income of every productive entrepreneur. However, lower income from productive activity makes it relatively even more attractive to engage in rent seeking. This leads to a further fall in the number of productive entrepreneurs, a further fall in the income for those who are engaged in productive activity, an even greater reduction in the number of productive people and an increase in the number of rent seekers, and so on. Resource abundance thus initiates a multiplier process—but the bad news is that the multiplier is negative. The reason this process will not continue indefinitely is that the income of rent seekers, too, falls when there are more rent seekers and fewer productive agents.

In the new economic equilibrium, it must be the case that what at first seemed like a better income opportunity for private entrepreneurs is a disadvantage for each and every one of them: Political systems that do not prevent rent seekers from taking advantage of resource abundance make the income of every entrepreneur go down—not up, as one might believe at first glance.

How More Can Become Even More

Consider now the same situation as above, but with the difference that reform has been undertaken so as to limit abuse of political power and to combat rent seeking. In such a case, an increase in natural resources does not benefit the rent seekers; on the contrary resource abundance benefits the producers in the economy, who get access to more new economic opportunities than before. Thus, as represented in Figure 13.5, the curve for producers now shifts upward. As shown, in the new equilibrium income is higher than before. However, note that the increase in income is larger than the vertical shift in the curve, so the increase in income is larger than the value of the increased opportunities, which are measured by the vertical distance of the shift.

Figure 13.5



The intuition for this is that as in the earlier case, where reform has not been undertaken, resource abundance induces a multiplier effect, but now the multiplier is positive rather than negative. When production becomes more valuable entrepreneurs enter into productive activity. In turn, the lower number of entrepreneurs in unproductive activity and the higher number of entrepreneurs in productive activity mean that profit in productive activity increases further, inducing more entrepreneurs to flow into production, and so on. The end result of this process is that because of a more favorable allocation of talent, the increase in income is higher than the initial increase in resource abundance. Resource abundance then stimulates rather than retards productive economic activity.

Note that even though we have a full utilization of resources, fully flexible prices, and rational agents, we obtain a multiplier effect that resembles the one in the simplest Keynesian model. But the reason for the multiplier is different. It stems from channelling scarce factor inputs into more socially productive uses rather than from an increased utilization of factor inputs.

WHICH REFORMS?

The model above sheds some light on why we may observe huge variations in the way countries respond to resource abundance. However, due to the model's reduced form nature, it is relatively silent on precisely which characteristics separate countries where resource abundance induces prosperity from those where resource abundance retards prosperity. Recent research has identified at least some dimensions that are decisive, and these are discussed next.

Democracy versus Autocracy

Among others, Bulte and Damania (2008) find that it is especially in countries with weak democracy that resource abundance tends to generate negative outcomes. In such countries the voters' control of politicians is weaker, in turn leading politicians to choose policies that maximize their own interests but put the economy off its optimal growth path from the point of view of society.

Presidentialism versus Parliamentiarism

Andersen and Aslaksen (2008) find the following: on average, resource abundance reduces growth in democratic countries with presidentialism, but not in democratic countries with parliamentarism. The result in Andersen and Aslaksen (2008) is a strong indication for a close connection between political incentives and the resource curse, although we still have a somewhat limited understanding of why presidential countries react less favorably to resource abundance than parliamentary ones. One hypothesis may be that the political checks in presidential countries are weaker than in parliamentary ones. With the exception of the U.S. presidential system, many presidential systems around the world feature strong presidential power that is checked by parliament only to a limited degree. Indeed, as argued by Robinson and Torvik (2010a), the growing incidence of

presidential rule in many developing countries has been associated with fewer and not more checks and balances. For instance, most African countries started off with a parliamentary system at independence. Today, nearly all these countries have since changed their constitutions to a presidential system. A challenge with these systems is to ensure that they do not concentrate power within an economic and political elite but instead allow greater economic opportunities to be utilized by a broad segment of society.

Institutional Quality

Several authors, such as Mehlum, Moene, and Torvik (2006) and Boschini, Pettersson, and Roine (2007), have shown that when economic and political institutions feature checks on politicians and secure property rights, then resource abundance stimulates growth. But with limited checks and balances and unsecure property rights, resource abundance retards growth. In these latter cases, resource abundance stimulates grabber activity, in turn crowding out productive activity. Again we note the key role of incentives: the institutions matter because they affect the incentives that political and private agents face when a new income opportunity arises.

Type of Resources

Boschini, Pettersson, and Roine (2007) produced what is probably the most detailed study on how different types of natural resources affect growth and how this is linked to the quality of institutions. These authors use four different measures of resources and find that crucial for growth implications is the combination of institutional quality and the "lootability" of resources. The worst possible growth effect from natural resources stems from the combination of diamonds in countries with weak institutions.

Offshore versus Onshore Oil

There are some indications that countries with offshore oil fare better than countries with onshore oil. For instance, Lujala (2010) finds that onshore oil increases the risk of violent conflict in a country, but that offshore oil has no effect on the risk of conflict onset. This finding may reflect the fact that onshore oil represents different incentives and opportunities for rebel groups than offshore oil. Offshore oil installations are easier to protect, and the operations of an offshore oil field can be more or less independent from activities onshore. Onshore oil provides different actors with better possibilities for using violence and predation to grab part of the oil resources, which in turn may be socially destabilizing.

Early versus Late Industrialization

Entering the 1900s, Norway was (together with Ireland) one of poorest countries of Europe. Today Norway is one of the richest countries in the world. This remarkable

transition has been driven by the exploitation of natural resources. It started with fish, timber, and minerals, continued with hydroelectric power, and since the 1970s has developed oil and natural gas as key sectors. It is obvious that natural resources have been a blessing for Norway. Economic historians, in particular Gavin Wright (see e.g. David and Wright, 1997), have pointed out that looking back in time resource abundance has been a main driver of growth rather than being the opposite. For example, in Finland, Sweden, Norway, Australia, Canada, and the United States there is little doubt that resources have historically promoted growth and industrialization. Contrasting the literature in economic history with the literature on the resource curse, one is led to question whether the effect of resource abundance has changed over time—and if it has, then why?

One hypothesis is that an eventual change in the growth effect of natural resources has been found because countries with different degrees of institutional quality industrialized at different times. As shown by Acemoglu, Johnson, and Robinson (2001, 2002) the countries that industrialized first were those with the best quality of institutions. Therefore, the countries that industrialized early had an institutional apparatus in place that prevented the negative growth effects of resources, while those that first utilized their resources at a later stage did not have such institutions in place. Karl (1997) was an early proponent of the view that a resource discovery is worse for a country that has not yet developed its institutions.

Taking Stock

Most dimensions where the successful resource-abundant countries differ from the less successful resource-abundant countries can be linked to differences in economic and political incentives. Moreover, the design and reform of institutions to deal with resource incomes will themselves be shaped by the initial political incentives. This may create massive economic and political divergence. Countries with strong institutions reform those institutions further to take advantage of the new economic opportunities, while countries with weak institutions may reform in directions not conducive to prosperity.

But there are also interesting lessons to draw from *within* the group of countries that are resource-abundant and have *strong* institutions. A key element in economic reform here is the establishment of petroleum funds. These funds, however, have been set up in different ways within this group of countries. Such differences in design have created differences in political incentives, in turn explaining differences in performance. To shed light on this, below I compare the design of three petroleum funds where initial institutions were strong, and discuss how the different political incentives built into the funds explain their differences in performance.

THE DESIGN OF PETROLEUM FUNDS AND POLITICAL INCENTIVES

In general petroleum funds may or may not assist in the challenges that resource-abundant countries face. When institutions do not place strong checks

on politicians, petroleum funds may simply make the problem worse, because the funds concentrate the resource income. In turn, such concentration may make it easier for the political elite to monopolize the property rights to the resource wealth.

When institutions do place strong checks on politicians, however, petroleum funds may contribute to a socially beneficial development. Petroleum funds may help ensure a sustainable use of the petroleum wealth and efficient management of that wealth, and that payments out of the fund are allocated to socially efficient projects. However, even in easy places the design of petroleum funds is difficult. This can be seen by comparing the experiences of three petroleum funds in Alberta, Alaska, and Norway.

The institutional design of a petroleum fund differs along three main dimensions:

- The inflow of resources into the fund
- The management of the fund, and
- The payments out of the fund.

In the next subsections, we describe and contrast the three petroleum funds with a special emphasis on these dimensions and discuss the political incentives and the political outcomes these designs have led to.

The Alberta Heritage Savings Trust Fund

Alberta is the fourth largest of the Canadian provinces with a population of about 3 million. Two-thirds of the province is publicly owned land, and about 80 percent of the oil and natural gas extraction takes place on this public land. In connection with the OPEC-1 oil price shock in 1973, it became clear that the province would receive substantial incomes from its petroleum sector. As a response, in 1974 it was proposed to establish a savings fund. The Heritage Fund was established in 1976, with three main objectives:

- Save for the future
- Strengthen or diversify the economy, and
- Improve the quality of life of Albertans.

Up until 1983, 30 percent of the petroleum incomes were channelled into the fund. In the period 1984–87 this was reduced to 15 percent, before the payments into the fund went down to zero. Since then there have been no additional payments into the fund.

The Heritage Fund is managed within the provincial government bureaucracy by an investment committee with members from Alberta's Legislative Assembly. Many of the investments made by the fund have been within the province, and to a large degree in publicly owned companies. This strategy has been debated. Mumey and Ostermann (1990) note that at the same time as politicians decide how much revenue is to be taken out from the companies, they also decide how much in subsidies should be allocated to the same companies. The result of the political investment and subsidy decisions has been that many of the investments have been in companies that are

unprofitable, and according to Mumey and Ostermann (1990) the value of these firms estimated by the Heritage Fund has been 10 percent above their actual value. Moreover, the fund has provided preferential treatment loans to other provinces with interest rates below market rates.

There are no fixed rules for payments out of this fund. The payments are discretionary decisions made by the politicians. With the establishment of the fund, the intention was to use a maximum of 5 percent of the value of the fund each year. In the first years of the fund this intention was more than fulfilled, in that no payments at all were made out of the fund until 1983. During the 1980s, the politicians decided to spend more of the fund, and at the same time they did not take into account that the real value of the fund was eroded by using the nominal returns. Even though the payments into the fund dried up in 1987 and onwards, the politicians decided to continue spending approximately the nominal return from the fund. Until 1995, the fund invested in a variety of projects ranging from irrigation and education to facilities, art galleries, research, parks, hospitals, and theatres. During the first half of the 1990s the real value of the fund was reduced, while the nominal value of the fund was fairly stable. After 1995 the policy of using the nominal return from the fund was reversed.

In 1997, the fund was restructured with a gradual transition of the old portfolio to a portfolio where 35 to 65 percent would be placed in fixed-income securities and 35 to 65 percent in equities. The three primary objectives of the fund were changed to

- Earn income to support the government's fiscal budget
- Maximize long-term returns, and
- Improve the public's understanding of the fund.

A new Legislative Standing Committee, operating at arm's length from the government, was put in place to ensure that the objectives and goals of the fund were met. It seems clear that the restructuring of the fund was motivated by the experiences to date, although some claim that the restructuring has limited practical importance. For instance, Warrack and Keddie (2002, p. 9) report that

> many Albertans question whether there is substantial change to the fund. Proponents argue that the Heritage Fund is nothing more than a political lever used to implement and reinforce public policy decisions. They allude to the fact that income is transferred directly into General Revenues, indicating that the direction of the fund is dependent on the desires of the government of the day.

Whatever position one may have on the 1997 restructuring of the Heritage Fund, it seems clear that there are important lessons to draw about how the political incentives built into the fund in the first two decades shaped policy. The objectives of the fund were unclear and may have been partly in contradiction. The objective of saving for the future can be measured by the development in the value of the fund, while the objective to improve the quality of life of Albertans is not very specific and is hard to measure. In addition, this second objective may to some degree be in conflict with the objective of saving for the future. The fund

has a large degree of heterogeneity in its investments, which range from financial investments to recreation areas. The fund seems to have been much influenced by shifting political priorities, and it is hard to discriminate between those positions of the fund that should be thought of as investments and those that should be thought of as consumption spending. The 1997 restructuring of the fund was partly motivated by the need to improve the public's understanding of it, which indicates that the initial institutional design of the fund had unclear objectives and that it was unclear how to measure its performance.

The history of the Alberta Heritage Fund shows the importance of political incentives when designing institutions. The decisions on payments into the fund, the management of the fund, and the payments out of the fund were all discretionary political decisions. The strength of this is that there is strong day-to-day democratic control of the fund. The obvious weakness is that, especially with unclear and unmeasurable objectives, the fund becomes too short-term and insufficiently transparent. The design includes those types of political incentives that may easily produce myopic behavior and inefficiency. The payments into the fund were reduced over time and eventually stopped. Political considerations replaced economic considerations in the fund's investment decisions. The payments out of the fund were larger than the original objective. Warrack (2005, p. 17) is highly critical of the way the Alberta Heritage Fund developed and argues that the main problem was its institutional design: "Time has demonstrated that the governance system in place was faulty—it was not resilient to changing fiscal circumstances." According to Cowper (2007, p. 224):

> Over time it became clear that the AHFs' (Alberta Heritage Fund) purpose was indistinguishable from the role of the Parliament. Not surprisingly, the ASF "invested" in social improvements and infrastructure normally paid for by the provincial government. Its investments to diversify the Alberta economy were politically inspired and most of them were conspicuous fallacies.

The Alaska Permanent Fund

Alaska is one of the U.S. states with the smallest populations, containing only about 600,000 people. As of 2010, about 90 percent of the state's income stems from petroleum income. In 1969, Alaska auctioned 164 drilling rights on publicly owned land, resulting in an income large enough to fund eight years of the state's budget. The income from the auctions was soon used for investments, in particular in infrastructure. According to Warrack and Keddie (2002, p. 11), "Soon public opinion was that a significant portion of the money has been wasted." There were widespread arguments that all inhabitants of Alaska should have a part of the future petroleum income. The Alaska Permanent Fund was initially proposed by a state legislator and quickly attracted public support. In 1976, the citizens were asked whether to include the proposal "as a constitutional amendment, so as to ward off future legislative 'raids' on the fund" (Cowper 2007, p. 223). Almost two-thirds of the electorate approved the proposal, and The Alaska Permanent Fund was established.

The main objectives of the fund became these: to achieve high real returns with low risk, to undertake cost-efficient management, and to offer transparency to increase accountability. The fund is made up by two parts. The "Principal" is the main body of the fund, and it is the payments into the Principal, the management of the Principal, and the payments out of the Principal that are contained in the constitutional amendment. The other body, the "Earnings Reserve," can be understood as an account where remaining money not allocated to the Principal is transferred. (The next section of this chapter, after a short description of the use of the Earnings Reserve, will concentrate on the Principal and refer to that as "the fund.")

Until 1980, 25 percent of the royalties from the petroleum sector were allocated to the Principal. (Note, however, that as pointed out by Hannesson (2001, p. 59), even if the constitution specifies that at least 25 percent of the royalties shall be allocated into the Principal, this amounts to about 10 to 15 percent of petroleum income, which also consists of various taxes). From 1980 onwards, it was decided that the share of royalties that goes into the fund would be 50 percent (a decision that is not part of the constitution). The use of the remaining money in the Earnings Reserve is politically decided, but the politicians traditionally have decided to transfer more of the royalties into the fund so as to keep the real value of the Principal. But again, this is a yearly discretionary decision that is not part of the constitution. The size of the fund as of October 2010 was US$37,188,100,000 (see http://www.apfc.org).

The fund is operated by a public corporation, the Alaska Permanent Fund Corporation. This is a separate and independent body managed by a board of six individuals, a majority of four being elected members of the public with an expertise in finance and business management while the Commissioner of the Revenue and an appointee of the governor's make up the other two. The investment composition of the fund is currently about 18 percent invested in U.S. bonds, 18 percent in U.S. stocks, 3 percent in foreign bonds, 32 percent in foreign stocks, 10 percent in real estate, and the remainder in various other financial instruments.

Payments out of the fund are specified in the constitution. The net return for the preceding five years is added up, and 21 percent of those returns can be spent (given that this amount does not exceed the sum of net income of the fund during the last year and what is left in the Earnings Reserve account). Normally, half of what is spent has been distributed as a lump sum transfer to the inhabitants of the state. Note that this is also a political decision and not part of the constitution. In 2010, the dividend paid out to each inhabitant was US$1,281.

Toward the end of the 1990s, the State of Alaska got into economic problems with the decrease in the oil price. It was debated whether the state should use the fund to cover its budget deficit. In 1999, voters defeated such a proposal by a large majority.

In recent years there has also been a debate about changing the rules in the constitution that determine the yearly spending out of the fund. In particular, three aspects have been criticized. First, it would have been better to link the payments out of the fund to the market value of the fund rather than to the five-year

average return. Even the five-year return may display high volatility (and possibly be procyclical). Second, an active political decision has to be taken each year to transfer money into the fund to protect its real value. Third, the inflation-proofing of the fund has been undertaken only for the Principal and not for the Earnings Reserve.

Against this background, the board suggested in 2004 to change the rules that govern the fund. Such a change must be approved by a constitutional amendment. The proposal of the board was announced as "POMV" which stands for "five **p**ercent **o**f the Fund's total **m**arket **v**alue." According to the proposal, the upper limit on how much could be spent from the fund should be changed from a limit based on returns to one based on 5 percent of the average market value of the fund over the last five years. This would contribute to more stable payments out of the fund, and with a predicted real rate of return of 5 percent protecting the fund's real value, it would become part of the constitution and would encompass the whole fund and not only the Principal.

In the public debate over this, there was concern that the proposal would have the effect of reducing the yearly dividend payments and that more of the spending from the fund would be used to cover the public deficit. Before the proposal could have been presented to the voters of Alaska it would have needed approval of a two-thirds majority in the state legislature, but it did not receive sufficient support and thus was not presented to voters. The board of the Alaska Permanent Fund Corporation is still of the opinion that the proposal should be implemented, and point out that "many Alaskans mistakenly believe that POMV will affect the dividend program." The constitution does not include rules about the dividends being paid to the inhabitants.

The Norwegian Petroleum Fund

Norway discovered petroleum in the 1960s and became an oil producer in 1973. The Norwegian Petroleum Fund—which is now officially renamed the "Government Pension Fund Global"—was established in 1990, and the first deposits into the fund where made in 1996. Compared with the funds of Alberta and Alaska, the Norwegian Petroleum Fund is better integrated into and coordinated with the country's overall macroeconomic policy.

A major shift in Norway's macroeconomic policy composition was undertaken in 2001 (see Norway, Ministry of Finance, 2001). Up until then the monetary policy had formally aimed to keep the exchange rate stable, while fiscal policy had aimed to dampen fluctuations in output and employment. As in other countries, the experience with countercyclical fiscal policy and the fixed exchange rate regime had been mixed. In addition, with the dependence on nonrenewable resource exports, it was seen to be crucial for Norway to adopt a more long-term view of fiscal policy. Thus monetary policy was given a more prominent role in short-term stabilization through the adoption of a flexible inflation target, while a new so-called rule (which is not a rule but an objective) stated that over the cycle the real return (predicted as 4 percent annually) of the petroleum fund could be spent.

The payments into the fund consist of the return on the fund, government petroleum income, and net financial transactions in relation to petroleum activity. In Norway all government income from the petroleum sector is channelled into the fund.

The management of the fund has been delegated from the Ministry of Finance to a separate unit within the central bank, the Norges Bank Investment Management.[1] All investments of the fund are in foreign assets, and over time the investment universe has been expanded to allow for such assets as private sector bonds and real estate. In 2006, the maximum share the petroleum fund could invest in one company was increased from 3 percent to 5 percent.

The amount that is paid out from the fund is a yearly decision made by Parliament. This amount covers the public sector deficit, excluding petroleum income. The objective is that the payments out of the fund shall equal the real return of the fund, which is expected to be 4 percent on an annual basis. In Norway, this is known as the "rule for the use of petroleum money," although this is not a binding rule. There are no formal institutional designs that limit the spending out of the fund. How much to use is continuously debated, and some politicians argue that Norway should use more of the fund than it is now using. The actual use of petroleum revenues has exceeded the 4 percent objective.

The rule for the use of petroleum money also includes the possibility that in economic downturns one can pursue an active fiscal policy and use more than the 4 percent of the fund. Thus, even if monetary policy has been given a more prominent role in macroeconomic stabilization policy, fiscal policy still has some short-term, and not only long-term, considerations.

A summary of some main points in the design and management of the three petroleum funds just discussed is outlined in Table 13.1.

Comparing Experiences of the Petroleum Funds

We can now briefly compare how the different political incentives of the three funds just described have mapped into different experiences in their operation. There are major differences between the three funds when it comes to payments in, management, and payments out of the funds.

In Alberta and Alaska, a share of the public petroleum income is invested in the fund, while in Norway all government income from the petroleum sector is channelled into the fund. With the exception of Alberta, the payments into the funds have been in accordance with the stated intentions.

The management of the funds differs. In Alaska and Norway, the management has been delegated to bodies that are largely independent from politicians, while in Alberta politicians have had a hands-on approach. The management in Alaska and Norway must be considered successful, with acceptable rates of return and an investment policy in accordance with the intentions. The management in Alberta, on the other hand, must be characterized as not very successful. Unclear

[1]The Norges Bank Investment Management website provides much information about the institutional structure, investments, and value of the fund at www.nbim.no.

TABLE 13.1

Design of three petroleum funds

	Payments *in*	**Management**	**Payments *out***
Alberta Heritage Fund	Discretionary: 30% → 15% → 0%	Political investment committee	Discretionary: Objective: Cannot exceed 5%
Alaska Permanent Fund	Rules in constitution: At least 25% of royalties	Independent company with a public majority on the board	Rules in constitution: 21% of net return of last five years
Norwegian Petroleum Fund	Guidelines: 100%	Separate unit under the central bank	Discretionary: Objective: Cannot exceed 4%

and shifting political priorities have given low rates of return, uncertainty as to what is the value of the fund, and "investments" that must be at least partly considered as consumption.

The payments out of the fund are decided by rules in the constitution in Alaska, while they are subject to discretionary political decisions in Alberta and Norway. In Alberta and Norway there are guidelines for how much of the fund should be used, but the actual payments have exceeded these guidelines (to a larger extent in Alberta than in Norway).

There are interesting contrasts between the two petroleum funds in North America. While the value of the fund in Alberta has decreased due to politicians not following their own intentions, the Alaska fund has rules in the constitution that to a large extent decouple payments out of the fund from short-term political priorities. Warrack (2005, p. 17) concludes that

> Without an arms-length mechanism resilient to/from ebbs and flows of fiscal demands, it seems impossible for a political system to manage energy revenues responsibly. That is a sad lesson for Alberta, the province being far less successful than Alaska.

Warrack (2005, p. 19) argues that the solution to this is to "establish arms-length governance by Trustees at the outset, preferably by constitution." The failed policy of the Alberta fund can be mitigated by adopting rules so that short-term bias in the use of petroleum wealth becomes more difficult.

Although the experiences in Alaska have been favorable when it comes to management and payments out of the fund, they also make it clear that the institutional design is not without potential for improvement. The rules that govern payments out of the fund make it resilient to short-termism, but at the same time they prevent what may seem as a more reasonable organization. The POMV proposal seems like a better rule for payments out of the fund than the current model, but the fact that the current system is part of the state constitution makes such a change difficult to establish. This illustrates how strict rules also come with costs because they reduce flexibility.

Moreover, one may argue that the relevant measure is not the fund itself but the country's (or region's) overall macroeconomic development; if the rules in the relevant constitution are directed toward the fund but there are no rules regulating public

sector deficit and borrowing, then although the development of the fund may look sustainable the accumulation of public debt outside the fund may not be. Thus, a potential drawback in linking only one part of the public balance to rules in the constitution may be that the petroleum wealth in essence is used to back public borrowing.

Although one may argue that a drawback of the Norwegian model when compared with the Alaskan one is that the payment out of the fund is a yearly discretionary policy decision, the Norwegian model also has some advantages. First, since the guidelines for using the Norwegian petroleum fund relate to its use in connection with the public sector deficit, they put emphasis on overall macroeconomic balance. The guidelines say that the public sector deficit (over the cycle) excluding petroleum shall not exceed 4 percent of the petroleum fund. Thus, the payments out of the fund are used to cover the public sector deficit, and adhering to the guidelines also ensures that macro balances are respected.

By contrast, in Alaska the public sector deficit is independent of the rules governing the petroleum fund. The fund is not well integrated with overall macroeconomic policy. One may ask what the rationale is for putting strict rules on part of the public balances, while these rules in effect may be undermined by other parts of the budget. The political incentives created by the rule in Alaska do not cope well with the long-term fiscal balance in the public sector, while the political incentives in the Norwegian model do not cope well with the temptation to use more of the fund in the short term than intended.

Thus, it seems that we have yet to see a design of a petroleum fund that deals in a satisfactory way with the tendency for political decisions to have a short-term bias.

CONCLUSION

Political institutions shape political incentives. This in turn helps explain why there is such a huge variation in the experiences of resource-abundant countries. Dependent on initial institutions as well as the incentives these create for further policy reform, resource abundance may lower welfare or may strongly increase welfare. However, even when initial institutions are strong, there may be a short-term bias in political decisions, and investments may be made for political rather than economic reasons. The political incentives built into petroleum funds are decisive for their success or failure. Transparency and strong macro institutions are necessary but not sufficient conditions for resource abundance to stimulate prosperity.

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CHAPTER 14

Terms of Trade and Growth of Resource Economies: Contrasting Evidence from Two African Countries

AUGUSTIN KWASI FOSU AND ANTHONY OWUSU GYAPONG

INTRODUCTION

The potential danger that natural resources pose to the economy of developing countries has been receiving increasing attention in the literature. The previously reigning hypothesis, especially in the 1950s and 1960s, was that natural resource richness implied economic prosperity. This was the "big push" view, so-named because such wealth would raise aggregate demand and hence income (see, for example, Murphy, Schleifer, and Vishny, 1989; Sachs and Warner, 1999). As many natural resource-rich countries in the developing world began to experience economic difficulties relative to resource-poor nations, however, a "resource curse" hypothesis began to gain traction.[1] According to this hypothesis, greater natural resource wealth would lead to less economic growth.

Although Raol Prebisch and Hans Singer had already raised the issue that countries relying on the exports of primary commodities would experience relatively weak growth,[2] their argument relied primarily on the hypothesized long-run deterioration in the terms of trade associated with primary products, especially agricultural products. The new resource-curse literature, however, is based on the harmful effects of rents derivable from natural resources. According to this

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[1]See, for example, Auty (2001), Baland and Francois (2000), Gelb and associates (1988), Gylfason, Herbertsson, and Zoega (1999), Lane and Tornell (1996), Sachs and Warner (1997, 1999, 2001), and Torvik (2002). Van der Ploeg (2008) provides a useful review.

[2]See Prebisch (1950) and Singer (1950).

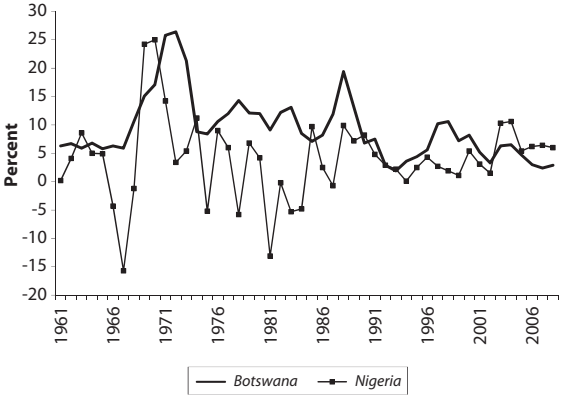
literature, terms-of-trade appreciation that raised natural resource rent could reduce economic growth; conversely, declining terms of trade that lowered the rent might actually increase growth, contrary to the Prebisch–Singer hypothesis.

Recent literature suggests, though, that whether natural resource abundance increases or decreases economic growth depends on the institutional architecture. Mehlum and others (2006) and Robinson, Torvik, and Verdier (2006), for example, observe that resource-rich countries need not experience lower growth as long as they are endowed with "good institutions." Nonetheless, it is still unclear what good institutions are and whether these institutions may themselves be eroded by natural resources.

Africa is often characterized as the continent with the largest abundance of natural resources. While most countries on the continent could be regarded as having significant natural resources, the IMF currently classifies one-third of sub-Saharan African countries as resource-rich. Among these are Botswana and Nigeria, which are rich in non-oil and oil resources, respectively. As is generally well known, the development paths of these countries have been quite different. While Botswana has succeeded in increasing its per capita GDP by an average of about 7 percent annually since 1960, Nigeria's per capita GDP growth has averaged approximately 1 percent (Fosu, 2010, table 1). Indeed, as Figure 14.1 shows, the growth rate of Botswana's GDP has been well above Nigeria's not just on average but every year, with few exceptions, until about 2002.

Yet both countries have enjoyed substantial revenues from their natural resource wealth: primarily diamonds in Botswana and oil in Nigeria. In Botswana, diamonds have traditionally constituted 70 to 80 percent of export earnings and about one-half of the government's revenues. In the case of Nigeria, oil has historically provided more than 90 percent of foreign exchange earnings and about

Figure 14.1
GDP growth, Botswana and Nigeria, 1961–2008



Source: Data from World Bank (2010).

80 percent of budgetary revenues (United States, CIA, 2010), with the country estimated to have accumulated oil revenues of about US$350 billion (at 1995 prices) since 1965 (Sala-i-Martin and Subramanian, 2003). Thus, both countries may confidently be viewed as resource economies, although Nigeria seems to be more dependent on oil than Botswana is on diamonds.

In the present chapter, we examine how the barter terms of trade, or simply terms of trade, may have affected economic growth in either country. We use terms of trade, rather than income terms of trade or measures of actual revenues, as the relevant explanatory variable. Terms of trade can reasonably be considered as exogenous for a given country, while other income-related measures are not.[3] Actually, terms of trade is probably one of the precious few bona fide exogenous variables at the country level, provided of course that a given country does not have monopoly power in the export or import of the commodity. In the next section of this chapter, we present a theoretical discussion on the channel through which terms of trade is expected to affect growth, with implications for the two countries of interest, Botswana and Nigeria. The third section then presents the empirical model, which is estimated and discussed, respectively, in the fourth and fifth sections. The last section offers some lessons and concluding observations.

THEORETICAL DISCUSSION

By relieving the balance-of-payments constraint and expanding the production set, improvements in a country's terms of trade should in turn increase GDP, implying a positive effect of terms of trade on GDP. The rise in the relative price of exports expands the feasible set for purchasing greater quantities of production inputs and for investing in productivity-enhancing measures such as adopting more technologically efficient production processes. Several studies present evidence in support of this hypothesis of a positive growth impact of terms of trade, including Basu and McLeod (1992) for 12 developing countries, most in Latin America. Deaton (1999) and Deaton and Miller (1996) further bolster this hypothesis for African countries generally. Based on a sample of 14 African countries, Bleaney and Greenaway (2001) provide additional support for the hypothesis.[4]

An alternative hypothesis is that of the resource curse, which implies that improvements in terms of trade from natural resources would adversely affect economic growth. One of the most potent explanations is that such improvements would create opportunities for rent seeking (Baland and Francois, 2000; Krueger, 1974). Rent-seeking activities themselves tend to be nonproductive and inefficient, resulting in lower growth. Furthermore, resource rents from terms-of-trade improvements would exert a corrosive effect on institutions (Isham and others, 2003; Sala-i-Martin and Subramanian, 2003). Another channel is the

[3]There is also the unresolved issue of whether the relevant non-price variable is the income derivable from the resource exploitation or the wealth represented by the known reserves.

[4]Fosu (2001) presents a summary of studies on the impact of terms of trade on African economies.

Dutch disease resulting from real exchange-rate appreciation, which hurts relatively growth-enhancing (manufacturing) exports (van Wijnbergen, 1984).[5]

Cross-country analyses are the usual basis for evaluating the resource curse hypothesis. In addition to the usual omitted-variable and endogeneity problems plaguing such methods, the relevant studies often do not shed light on country-specific or long-term effects. The latter problem is usually addressed by estimating the growth equation over a relatively long period, such as 1970–98 by Sala-i-Martin and Subramanian (2003) and 1965–90 by Mehlum and others (2006). The former study also persuasively draws important inferences about Nigeria, a country of present interest. Nevertheless, still at issue is the inability of such studies to control for unobserved country-fixed effects, despite the use of reasonably credible instruments. Germane to this issue also is the possibility that the response of growth to natural resources may have country-specific periods of adjustment.

The vector autoregressive models employed by Deaton and Miller (1995), which include lagged values of commodity prices as well as autoregressive terms, represent a considerable improvement over the cross-country studies. Nonetheless, these models do not lend themselves to generating long-term effects either, since degrees of freedom problems militate against longer lags, nor do they account for possible differences in periods of adjustment or in model specification across countries.[6]

Most recently, Collier and Goderis (2007) have advanced the empirical debate by employing a panel estimation of GDP growth and generating long-term effects of commodity prices involving the coefficient of the lagged dependent variable. While this approach represents an important improvement on the existing literature, it still does not resolve the issue of the country-specific relationship between prices and growth; after all, the same period length is used for the panel and the long-term parameter is assumed to be constant across countries.[7]

We employ in the current paper the distributed-lag model to test the resource curse hypothesis. Although such modeling may still suffer from deficiencies, including the possibility of inadequate degrees of freedom, it makes it feasible for us to estimate country-specific relationships by allowing both the lag length and model specification to differ across countries. We apply this model to the two countries, Botswana and Nigeria, which we hypothesize to exhibit different growth–terms of trade relationships with respect to the predictions of the resource curse hypothesis. A critical assumption here is that higher terms of trade result in

[5]For an example of a study showing that countries with a greater composition of manufacturing in exports tend to experience higher growth, see Fosu (1990).

[6]Deaton and Miller (1995) use 1961–87 yearly data to estimate seemingly unrelated regression (SUR) models involving commodity prices as well as the four endogenous variables: GDP, investment, consumption, and government expenditure, involving a pooled set of African countries. Each variable was lagged three years.

[7]See for instance equation (1) of Collier and Goderis (2007), where the long-run parameter λ is specified as a constant coefficient of the lagged dependent variable.

larger revenues. We present below several of the channels via which the implied terms of trade effect may materialize.[8]

Institutions and Governance

One potential adverse effect of generating public revenues from natural resources is the tendency for the revenues to promote rent seeking and to undermine government accountability (Baland and Francois, 2000; Tornell and Lane, 1999). Indeed, the revenues often provide the grease for the maintenance of dictatorships (Acemoglu, Robinson, and Verdier, 2004). If this effect holds, then unless mediated by good institutions, we should expect measures of political contestation, executive constraint, political rights, and civil liberties to be relatively low. Indeed, this might represent a channel by which institutional quality is eroded, although the present study is not intended to delineate between the two hypotheses—that it is the initial bad institutions or that it is corroded institutions—that might cause the negative growth effect of natural resources. In Table 14.1, we present comparative values for the above institutional/governance measures for Botswana and Nigeria.

As the statistics in Table 14.1 clearly indicate, and consistent with several studies (e.g., Acemoglu, Johnson, and Robinson, 2002; Robinson, 2009; Robinson and Parsons, 2006), Botswana displays good institutions that give rise to the above relatively high governance measures. It is also noteworthy that the initial quality of the institutions does not appear to have been eroded over time. Thus, by this institutions channel, it is anticipated that the effect of terms of trade on GDP would be positive in Botswana; greater rents from higher terms of trade would be allocated in favor of growth due to such institutions (e.g., Knack and Keefer, 1995; Acemoglu, Johnson, and Robinson, 2001).

Historically, Nigeria stands in stark contrast with Botswana on all the governance measures presented in Table 14.1.[9] Compared with the sub-Saharan Africa average, furthermore, Nigeria does rather poorly, that is, until most recently.[10] This evidence of poor governance suggests that the effect of terms of trade on GDP would be negative (or at least nonpositive). For example, terms-of-trade improvements should generate oil resource windfalls, which in turn engender rent seeking in the form of bribery and corruption (Ades and Di Tella, 1999), with negative growth consequences (Mauro, 1999). Greater revenues from higher

[8]The channels discussed here are not exhaustive. For example, Sala-i-Martin and Subramanian (2003) argue persuasively that the Dutch disease was not a problem in Nigeria. We have no evidence on Botswana and do not discuss this possible channel between the two countries.

[9]However, Nigeria's governance measures have improved considerably in the early 21st century, with measures in the legislative index of competitiveness and executive index of electoral competitiveness standing at the maximum possible level of 7.0 during 2000–04 (Table 14.1).

[10]While Nigeria does relatively well compared to sub-Saharan Africa as a whole, on these governance measures there appears to have been considerable deterioration during the intervening years, that is, until most recently in the 21st century.

TABLE 14.1

Governance indicators, Botswana and Nigeria, 1975–2004

	Botswana			Nigeria			SSA		
	1975–79	1995–99	2000–04	1975–79	1995–99	2000–04	1975–79	1995–99	2000–04
Political Rights	6.0	6.0	6.0	3.2	1.8	4.0	2.3	3.4	3.6
Civil Liberties	5.2	6.0	6.0	4.2	2.8	3.6	2.7	3.5	3.8
LIEC	6.0	7.0	7.0	1.0	1.0	7.0	2.8	5.5	5.9
EIEC	6.0	7.0	7.0	2.0	2.0	7.0	2.8	5.4	5.6
XCONST	5.0	6.6	7.0	2.8	2.2	5.0	2.6	3.3	3.7

Note: LIEC = Legislative Index of Electoral Competitiveness
EIEC = Executive Index of Electoral Competitiveness
XCONST = Degree of Constraint on the Government Executive

Political Rights and Civil Liberties are calculated as unweighted averages by the corresponding author using data from *Freedom in the World*, Freedom House, various issues. Note that the numbers, which range from 1.0 to 7.0, are transposed here so that 1.0 indicates the lowest level of freedom and 7.0 the highest level. LIEC and EIEC, whose values range from 1.0 to 7.0 (highest level to lowest level of democracy), are unweighted averages using data from the *Database of Political Institutions (DPI)*, World Bank. XCONST ranges from 0.0 to 7.0 (0.0 = perfect incoherence; 1.0 = no one regulates the authority; 7.0 = strict rules for governance) and are unweighted averages of data from the *Polity IV Project*. (For details regarding the implications of LIEC and EIEC for growth in African countries, see Fosu, 2008a; of Political Rights and Civil Rights, see Fosu, 2011a; and of XCONST, see Fosu, 2011b.)

terms of trade may also result in less political contestation (Acemoglu, Robinson, and Verdier, 2004), which could diminish growth.[11]

Civil Conflicts

Similarly, by financing rebel groups or by raising the expected value of territorial capture through war, abundant natural resources would raise the risk of civil conflicts (Collier and Hoeffler, 2004; Skaperdas, 2002), with adverse growth implications (Collier, 1999; Gyimah-Brempong and Corley, 2005). During civil war, the annual per capita growth in sub-Saharan Africa is estimated to fall by 2.2 percent (Collier, 1999). Given, furthermore, that per capita growth in the region has been rather paltry, averaging no more than 1 percent for sub-Saharan Africa generally and for Nigeria in particular, civil wars could indeed be quite economically destructive.

In contrast to Botswana, where there have been no major conflicts since independence in 1966, Nigeria has experienced a number of civil conflicts in the form of ethnic/religious clashes during its 50 years since independence. In particular, there have been two civil wars between 1960 and 1999: one from January 1966 to January 1970, and the other from December 1980 to January 1984. The former was

[11]Fosu (2008a), for instance, finds from a decadal panel of a large sample of sub-Saharan African countries that at the intermediate level of democracy, as measured by the index of electoral competiveness, democratization tends to be growth-inhibiting, but it tends to be growth-enhancing in advanced-level democracies. The threshold is estimated at 4.4, which is much higher than the values historically exhibited by Nigeria (see table 4 in Fosu, 2008a, in contrast to those for Botswana, which scores well above the threshold).

TABLE 14.2

Public spending on education and health, Botswana and Nigeria, 1975–94

	Botswana		Nigeria	
	Education	Health	Education	Health
Per capita (1987 US$)	88.5	23.0	4.0	1.1
Expenditure share (%)	18.7	5.2	7.6	1.9

Source: Computed by authors using data from World Bank (1992, 1996, 1998/99). For details, see Fosu (2008b) and Fosu (2007).

the well-known Biafran civil war, and the latter consisted of severe ethnic clashes that resulted in at least 1,000 deaths annually (Collier and Hoeffler, 2004, table 1).

Elite Political Instability

Natural resource abundance may also result in elite political instability in the form of military coups d'etat, as various elite groups compete for power in order to extract rent from natural resources (Kimenyi and Mbaku, 2003). Moreover, elite political instability has been deleterious to growth in sub-Saharan Africa (e.g., Fosu, 1992, 2001a, 2002, 2003; Gyimah-Brempong and Traynor, 1999). Having a high level of elite political instability could reduce GDP growth by as much as 1.2 percentage points, about one-third the average growth during the 1960–86 sample period, for instance (Fosu, 1992).

Botswana and Nigeria differ substantially in terms of their post-independence record of elite political instability. While Botswana had no history of this kind of instability—no successful or failed coups or plots—during 1956–2001, Nigeria experienced six successful coups, two failed coups, and six coup plots during the same period, ranking the country seventh out of the 46 sub-Saharan African countries in a ranking of high elite political instability (McGowan, 2003; appendix C).

Human Capital

Another argument supportive of a negative relationship between natural-resource terms of trade and economic growth pertains to the view that the higher rent from increasing terms of trade would discourage investment in innovation, particularly in education (Gylfason, 2001). The data for Nigeria, relative to Botswana, seem rather consistent with this view. We present in Table 14.2 comparative statistics on educational expenditures for Botswana and Nigeria. Also reported are data on health spending, since the above hypothesis may be extended to human capital more generally.

We find that public expenditures on education and health are quite high for Botswana and very low for Nigeria. On a per capita basis, Nigeria's public spending represents only about 5 percent of Botswana's for either sector. Furthermore, as a measure of budget allocation priorities, the expenditure shares are also respectively higher, more than twice as high in Botswana as in Nigeria. Thus, assuming that human capital expenditures positively affect growth (Baldacci and others, 2004), we should expect a negative effect of terms of trade on GDP.

Openness

Another view about natural resource economies is that they are more likely to adopt trade restrictions (Auty, 2001). This view is underpinned by the belief that the larger resources would render governments less interested in other tradable products. Hence, governments would shift economic activity in the nonresource sector toward domestic production that is shielded from foreign competition. We should therefore expect such economies to be less open than their counterparts are. To the extent that openness exerts a positive impact on growth (Sachs and Warner, 1997), it is anticipated that terms of trade would decrease growth under the resource curse hypothesis.

The data show a wide divergence in the index of openness between Botswana and Nigeria. Based on Sachs and Warner's (1997) comprehensive measure of openness,[12] Mehlum, Moene, and Torvik (2006, table 4) report the respective levels of 0.42 and 0.00 for these countries, where 0.00 and 1.00 indicate the least and highest levels of openness, respectively.

EMPIRICAL MODEL

The above channels then suggest that Nigeria is likely to conform to the resource curse hypothesis, while Botswana is not. That is, we expect a positive impact of terms of trade on GDP for Botswana, and a negative, or at least a nonpositive, effect for Nigeria. To test the resource curse hypothesis, we estimate for each country the following distributed-lag model:

$$y_t = \alpha + \sum_{j=0}^{J} \beta_j X_{(t-j)} + u_t \quad t = 1,2,\ldots,T \tag{1}$$

where y is GDP growth, X the growth of terms of trade, u the error term, and t is the year index; α and β_j are coefficients to be estimated. X_t is nonstochastic, and u_t is distributed as $(0, \sigma^2)$, for all t. Assuming a polynomial lag structure, β_j can be written as

$$\beta_j = \sum_{k=0} p \; \delta_k (j)^k \quad j = 0,1,2,\ldots,\lambda_j \tag{2}$$

Neither the lag length λ_j nor the degree of the polynomial P is known ex ante and must be selected, with the weights λ_k also to be determined. There are several

[12]The Sachs and Warner openness measure is the proportion of years that a country is open during the 1965–90 sample period. A country is considered "open" if it satisfies all the following five conditions: (1) average tariff rates below 40 percent; (2) average quota and licensing coverage of imports of less than 60 percent; (3) a black market exchange rate premium of less than 20 percent; (4) no extreme controls (taxes, quotas, or state monopolies); and (5) not considered a socialist country (Sachs and Warner, 1997).

methods for such selection.[13] We opt here for more heuristic but relatively strict criteria as follows: for each country, equations (1) and (2) were estimated for a large number of lag lengths (maximum of 15 years) and orders of polynomial (maximum of 4). The admissible set comprises those regressions with p values of at most 0.01 for the F statistic and no evidence of autocorrelation.[14] Where necessary, the Akaike information and Schwartz criteria were applied to selecting the optimal lag length among the admissible set.

If the resource curse hypothesis does not hold, then we should expect the sum of the lags to be positive, that is, $\sum_j \beta_j > 0$; increases in terms of trade should expand the production set and hence expand output. A non-strict condition for upholding the resource curse hypothesis, then, is that the sum of the lags is nonpositive.

Data and Estimation

GDP and terms of trade data were obtained from the World Bank (2004a and 2004b, respectively). The sample periods differ somewhat between the two countries (see Table 14.3) due to data availability. Both periods end in 2002, however, mainly because the data sources differ thereafter, but also because there appears to have been some structural change that year between the two countries with respect to growth (see Chart 1). The mean values, reported in Table 14.3, show that the value for net barter terms of trade (GTOT) is much higher for Nigeria than for Botswana (nine times higher), while GDP growth was on average more than three times lower in Nigeria. Thus, casual empiricism suggests that the higher growth of terms of trade, GTOT, in Nigeria, relative to Botswana, did not translate to larger GDP growth. The question of interest, though, is whether on an absolute basis the cumulative effect of GTOT was positive or negative for either country. If negative, it would favor the resource curse hypothesis.

The results of the distributed-lag analysis are reported in Tables 14.4 and 14.5 for Botswana and Nigeria, respectively. As apparent from Table 14.4, the cumulative effect of GTOT for Botswana is positive and rather large. The long-term effect of an increase in GTOT, estimated with a third-degree polynomial and a 10-year lag, is 2.3, which is highly significant with a t ratio of 5.0. This estimate constitutes 23 percent of the mean GDP growth rate reported in Table 14.3.

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[13]See, for instance, Trivedi and Pagan (1979) and Hendry, Pagan, and Sargan (1984). One of the popular selection methods is the Pagano and Hartley (1981) procedure involving choosing first the optimal lag length and then the optimal degree of the polynomial. For details of the implementation of this procedure, see for example Azzam and Yanagida (1987). However, this method is susceptible to the existence of autocorrelation (Azzam and Yanagida (1987). I opt for a more heuristic approach by estimating a large number of regressions involving different lag lengths and orders of polynomial and selecting a set that simultaneously meets the F statistic and autocorrelation test criteria, as stated in the text.

[14]These criteria, especially that involving the F statistic, are rather stringent, thus omitting other potentially good candidates with respect to the goodness of fit. For example, a specification for Nigeria involving a second-degree polynomial with an F value of 0.027 was rejected even though the sum of the lags was much more statistically significant than that reported here. However, this small risk of type 1 error is meant to ensure that any selected model is highly reliable in terms of goodness of fit.

TABLE 14.3

Mean GDP growth and GTOT (annual average, percent), Botswana and Nigeria

	Botswana	Nigeria
Mean GTOT	0.9	6.3
Mean GDP growth	10.2	3.2

Sources: GDP and terms-of-trade data are from World Bank, *World Development Indicators* 2005 and World Bank Africa Database CDROM 2004, respectively.

Note: GTOT is the Net Barter Terms of Trade. Data are for 1966–2002, except GTOT for Botswana, which is for 1976–2002.

TABLE 14.4

Distributed-lag analysis: GDP growth vs. GTOT, Botswana

Sum of lag coefficients (t value) = 2.26 (5.00)
Number of lags = 10; Degree of polynomial = 3
Sample period = 1976–2002; Adjusted sample period = 1986–2002
R^2 = 0.867, Adj. R^2 = 0.834
F statistic [p value] = 28.4 [0.000]
DW = 2.09
Akaike Information Criterion = 4.16
Schwartz Criterion = 4.36

TABLE 14.5

Distributed-lag analysis: GDP growth vs. GTOT, Nigeria

Sum of lag coefficients (t value) = -0.350 (–1.70)
Number of lags = 15; Degree of polynomial = 4
Sample period = 1966–2002; Adjusted sample period = 1981–2002
R^2 = 0.513, Adj. R^2 = 0.400
F statistic [p value] = 4.48 [0.012]
DW = 2.30
Akaike Information Criterion = 5.81
Schwartz Criterion = 6.06

In contrast, the cumulative effect of GTOT, which is estimated using a fourth-degree polynomial and a 15-year lag, is negative for Nigeria, though with a relatively low 0.10 statistical significance level (Table 14.5). This outcome supports the resource curse hypothesis and suggests that increases in GTOT would reduce GDP growth. The cumulative effect is 0.35 percent for a 1 percent rise in GTOT, [15] representing roughly 10 percent of the mean growth rate over the sample period.

[15]As indicated above, another set of results (a second-degree polynomial with a 15-year lag), which did not pass the selection criteria because of its relatively high p value of 0.027 for the overall goodness-of-fit F test, yielded a cumulative GTOT coefficient of 0.38 with a more statistically significant t value of –2.42.

Discussion of Results

The above results suggest that while appreciation in terms of trade increased long-run growth in Botswana, the reverse was the case in Nigeria. We interpret these results as indicative of the existence of a resource curse in Nigeria but not in Botswana. As is customary, one must exercise caution in reaching such a conclusion. It is conceivable that factors unrelated to the "curse" but omitted from the model might bias our estimates of the terms-of-trade effect.[16] For example, there is existing evidence that the volatility of terms of trade has an adverse effect on growth (Blattman, Hwang, and Williamson, 2007). Using a sample of 14 sub-Saharan African countries, including Botswana but not Nigeria,[17] Bleaney and Greenaway (2001) also find that the volatility in terms of trade negatively affected growth between 1980 and 1995, though GTOT itself had a positive effect on growth. Hence, the negative cumulative impact of GTOT obtained above for Nigeria may simply be the result of the volatility of terms of trade, that is, if terms-of-trade instability is positively correlated with GTOT. Indeed, using data for 1981–2002,[18] the standard deviation for terms of trade is computed at 26.7 and 7.3 for Nigeria and Botswana, respectively.[19]

There are two reasons why the above omitted-variable scenario involving terms-of-trade instability need not invalidate the above conclusion in support of RCH for Nigeria. First, the issue of the negative effect of terms-of-trade volatility on growth for sub-Saharan African countries is far from settled. Reviewing the evidence, Fosu (2001a, p. 300) concludes: "That is, for African economies, instabilities in exports, in their price or in terms of trade, do not seem to explain the low growth experienced in many of these countries." Instead, Fosu (p. 304) concludes that, "terms of trade deterioration has a substantial negative impact on growth in sub-Saharan Africa, both directly and indirectly via investment." Thus, for sub-Saharan Africa generally, the reviewed evidence seemed to imply that it is the trend in terms of trade, and not so much its variability around trend, that apparently matters for growth.

Second, and perhaps more importantly, even if terms-of-trade volatility exerted an adverse impact on growth, it may be viewed as part-and-parcel of the resource curse syndrome. Specifically, high terms-of-trade volatility might result in suboptimal intertemporal allocation of revenues, characteristic of resource economies, which could be deleterious to growth.[20] In that case, however, reducing the volatility through delinking public revenues from such volatility would be

[16]The question is whether other variables correlated with but not caused by terms of trade are omitted from the equation, in which case the estimated terms-of-trade impact would be biased.

[17]These 14 countries are Botswana, Burkina Faso, Cameroon, Cote d'Ivoire, Gambia, Ghana, Kenya, Malawi, Mauritius, Niger, Senegal, Tanzania, Togo, and Zimbabwe.

[18]Note that the adjusted sample periods are 1986–2002 and 1981–2002 for Botswana and Nigeria, respectively.

[19]These estimates are based on data from World Bank (2009).

[20]For an elaboration of this "policy syndrome" see, for instance, Collier and O'Connell (2008), Fosu (2008c), and Fosu and O'Connell (2006).

the appropriate strategy for addressing the resource curse. Finally, the finding here for Nigeria is consistent with that by Sala-i-Martin and Subramanian (2003), which is based on the share of natural resources in GDP or exports rather than terms of trade.

SOME LESSONS AND CONCLUDING OBSERVATIONS

As already alluded to above, a resource curse need not occur under the right set of institutions. Mehlum and others (2006), for instance, find that resource abundance actually increases growth when there are good institutions, even though the independent effect of resource abundance is negative. What then are good institutions?

In the study by Mehlum and others, institutional quality is measured by the simple average of the following indexes: rule of law, bureaucratic quality, corruption in government, risk of expropriation, and government repudiation of contracts. A larger value of this average index indicates a higher institutional quality. Furthermore, the threshold for good institutions is computed as 0.93 over the (0.0–1.0) interval (ibid., p. 13). Thus, with Botswana and Nigeria scoring 0.70 and 0.31, respectively, on institutional quality (ibid., table 4), neither is considered to have good institutions.[21] Qualitatively speaking, though, Botswana should have less of a resource-curse risk than Nigeria.

With an institutional quality score of 0.96, Norway is beyond the above estimated threshold and is thus considered, with a high degree of confidence, as one of the non-resource-curse countries. Despite detractors,[22] the country is often cited as a case in favor of the alternative view that resource abundance is good for growth. That is, Norway has had good institutions and clever policies to prevent the resource curse (Cappelan and Mjoset, 2009). High institutional quality is likely a necessary condition for guarding against the resource curse, but is it sufficient? Probably not, for in addition to its solid institutional base, Norway undertook steps to ensure that its revenues from petroleum exports were well managed and that the petroleum sector was integrated with the rest of the economy. Norway accomplished this by ensuring forward and backward linkages with the petroleum sector, in part by establishing the Statoil Company in 1972. Cappelen and Mjoset (2009) write that "This state-owned company played a critical role as parts of the Norwegian manufacturing industry were transformed into an engineering supply industry with specialized knowledge in the production

[21]Actually, only the developed countries qualify for this non-resource-curse status. Thus, the Mehlum, Moene, and Torvik (2006) results do not seem to adequately help to delineate between resource-curse and non-resource-curse groups among developing countries like Botswana and Nigeria.

[22]For example, Gylfason (2001, p. 851) argues that, "Norway's oil exports have crowded out its non-oil exports *krone* by *krone*, leaving total exports stagnant relative to national income for a generation." This argument suggests the Dutch disease in operation in Norway as well. However, the more recent evidence does not really support this view. For example, though total exports, as share of GDP, remained stagnant from 1981 to the mid-1990s, by 2008 exports had reached 55 percent, from 37 percent in 1981 (World Bank, 2010).

of deep-sea oil drilling equipment, platforms, pipelines and supply ships" (p. 8). They further write:

> One of Statoil's main tasks was to organise learning and technology transfers. A separate government body or directorate was set up to implement part of government policy in the area. Some universities developed their education and research in areas relevant for the petroleum sector. Government policies were in place to ensure that linkages could develop between petroleum extraction and the supply industry. As the new manufacturing skills spread, Statoil would place orders with a variety of old and new Norwegian firms. Crisis-ridden shipyards were restructured into producers of oil-exploration equipment. (Cappelan and Mjoset, 2009, p. 17)

Hence, Norway took special policy steps to ensure that its oil sector was well integrated into the rest of the economy. In particular, it exploited natural linkages with the sector by adopting proactive and farsighted policies. "The government focused on technology transfers from foreign companies" and "Norwegian industry developed production technologies which later turned out to be quite competitive" (Cappelen and Mjoset, 2009, p. 17).

Another potential lesson is Norway's establishment of the Petroleum Fund, intended to delink the economy from the vagaries of oil prices and to minimize the potential corrosive power of oil dependency. In particular, the Norway Petroleum Fund, now called the Norway Pension Fund, was established in 1990, even though the country's oil production actually began in 1970. A key policy rule associated with the fund was that only the expected earnings from it (estimated to be 4 percent of the domestic value of the fund) would be transferred to the state budget every year, with any change in the transfer rules to be approved by parliament.

In 2003, Nigeria established its Excess Crude Account, in order to save windfall revenues during periods of above-benchmark high oil prices. By 2007, the amount in this account had reached US$17.3 billion from $5.1 billion in 2004.[23] According to a news report, "However, permissive governance structures have allowed extensive ad hoc withdrawals, reducing the ECA balance by almost 85 percent, or 16 billion dollars, in just 18 months."[24] Unlike the case of the Norway Petroleum Fund, Nigeria's Excess Crude Account does not have a well-defined legal framework for its operation, which allows powerful political interests to prevail in its disposition.[25] The recent withdrawals might be prudent in terms of meeting unanticipated exigencies associated with the 2008–09 economic crisis; however, the process also underscores Nigeria's weak governance.

The important lesson here is that it is not sufficient just to set up a fund. The necessary legal and policy framework should complement its establishment. Indeed, there is currently strong urging to convert the Excess Crude Account to

[23]Sovereign Wealth Fund Institute – Nigeria, website, dated 2/19/2008.
[24]*Africa News*, online, July 30, 2010.
[25]*Africa News*, online, July 30, 2010.

a sovereign wealth fund (SWF), which would properly define the legal and policy rules for its operation, as in the case of the Norway's fund, for example.

While Botswana's institutional quality, unlike Norway's, is not considered good enough (according to the standards in Mehlum and others, 2006), Botswana likely presents useful lessons as well. After all, its institutions were strong enough to transform its terms of trade growth to considerable economic growth.[26] It would be too presumptuous, however, to assert that Nigeria should acquire a good-governance status similar to Botswana's. That would be easier said than done, for Botswana's governance status, just like Norway's, is steeped in its political history involving a relatively homogeneous, small population.

This is in contrast to Nigeria, which is Africa's most populous country and is among the most ethnically diverse countries on the continent.[27] While recent literature suggests that ethnic diversity need not be deleterious to growth,[28] it is nonetheless true that ethnic and religious clashes, likely related to Nigeria's ethnic and religious configurations, have posed ongoing conflicts for the country. However, poor governance may have contributed to these conflicts, with Easterly (2001) and Collier (2000), for example, arguing that good institutions can attenuate the risks of ethnic conflicts. If so, then it all boils down to the attainment of good institutions. But again, what are good institutions? Unfortunately, and as alluded to above, there is not yet an available quantitative threshold.

A radical solution to Nigeria's resource-curse problem is provided by Sala-i-Martin and Subramanian (2003): Distribute all the oil revenues to the adult citizens of Nigeria. While this proposition has some merit, the political feasibility of its implementation may be dubious. Carrying out the proposal would be tantamount to requiring Nigerian politicians to vote themselves out of office. After all, like many other politicians in the developing world, their interest in office-holding is likely to be guided, at least in great part, by their expected gains, which may include public revenues, whether legal or illegal.

A less radical and perhaps more implementable proposal is suggested here: Ensure that there are sufficient checks and balances in the system to provide transparency and accountability. Of course, politicians would be unlikely to directly vote for such a proposal either. A similar favourable outcome could, however, be achieved via an appropriate democratization process, one that might take

[26]Unfortunately, though, Botswana has not succeeded in achieving a structural change despite its remarkable growth.

[27]Nigeria's population is about 150 million, compared with Botswana's of only 2 million, while the ethnic fractionalization scores are 0.485 and 0.885, respectively, for the two countries (Montalvo and Reynal-Querol, 2005; Appendix B).

[28]Montalvo and Reynal-Querol (2005) argue that it is the ethnic polarization rather than ethnic fractionalization that matters for the risk of civil wars and, hence, for growth, ceteris paribus. Furthermore, they actually report a higher ethnic polarization score of 0.650 for Botswana, compared with Nigeria's score of 0.404, despite the latter's higher level of ethnic fractionalization (ibid., Appendix B). Nonetheless, their results do not necessarily invalidate the Easterly and Levine (1997) finding that more ethnically fractionalized countries are more likely to adopt policies that hurt growth.

time to crystallize. For example, Fosu (2008a) observes that democratization in an electorally competitive advanced-level democracy in Africa tends to be growth-enhancing, perhaps as a result of the regime's ability to resolve the initial political disorder engendered by the initial democratization process.[29] Such advanced-level democracy would by and large entail significant executive restraint, consistent with the observation by Alence (2004), for instance, that it is the executive restraint in democratic institutions that improves "developmental governance."[30]

It is noteworthy that Nigeria's recent improvements on both the legislative and executive indexes of electoral competitiveness are also associated with an increase in executive constraint (which is labeled XCONST in Table 14.1). It is also significant that Nigeria's scores on other forms of governance indices, while still below the world's respective averages,[31] have improved (Table 14.6).[32] Hence, it seems as if the relatively recent multiparty democratization dispensation, which has witnessed a transfer of authority from one civilian government to another, may be bearing fruit in terms of governance improvements. The key challenge is the extent to which the momentum for the current democratization process can be maintained in Nigeria.

TABLE 14.6

More recent institutional/governance development, Nigeria, 1998–2008

	1998	2003	2008	1998–2003	2003–08	1998–2008
A. Voice and accountability	–1.19	–0.70	–0.60	0.49	0.10	0.59
B. Political stability and absence of violence	–0.98	–1.73	–2.01	–0.75	–0.28	–1.02
C. Government effectiveness	–1.06	–0.94	–0.98	0.12	–0.04	0.08
D. Regulatory quality	–0.93	–1.19	–0.62	–0.26	0.57	0.30
E. Rule of law	–1.30	–1.51	–1.12	–0.21	0.39	0.18
F. Control of corruption	–1.17	–1.34	–0.92	–0.17	0.42	0.25

Source: Kaufman and others (2009) and corresponding authors' computations.
Note: The value for each measure is standardized to lie between –2.5 and 2.5, with the world mean of 0.0.

[29]Using political and civil rights as measures of democracy corroborates this finding as well (Fosu, 2011a).

[30]Alence (2004) defines developmental governance as "economic policy coherence (free-market policies), public-service effectiveness, and limited corruption."

[31]In contrast, for Botswana, the governance indexes are all above the respective world averages, typically residing between 0.5 and 1.0 standard deviation above the world mean of 0.0.

[32]All the governance measures for Nigeria, except "political stability/absence of violence," show increases since 1998 or 2003 (see Table 14.6), with the increase (decrease) in "voice and accountability" ("political stability/absence of violence") between 1998 and 2008 significant at the 0.10 level (Kaufman, Kraay, and Mastruzzi, 2009, table 5).

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