Chapter 11

THE MINING SECTOR AND GROWTH: LESSONS FOR THE FUTURE

By Joseph M. Kargbo

11.1 Introduction

Mining has been a significant component of the Sierra Leonean economy since the 1930s, and the country is endowed with a wide range of minerals, including diamonds, iron ore, gold, and rutile. The nation's established diamond fields cover over 18,000 square kilometers (km^2) and are found mainly in the south-eastern and eastern parts of the country. The mining sector employed about 14% of Sierra Leone's labour force, accounted for over 60% of export earnings and up to 20% of the country's GDP during the prewar period (see Government of Sierra Leone (GoSL) 2003, 2008, 2009a,b; World Bank 2008).

The large-scale mining of diamonds, iron ore, rutile and gold is done by foreign-owned companies, while individuals and small groups focus mainly on artisanal and small-scale production of diamonds and gold. Sierra Leone's vast mineral wealth conveyed the mistaken notion that the country was destined for a bright future at the achievement of political independence from Britain in 1961. Control of the nation's diamond fields was a major reason for destabilizing the country and outbreak of the 11-year rebel war that was started by the Revolutionary United Front (RUF). Moreover, the evidence seems to indicate that Sierra Leonean politicians have created a decision-making environment that enables rogue operators in the minerals area to capture mineral extraction rights at the expense of the national economic development of the country (see, for example, Keen 2005; Reno 1995; Smillie *et al.* 2000; Gberie 2005, 2010; Gbenda 2011; *Standard Times Press* 2011a,b,c; and Kargbo 2010).

In view of the country's performance in the mining sector, one may ask whether Sierra Leone has experienced the natural resource curse or whether it has been a victim of other forces that may be more insidious and difficult to

Thanks to Omotunde Johnson and Nomathemba Seme for comments and suggestions on earlier versions of the paper. The paper has benefited from my exchange of ideas with Mr Herbert M'cleod during the initial phase of the project. I thank him for his cooperation and comments on an earlier version of the paper. The views expressed in this paper do not reflect the official position of Ameriprise Financial Services or its affiliates. The author accepts full responsibility for any errors or omissions.

manage. What should be expected of the mining sector and how can the gains be optimized for general economic growth? Answering these questions is the main focus of this research. This chapter examines the performance of the mining sector in Sierra Leone to glean lessons from the successes and failures of the sector, and of specific minerals. Questions relating to the structure, governance and operations of the sector are examined as well as issues relating to the integration of the sector into the rest of the economy.

The rest of the chapter is organized as follows. Section 11.2 examines the performance of the mining sector in Sierra Leone within a historical and contemporary context. Section 11.3 deals with the management of government revenues for economic growth. It contains macroeconomic growth multipliers for various sectors of the Sierra Leonean economy. Section 11.4 presents the model for diamond production followed by the empirical results. The final section has the conclusions with recommendations for policy and practice destined to yield optimum gains from the sector.

11.2 Mining in Historical Perspective

Mining has a fairly long history in Sierra Leone as organized mining was started shortly after the enactment of the Minerals Act of 1927 and diamonds were discovered in Kono district in 1930 (see, for example, Saylor 1967; Smillie *et al.* 2000; Kargbo 2010).

The mining sector in Sierra Leone has been organized in three broad categories over the years. Large-scale production of precious and non-precious minerals, such as diamonds, bauxite and rutile is carried out by foreign-owned companies. Large-scale annual mineral production is expected to reach at least US$500 million within the next decade. It is estimated that up to 38,000 people could be employed by the large-scale mines, with an additional 300,000 people including dependents and extended family members deriving their livelihoods directly from these mines (see World Bank 2008; M'cleod 2010). Mechanized small-scale mines mostly for diamonds are done by both foreign-owned and Sierra Leonean firms.

Artisanal production of precious minerals, such as diamonds and gold involves about 200,000–300,000 artisanal miners. This makes artisanal mining the second biggest employer in the country after agriculture. Government statistics show that artisanal and small-scale miners account for 80–90% of the diamond exports. However, artisanal mining is currently unregulated and surrounded by informality and human insecurity as there is no set minimum wage rate and health and safety standards, as well as lack of access to capital and reliable pricing information, coupled with frequent disruptions and deception that generally keep miners and their families in appalling conditions (see IRIN News 2009; Diamond Development Initiative 2008, 2009a,b; Kargbo 2010; Hund and Hart 2008). Mining without rehabilitation ruins arable farmland, pollutes streams and rivers, and damages the natural habitat of flora, fish

and fauna. The Sierra Leone Environmental Protection Agency (SLEPA) has been reviewing various large-scale mining operations in order to limit the environmental costs of mining in the country. Furthermore, SLEPA has plans to extend environmental regulations to the artisanal mining sector.

Mr Patrick Tongu, head of the Network Movement for Justice and Development, an NGO that works on mining issues in Sierra Leone, argues that:

> Efforts to overhaul mining legislation and to make the industry more transparent focus only on foreign-owned, large-scale, industrial mining but ignore the artisanal mining sector.... Unless that is addressed these changes will not lead to real sustainable growth.
>
> IRIN News Report 2009

In order to facilitate a better understanding of the contributions of the mining sector to the Sierra Leonean economy over the years, we divide the analysis in this section into two subperiods covering the colonial era to 1990, and 1991 to the present period.

11.2.1 Colonial Era to 1990

A wide variety of companies have participated in mining activities in Sierra Leone over the years, particularly following the significant discovery of minerals during the 1930s and 1940s. For example, the Sierra Leone Development Company (DELCO) mined iron ore at Marampa, near Lunsar, during the 1930–76 period. The Sierra Leone Selection Trust (SLST) started mining diamonds in Kono district in the 1930s, while the Sierra Leone Chrome Mines Company exploited chromite near Hangha (for further details see, for example, Kargbo 2010; Smillie *et al.* 2000; Gberie 2005, 2010). The discovery of minerals triggered a huge influx of foreigners, in particular the Lebanese and citizens of other West African states that somehow acquired Sierra Leonean passports. Partnership Africa Canada (PAC) (2004) reported that as much as 55% of the diamonds produced in Sierra Leone were smuggled out of the country during the 1950s and 1960s.

Figures 11.1 and 11.2 present the evolution of official diamond exports and their importance in the Sierra Leonean economy during the past eight decades. Cumulative diamond production exceeded 26.0 million carats over the 1930–64 period. Almost all of these were from the alluvial diamond fields. The average SLST annual diamond production was approximately 750,000 carats over the 1956–75 period. The SLST, which was a wholly owned subsidiary of the Consolidated African Selection Trust (CAST) Limited received an exclusive prospecting and mining license from the colonial government that covered the whole country for 99 years. In return, SLST was to provide all the necessary capital to develop the diamond fields, and 27.5% of the profits were to be paid to the government. Moreover, SLST paid an annual rental fee of £7,000 to the government. At the same time, a Protectorate Mining Benefit Trust Fund was set up in 1932 for the benefit of all inhabitants of the Protectorate, and all proceeds

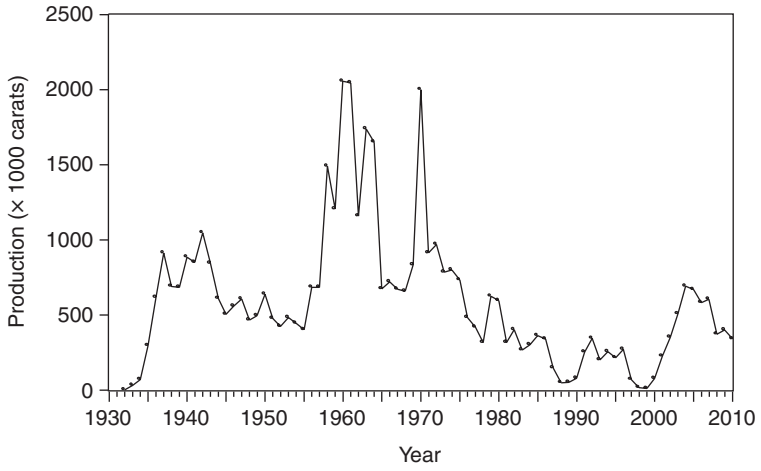

FIGURE 11.1. Diamond production in Sierra Leone, 1932–2010. *Source*: based on data from government of Sierra Leone and Levi *et al.* 1976. *Note*: the figure for 2010 includes only the first eight months of the year.

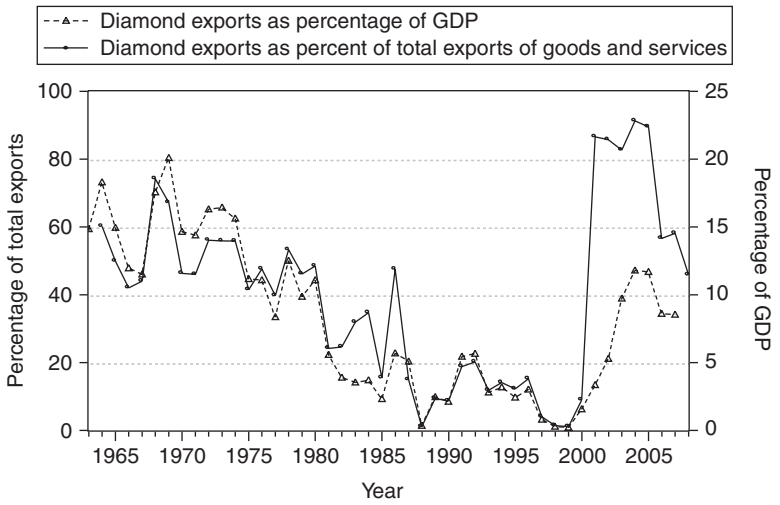

FIGURE 11.2. Diamond exports in Sierra Leone, 1963–2008.
Source: based on data from the government of Sierra Leone and IMF.

from the mining rental fees were deposited into this fund (see Kargbo 2010; Williams *et al.* 2002; Gberie 2002, 2005).

The huge influx of individual miners in Kono district increased illegal diamond mining during the 1950s. The number of diggers increased up to 75,000 in 1955, with significant negative impacts on other economic activities in the country. In particular, the agriculture sector experienced significant production declines as the farmers abandoned rice fields for the diamond fields of Kono,

and iron ore mines in Marampa, near Lunsar (see Levi *et al.* 1976). The farmers who remained on their farms were not able to produce enough food to meet domestic demand. Moreover, the rice shortages were exacerbated by alleged hoarding and smuggling by Lebanese merchants in order to artificially increase food prices in the country (see, for example, Van der Laan 1975; Williams *et al.* 2002). The significant shortages of rice and other food items led to price hikes and the outbreak of riots in Freetown and other parts of the country during the 1955–6 period. About 18 people died and there was widespread destruction of property during the riots. Gberie (2002) reported that riots in 1919 in Freetown were also triggered by rice shortages, and those riots were directed mainly at the Lebanese merchants who dominated the retail trade in Sierra Leone at the time. The colonial administration investigated the causes of the 1955–6 riots and hoarding allegations; in the end, they deported two Lebanese rice dealers for their role in creating the rice shortages.

The influx of illegal miners led to their encroachment into the SLST concession areas as more and more Sierra Leoneans demanded mining access rights to some of those concessions. These were demands that the government could not ignore without serious clampdown and bloodshed, which neither the government nor SLST could stomach. This situation prompted the colonial government and SLST to review their existing agreement, resulting in a reduction of SLST's concession to 590 km^2 in the Yengema/Koidu area and 210 km^2 in the Tongo area. The revised lease was for 30 years and SLST received a compensation of £1.57 million for giving up mining rights in Bo District (see Kargbo 2010; Williams *et al.* 2002).

The Alluvial Diamond Mining Scheme (ADMS) was introduced in February 1956 to facilitate the provision of licenses and legal mining activities by artisanal and small-scale miners in Kono district and other parts of the country. The ADMS awarded 2,000–3,000 licenses per year covering 40 chiefdoms during the 1956–76 period. There were 25,000–40,000 tributors working in the licensed areas during this period. The ADMS regulated diamond sales and exporting through the then sole exporter – the Diamond Corporation of West Africa (DICORWAF), which was a subsidiary of De Beers. To some extent, the ADMS was successful in curtailing illegal diamond mining activities in the ADMS areas until the outbreak of the rebel war in the 1990s. However, SLST continued to experience illegal diamond mining activities in its leased areas throughout their stay in Sierra Leone (see Reno 1995; Williams *et al.* 2002).

The government of Sierra Leone became a direct participant in formal mining activities when it acquired a 51% stake in SLST through the National Diamond Mining Company (NDMC) in September 1970, thereby effectively nationalizing SLST. Prime Minister Siaka Stevens allowed Jamil Said Mohammed – a businessman of mixed Sierra Leonean–Lebanese heritage and Siaka Stevens' close business associate – to buy 12% of the government's shares without any open bidding process. In effect, Jamil controlled 6.12% (i.e. $0.12 \times 0.51 = 0.0612$) of the entire mining company's shares. British Petroleum International Limited ('BP Minerals') acquired SLST's 49% stake in 1980 and sold its shares to the

Precious Minerals Mining Company (PMMC) four years later for US$8.5 million (see Williams *et al.* 2002; Kargbo 2010).

The government gave the PMMC full control of NDMC management and the company's shares were distributed as follows: government of Sierra Leone had 35%, Jamil Said Mohammed and Tony Yazbeck (a Lebanese businessman with close ties to Siaka Stevens and Jamil) each had 15%, and the remaining 35% was distributed amongst 46 people and companies with close ties to Siaka Stevens, Jamil, Yazbeck or senior politicians of the All People's Congress (APC), the ruling party, and their associates (see Kargbo 2010; Smillie *et al.* 2000; Williams *et al.* 2002). The attempts of Siaka Steven's successor, Joseph Momoh to reform the mining sector, in particular, the diamond trade, were not successful.

11.2.2 1991 to Present

The mining sector in Sierra Leone has been dysfunctional and riddled with corruption, poor government policy and lack of technical staff and resources to effectively manage the country's mineral wealth over the years. These problems are most pronounced in the diamond industry, which is largely alluvial in nature. One can argue that government mismanagement, corruption and greed contributed to the political instability and rebel war that started in 1991, which led to the death of up to 200,000 people, with thousands maimed and having their limbs cut off, and sending nearly 500,000 people as refugees to various other countries.

The struggle to control the diamond mining areas perpetuated the war. Both the Revolutionary United Front and government forces were intricately involved in diamond mining and smuggling. The Government Gold and Diamond Department (GGDD) which values and levies export taxes on all diamonds that are officially exported from Sierra Leone was eventually closed in the 1990s after the National Provisional Ruling Council (NPRC) looted the gold and diamonds that were kept in the GGDD headquarters in Freetown. According to the *Cocorioko Newspaper* (2010a,b), John Benjamin, NPRC's Chief Secretary of State and currently Chairman of the SLPP, made all the arrangements for the sale of diamonds in Antwerp valued at US$45 million (see also Kargbo 2010; Abraham 2004; Kpundeh 2004).

Despite Sierra Leone's well-known vast mineral wealth, the country has not been able to attract any of the large global mining companies like Rio Tinto operating in Guinea, and ArcelorMittal working in Liberia. The more recent entrants into the nation's mining sector, especially during the war period, include African Minerals Limited (AML), Koidu Holdings and London Mining Company (LMC). These companies are generally known in the global mining industry as *'juniors'* or *'bottom feeders'* that scour the earth in search of new mineral deposits that they may partially develop, advertise and sell to bigger and more developed mining companies (see, for example, Gbenda 2011; Smillie *et al.* 2000; Gberie 2005, 2010; Kargbo 2010). These companies generally lack the reputation of global giants.

Let us briefly look at each of these companies to have a better understanding of the role they play in the economic performance of Sierra Leone.

Koidu Holdings Limited

Koidu Holdings Limited, a former South African-owned company whose ownership has transferred to the Geneva-based Benny Steinmetz Group is involved in Kimberlite diamond mining, and shortly after the war it signed an exclusive 25-year lease to mine all known Kimberlite deposits in the country. Gberie (2010) reported that the Kimberlite mines are expected to yield for the company diamonds worth approximately US$1.5 billion during the lease period. Koidu Holdings Limited claims it spent US$18 million during 1995–7 on trial mining activities but had to halt operations because of the war (see Smillie *et al.* 2000; Partnership Africa Canada 2004, 2006).

African Minerals Limited

African Minerals Limited (AML) which is controlled by the controversial Romanian-born businessman, Frank Timis, was started in 1996 as African Diamond Holdings Limited, and later changed its name to Sierra Leone Diamond Company. The company is now registered in Bermuda and started operations in Sierra Leone during the war. Through its incarnations over the years, African Minerals has a number of subsidiaries that acquired prospecting and exploration licenses for diamonds, bauxite and other minerals in Sierra Leone. Partnership Africa Canada (2006, 2009a,b) reported that these subsidiaries include Fatkad Mining Company Limited, Kangaroo Mining Company Limited, and Molans Mining Company. Sierra Leone Diamond Company had beneficial interests in North West Diamond and Gold, Limited. The tangled web of corporate names and interests creates confusion and raises concerns amongst serious observers about the legitimacy or truth about some of the claims African Minerals is making in Sierra Leone.

According to Partnership Africa Canada (2009a,b), African Minerals claims (without providing any evidence publicly) that it holds mining and exploration licenses that cover more than 40,000 km^2, which is an area covering over 50% of the country. The mineral rights were granted by the government of Sierra Leone sometime between 2004 and 2005. These claims have prompted civil society groups to accuse the company of 'land grabbing' (see also Gberie 2010). Milestone Trading Company and African Minerals were recently suspected of fraudulently passing leaflets to scare off artisanal miners from their leased property in Sando Chiefdom, Kono district (see Kargbo 2010). African Minerals has made a series of attention-grabbing announcements about its Tonkolili iron ore project during the past two years. It claims that, based on its detailed surveys, Sierra Leone has nearly 10 billion tons of iron ore deposits at an average grade of 29.9%, mostly in the Northern Province, in particular Tonkolili district. This claim makes this discovery the largest iron ore find in the world within the past 20 years and largest deposit in Africa (see Gbla 2009; Gberie

2010; Kargbo 2010). Shortly after these announcements, Frank Timis made over US$500 million in 2010, thereby making African Minerals the largest company listed on London's Alternative Investment Market (AIM). The earlier attempts by African Minerals to sell a 12.5% stake of its company to China Railway Materials Commercial Corporation for US$245 million did not materialize. However, there are arrangements underway for China's Shandong Iron and Steel to invest over US$1 billion in the company's mining operations in Africa (see, for example, McNamara 2010; Gberie 2010; Kargbo 2010).

For his part, Mr Tony Sage of Cape Lambert Resources, which fully acquired Marampa mines from African Minerals within the past year, announced that the company was putting up the mines for sale in 2011 (see Evans 2010). During the discussions for the purchase of the mines, Cape Lambert had agreed to spend at least US$25 million on the development of the mines. However, within a year, they were seeking at least US$500 million plus an ongoing equity interest in the project. According to Cape Lambert, the Marampa mines contains 197 million tons of a 28.5% grade iron ore with further exploration expected to expand this resource base.

In view of Frank Timis's chequered past, the political leadership in Sierra Leone should be very careful in dealing with him, in particular, when there is enough evidence available for them to make the right decisions. For example, African Minerals claimed in 2005 that it had invested US$12 million the previous year in a series of high-resolution airborne magnetic surveys over its license areas, and that nearly 40% of the area had been surveyed. As Gberie (2010) has reported, this turned out to be false.

Frank Timis founded Regal Petroleum in 1996 and, while Timis was serving as head of the company, Regal produced a series of false and misleading reports concerning the production potential of Greek oil wells that the company was developing (see Holmes 2009; *Wall Street Journal* 2009a,b; Kargbo 2010). The deception led to the sharp rise in Regal's share price by more than 500% between June 2003 and March 2005. The three fundraisings held by Regal during this period produced more than £100 million. After admitting that the Greek wells were in fact dry, Regal's share price dropped by more than 60% in a single day in May 2005. The matter was investigated by the UK Alternative Investment Market (AIM) disciplinary committee since Regal violated AIM's rules. After almost five years of investigation, Regal Petroleum was found guilty, fined £600,000 and was publicly censured. This was the largest fine ever handed down by the Alternative Investment Market.

The current political leadership in Sierra Leone should benefit from the advice of knowledgeable persons and organizations if Sierra Leone is to benefit from its mineral wealth far more than in the past. Such advice would no doubt include the importance of collecting information on the quantity and value of the minerals and of using auctioning processes in allocating extraction rights to the minerals. As *The Economist* (2010) has noted, Sierra Leone seems to be repeating the mistakes of the past, only that now the stakes are higher. In particular:

> The kind of resource predation that led to violence breaking out in the first place may be returning, this time with iron ore rather than diamonds as the catalyst. With notable haste, the government in Freetown has given two big extraction leases to British companies. The first, London Mining, will redevelop an abandoned mine at Marampa. The second, much larger, deal with African Minerals concerns a find at Tonkolili that the company says is the world's largest deposit of magnitite – used, among other things, for coating industrial boilers.
>
> *The Economist* 2010

Obviously the Sierra Leonean authorities should ensure that all deals conform to the Mines and Minerals Act 2009 that was passed by parliament in November 2009 (see GoSL 2009c). In this regard, various observers have identified serious breaches of the law. For example:

> On 31 December 2009, the government signed a 25-year agreement with London Mining which bluntly violated key provisions of the recently passed 2009 Mines and Minerals Act. The Agreement included an 80% reduction in income taxes for 10 years for the company, as well as 80% reduction in other major revenue streams from it for 25 years. London Mining is to pay a corporation tax of 6% – instead of 30% set by the 2009 Act – on its investment; duty on its mining materials was pegged to 1% instead of the official rate of 5% which all other companies pay, and royalties were reduced for it to 3% instead of the official 4%. Worse yet, the agreement should remain in force for 25 years, and can only be changed if London Mining wishes to do so.
>
> Gberie 2010, p. 13

This controversial deal drew angry protests from a wide range of quarters, including civil society organizations such as the Network Movement for Justice and Development, the media and other sections of the society (see Gberie 2010; Kargbo 2010). It is rather ironic that during the same month President Koroma's administration signed documents that gave huge tax concessions to foreign-owned mining companies, the government imposed the Goods and Services Tax which has severe consequences on vulnerable members of the population in the country (see, for example, GoSL 2009d; Gbenda 2011; Kargbo 2011). The country's Minister of Trade and Industry, Dr Richard Konteh, announced on 1 May 2011 that the government was cutting by 50% (effective immediately) the annual fuel subsidy to save money and help repay the country's foreign debt (see Akam 2011; Bah 2011). As a result, fuel prices increased by nearly 30% overnight at the gas stations. This policy has been adopted during a time of rising street tensions and riots due to sharp increases in commodity prices that exacerbate food and fuel price inflation across countries around the world (see also Kargbo 2009).

Frank Timis formed African Petroleum so that he could bid for the offshore oil fields of Sierra Leone's newly discovered oil reserves. Gbenda (2011) reported that parliament is in the process of ratifying an offshore lease agreement for African Petroleum despite the evidence that is available in the public domain about the deceptive business practices of Frank Timis and his companies. Both

the London Stock Exchange and the Australian Stock Exchange have blocked the listing of African Petroleum on their markets (Bennet 2010; Kargbo 2010). Frank Timis accused the exchanges of a 'witch-hunt', but others will call it due diligence to prevent the ripping-off of an unsuspecting public.

Already, there are disputes between the exploration companies concerning the demarcations of the various areas covered by each company's exploration license. For example, the dispute between the Nigerian-owned Oronto Petroleum of Chief Arthur Eze and Anadarko Group, an American company working with Repsol and Woodside, could be referred to the US State Department and Justice Department in Washington, DC, for violation of the Foreign Corrupt Practices Act of 1977. Fugleberg (2011) reported that Oronto Petroleum Corporation has filed a complaint against Anardako in the US District Court in Wyoming on 14 April 2011, claiming that Anardako and Repsol conspired with the government of Sierra Leone to take away part of the exploratory block (off-shore area) that was initially leased to Oronto, thereby hindering Oronto's ability to market and develop the block. Meanwhile, both the government of Sierra Leone and Oronto are in arbitration proceedings at the International Chamber of Commerce Court of Arbitration in London to settle Oronto's claims that the government took part of its block and gave it to Anardako and Repsol. The evidentiary hearing is set for 5 December 2011. Gberie (2010) reported that Repsol allegedly bribed Sierra Leonean government officials to win their portion of the contract. At the same time, it is not entirely clear whether Oronto Petroleum was doing any serious oil exploration in Sierra Leone since it was granted the first lease shortly after the end of the war (see Gberie 2010).

President Koroma told parliament on 8 October 2010 that:

> All of us grew up knowing that our country is rich in mineral resources. However, these riches have not been translated into tangible benefits for our people. The country's mineral sector also lacked proper regulatory regimes, leading to non-transparent transactions, decrease in investor confidence and failure to attract large-scale investments. My government is determined to change this.

President Koroma should put in place a proper management framework to facilitate the implementation of his *Agenda For Change*. The problems highlighted by the President are clearly tied to the endemic corruption that has permeated the Sierra Leonean society for decades (see, for example, Kargbo 2010; Adolfo 2010; GoSL 2010; Thomas 2011). President Koroma ran his election campaign leading up to the 2007 elections on a promise to vigorously fight corruption in Sierra Leone. Among other things, he should endeavour to keep this promise.

11.3 Management of Revenues for Economic Growth

The efficient management of the nation's wealth, for economic growth and reduction of income inequality and poverty, is urgently needed if Sierra Leone

TABLE 11.1. Estimates of Sierra Leone government revenues, 2011–15 (US$ million).

Company, ministry, department or agency	Year				
	2011	2012	2013	2014	2015
Mining companies	27.68	200.9	534.57	718.28	743.53
Projected tax receipts, excluding mining taxes	160.6	169.53	178.34	183.23	184.87
Ministry of Fisheries and Marine Resources	3.75	4.25	4.75	5.25	5.75
Ministry of Agriculture, Forestry and Food Security	0.26	0.3	0.31	0.33	0.34
Petroleum Resources Unit	5.73	5.73	5.73	5.73	5.73
Projected aid flow	200.95	219.57	197.07	205.86	204.86
Grand total	398.97	600.28	920.77	1,118.68	1,145.08

Source: based on M'cleod (2010). *Notes*: mining companies figures are projections by selected mining companies.

is to prevent another round of political instability, increased social tensions and outbreak of war. Nearly 70% of the population is below the national poverty line. Sierra Leone's current Poverty Reduction Programmes are being implemented within the *Agenda for Change* framework announced by President Koroma in December 2008. The Poverty Reduction Strategy requires significant investments in infrastructure, improvement in the delivery of social services, and private sector development.

Sierra Leone is expecting a very significant increase in government revenues within the next five years (see Table 11.1). The mining sector is expected to account for 48–81% of those revenues. Government analysts argue that these are very conservative estimates as they do not include taxes from some newly registered enterprises that will be generating tax revenues within the next 1–2 years. Furthermore, the estimates do not include the discovery of other minerals, such as heavy sands, gold and oil (see M'cleod 2010). Managing this unprecedented boom in national wealth for sustained economic growth and poverty reduction need to be the primary objective of government policymakers in Sierra Leone. They cannot adopt a business-as-usual approach as this could spell trouble for this post-conflict nation with a fledgling economy. Growth in real GDP was expected to be 4.5% in 2010, up from 3.2% in 2009, and may increase to 5% or higher in 2011.

The government's fiscal policy in recent years has largely focused on the mobilization of domestic revenues and improving the management of government expenditures to maintain macroeconomic stability and promote sustainable economic development. The government has increased enforcement of existing tax laws to eliminate tax evasion and avoidance. For instance, the National Revenue Authority is implementing measures in accordance with the

provisions of the Finance Act of 2009, in particular with regards to the issue of transferring off-budget revenues to the Consolidated Revenue Fund (see Kargbo 2011). Moreover, the government has designed the Integrated Public Financial Management Programme in efforts to achieve sustainable improvement in the credibility, predictability, transparency and control of fiscal and budget management in the country.

It is expected that the enactment of the Public Debt Management Act of 2011 which was signed by President Ernest Koroma on 14 March 2011 will boost the development of a comprehensive legal and regulatory framework for sustainable public debt management in the country. This bill will consolidate all existing laws that relate to public debt management in Sierra Leone (see GoSL 2011). The country's external debt in 2010 was equivalent to 39% of GDP, while domestic public debt was equal to 16.5% of GDP. The savings provided by the Highly Indebted Poor Countries (HIPC) initiative increased by approximately 41.0% during the 2008–9 period (see Kargbo 2011). Thus, the reduction of the public debt will free up funds for economic development. At the same time, the proper management of the mining sector can help to reduce or pay off the country's remaining debt, thereby freeing up funds for economic development because the debt burden will either be light or non-existent in the future.

The International Council on Mining and Metals (ICMM) reported in December 2008 that nearly 3.5 billion people worldwide live in economies that significantly depend on mining and related activities. Approximately 43% of these people live in low-income and emerging market countries and earn less than US$2.00 per day. The research findings of the ICMM's Resource Endowment Initiative that was launched in 2004 in partnership with the World Bank and the United Nations Conference on Trade and Development showed that contrary to the frequently cited 'resource-curse' arguments, mining can make significant contributions to economic growth and poverty reduction in Sierra Leone and other mineral-rich countries. However, such contributions depend upon the availability of the right management, building of institutional capacity that improves legislative and regulatory frameworks, improved governance, investor- and environment-friendly conditions, coupled with genuine collaboration between the host governments, civil society organizations, international aid agencies and foreign donor countries (see Commonwealth Secretariat and ICMM 2009; Dumas 2010).

Despite being amongst the top 10 diamond producing countries in the world, Sierra Leone consistently has ranked at the bottom of the UN Human Development Index during the past few decades. Table 11.2 shows Sierra Leone's ranking as a major diamond producer in recent years. Although countries such as Botswana, Mozambique, Uganda and Ghana are success stories in relation to management of their huge mineral wealth, the level of poverty remains high in several countries (see, for example, Partnership Africa Canada 2005, 2008, 2009a; Collier 2007, 2010; Dumas 2010).

Increasingly, there is an awareness across African countries that mineral resources are both economically and strategically important assets that must

TABLE 11.2. Major African diamond producers in 2007.

Country	US$ (million)	% of world production
Botswana	2,960.14	24.50
South Africa	1,417.33	11.70
Angola	1,271.96	10.50
Namibia	748.05	6.20
Democratic Republic of Congo	609.83	5.00
Lesotho	164.07	1.40
Sierra Leone	141.57	1.20
Central African Republic	59.86	0.50
Guinea	50.20	0.41
Tanzania	28.50	0.24
Ghana	27.86	0.23
Zimbabwe	23.38	0.20
Liberia	2.70	0.02
Togo	1.24	0.01
Total	7,506.65	62.08

Source: based on data from Partnership Africa Canada (2008).

be handled judiciously for the benefit of Africans. The catalysts for realizing better benefits from the vast mineral wealth in Sierra Leone and other African countries include: a sustained boom in commodity markets and prices, rapid global economic growth, especially in emerging markets such as China and India that fuel demand for resources, and improvement in governance and spread of democracy (see Pedro 2008; M'cleod 2010). As Ferguson (2007) has argued, for far too long, the most vigorous debates about Africa's economic development future have largely been directed and dominated by outsiders, in particular, citizens of industrialized countries and international institutions located outside the continent. Sierra Leone and the other African countries will find it very difficult to achieve their development potential if they continue to do things as usual. There must be a reawakening for the Africans to chart their own development trajectory and hold their political leaders accountable for their actions. Part of this process includes understanding the intersectoral linkages between mining, agriculture and other sectors of the economy.

11.4 Intersectoral Linkages

As Sierra Leone implements a wide range of postwar development policies and programmes to revamp the economy and reduce poverty, the policymakers need to identify and exploit the intersectoral linkages between mining, agriculture and other sectors of the economy. Using data covering the post-independence period, Kargbo (2010) estimated the macroeconomic growth

TABLE 11.3. Simulation results for sectoral income shocks of Le 1.00 in Sierra Leone.

Simulation experiment: shock to sector	Growth multiplier	Changes in sector			
		Agriculture	Manufacturing	Services	Mining
Agriculture	7.96	1.450	1.690	1.050	3.770
Manufacturing	8.68	1.590	1.860	1.150	4.080
Services	8.74	1.600	1.870	1.160	4.110
Mining	8.69	1.590	1.860	1.150	4.090

Source: author's calculations. *Notes*: see Chapter 9 of Kargbo (2010) for details of the econometric model used in providing the estimates for this table.

multipliers for agriculture, mining and other sectors of the Sierra Leonean economy that reflect the spin-off effects on local activities that are triggered by spending of increased incomes in the farm and non-farm sectors.

Table 11.3 presents the growth multipliers that estimate the magnitude and strength of the production and consumption linkages between various economic sectors in Sierra Leone.[1] The growth in mineral exports can trigger the initial income shock to generate the growth multipliers. Both forward and backward linkages are very important for sustaining economic growth in the country. Backward linkages deal with the demand for derived inputs from a new activity, such as the demand for logs/timber that is triggered by the establishment of sawmills in a rural area due to the boom in mining activities. Forward linkages involve production activities that grow from the introduction of a new intermediate product in the market. For example, the increased output of boards by the new sawmills or falling prices for boards could stimulate the construction industry, thereby requiring more labour, food supplies and services from other sectors of the economy. Thus, as shown in Table 11.3, an additional Le 1.00 of income pumped into the mining sector generates an additional Le 7.69 of income in the economy (i.e. growth multiplier (Le 8.69) − initial Le 1.00 = Le 7.69). The mining sector has the potential to generate higher additional income to the economy net of the initial Le 1.00 increase compared to any other sector. For example, an initial Le 1.00 increase in the mining sector will generate an additional Le 1.59 in agriculture, Le 1.86 in manufacturing, and Le 1.15 in the services sector. Furthermore, the initial Le 1.00 shock to mining feeds back into the mining sector through the various growth linkages in the economy, and generates an additional Le 3.09 of income within the economy.

Haggblade *et al.* (1991) argued that consumption linkages are more important than production linkages in the low-income countries. For example,

[1] The agriculture sector includes forestry, hunting and fishing. Mining sector includes quarrying and construction. Manufacturing includes handicrafts. Services sector includes wholesale and retail trade, hotels and restaurants, transport, storage and communication, finance, insurance, real estate and business services, producers of government services, etc. (see GoSL 1992).

consumption linkages accounted for 80–90% of the total growth multipliers in Sierra Leone and Malaysia, compared to 60% in Oklahoma. Two interrelated sets of consumption linkages are important in understanding the impacts of income distribution on sectoral growth and employment in Sierra Leone. The first set of consumption linkages deals with factor intensities of the consumption pattern – that is, the amount of labour, capital and foreign exchange resources used to produce the goods and services that shape that consumption pattern. The second set of linkages is referred to as locational linkages because they show us where the impacts of rural consumption expenditures are felt (see, for example, King and Byerlee 1977; Byerlee *et al.* 1983; Kargbo 2010). The extent to which the effects of locational linkages are felt in the economy depends on income and distribution – whether the commodities are produced at home by the family or purchased in rural or urban areas, and domestically produced or imported. Furthermore, consumption patterns are highly labour-intensive in Sierra Leone. Approximately, 84% of all increases in consumer expenditures were on goods produced in the small-scale agricultural, fishing, industrial and services sectors. Thus, increases in rural incomes are an effective way of creating employment activities in the country, in particular in rural areas.

According to the report on the *Census of Business Establishments 2005* produced by Statistics Sierra Leone, imported materials accounted for 75% of the raw materials used by business establishments in Sierra Leone (see GoSL 2006). Nearly 68.3% of the businesses (all in retail trade) in Sierra Leone imported 52.2% of the raw materials and goods, compared to using only 12.2% of the raw materials that are locally produced. Large-scale enterprises required Le 25.00 worth of imported inputs to produce Le 100.00 of output, compared to Le 4.50 of imported inputs for Le 100.00 of output in the agriculture and small-scale industry (see Byerlee *et al.* 1983). The small-scale sector imported only 20% of their capital goods requirement compared to more than 50% imported by large-scale enterprises.

The analysis in Table 11.3 is further supported by the intersectoral spending patterns during the postwar period as reported in the government's *2003/04 Sierra Leone Integrated Household Survey (SLIHS) Statistical Report*. For instance, non-farm enterprises spent a total of nearly Le 10.0 billion on inputs to operate their businesses. Nearly 33% of the input expenditures were on hired labour. Retail trade enterprises accounted for 48% of the total input expenditures, while enterprises involved with manufacture of wearing apparel and mining activities accounted for 27% and 22%, respectively (see GoSL 2007). Other non-farm enterprises accounted for the remaining 3%. About 7% of retail trade activities used hired labour of between 1 and 25 people. More than 50% of the mining activities used between 1 and 6 people as hired labour. Approximately 45% of retail trade expenditures were on vehicle rentals, while 28% of the expenditures in the mining sector were on fuel and lubricants.

It was estimated that 1.61 million households had access to 7.52 million pieces of farm equipment, such as hand hoes, cutlasses and winnowers. Furthermore, the *2003/04 SLIHS Statistical Report* showed that nearly 3.20 million

pieces of farm equipment were sold in Sierra Leone during the survey period. The total value of the various farm implements was Le 591 billion for hand hoes, Le 306 billion for winnowers and Le 365 billion for cutlasses (GoSL 2007).

The foregoing analysis shows that increased household incomes derived from, say, increased mineral and/or agricultural exports, better infrastructure or technology are spent on farm and non-farm items whose production was previously constrained by lack of adequate local demand. Such spending has spin-off effects that subsequently generate new additional income in the economy. The extent to which additional net income growth can stimulate rural development in Sierra Leone or any country depends on how the rural households spend the extra income. Is the incremental income spent on items imported or those produced locally? Does the extra income stimulate new local production or simply lead to higher prices?

As governments of the major mining countries debate the environmental, social and economic impacts of mining, a key question that features in these debates is whether the benefits exceed the cost of mining. Issues dealing with corporate and social responsibility, environmental stewardship and community development are increasingly being included in mining contracts. Taxation of mining companies is one way of increasing the benefits. Whilst mining companies (or most companies for that matter) are always in the habit of vigorously resisting higher levels of taxation, Otto (2008) argued that the prevailing total effective tax rate is generally not the dominant factor reputable mining companies use in deciding where to invest. His research shows that mining companies are more interested in the overall stability of the tax regime, including the predictability of tax changes within the next 10–20 years, say. Political risks and environmental laws are other major factors that are generally considered in the decision-making process. In effect, reputable mining companies do not necessarily invest in the country with the lowest level of taxation.

A team of consultants that were closely involved in the development of the ICMM's Resource Endowment Initiative made a number of observations on the issue of taxation in the mining sector (see ICMM 2008; Commonwealth Secretariat and ICMM 2009). First, the government should try to maximize its tax revenues over the long term instead of the short term, thereby allowing appropriate adjustments to the tax regimes as conditions change. When and where appropriate, the adjustments can be made in collaboration with the mining companies and disclosed to the public to ensure that the tax system continues to receive popular and political support. Second, special tax regimes for mining (e.g. project-specific arrangements) are inherently risky despite the fact that they seem to offer stability. It is better to adopt the longer-term goal and economy-wide perspective by subjecting mining into the general tax system, and if necessary including features in the tax code that are unique to the mining sector, such as extremely high up-front capital costs and the revenue stream from royalties provided by mining investments. Third, increased transparency is in the best interest of the companies and governments. There is a growing

body of evidence which shows that good governance and public accountability enhances political legitimacy while creating a viable and stable operating environment for the mining companies.

The above discussion on taxation means policymakers in Sierra Leone and other developing countries should consider the factors discussed above in designing their tax policies for the mining sector. For example, Sierra Leone could start off with simpler tax regimes rather than more complex regimes that may be hard to administer effectively. This allows for the development of competent local administrative capacity to handle more complex tasks in the future. Finally, as the ICMM (2009) has observed, the fiscal decentralization or revenue sharing arrangement with sub-national governments (e.g. Local District Councils and Chiefdoms in the case of Sierra Leone) do not necessarily achieve the desired benefits from mining, especially when the local governments are riddled with corrupt officials and the funds are not invested for the benefit of the people.

The next section presents the modelling exercise to illustrate its usefulness in quantitative policy making.

11.5 A Model For Diamond Production

The implementation of policy reforms requires decisions that are based on reliable information. We illustrate in this section how available data in the diamond industry and wider economy can be used to predict the impact of changes in prices, income, exchange rate and trade policies on diamond production in Sierra Leone. It is widely known that diamond smuggling is a very serious problem in Sierra Leone and neighbouring countries. Thus, based on our discussion in the previous sections, we hypothesize that officially recorded diamond production (DIAPD) in Sierra Leone could be represented by the following econometric relationship:

$$\mathrm{DIAPD}_t = f(\mathrm{PRDIA}_t, \mathrm{PRCOMM}_t, \mathrm{OPEN}_t, \mathrm{WINC}_t, \mathrm{RER}_t, \ldots, Z_t), \quad (11.1)$$

where DIAPD_t represents the quantity of officially recorded diamonds that are produced and exported per year in Sierra Leone. Note that Sierra Leone generally exports all the diamonds that are officially recorded as produced in a given year. PRDIA_t is the real price of diamonds exported through official channels, and it is calculated as the unit value deflated by Sierra Leone's CPI. Sierra Leone is a price-taker in the world diamond market, thus, it only reacts to movements of world diamond prices in terms of the quantity of diamonds it exports. De Beers and other members of the diamond cartel use various strategies, including withholding or reducing supply to control diamond prices around the world. In effect, diamond exports in the current period are likely to be influenced by exports in the previous periods. OPEN_t refers to openness of the Sierra Leonean economy, and it is calculated as the ratio of the sum of total

imports and exports over GDP. This variable is used as a proxy for the country's trade policies over the past decades (see Kargbo 2010).

PRCOMM_t is the world market price of commodities, such as coffee and cocoa. Artisanal diamond mining is a low tech and labour-intensive process that is done mostly during the dry season, which happens to be the time for harvesting of coffee, cocoa and other cash crops in Sierra Leone. Agricultural activities compete for the farmer-miner's labour hours. In effect, coffee or cocoa production is a substitute for alluvial diamond mining in the diamond mining areas of Sierra Leone (see Kallon 2004; Kargbo 2010). An increase in coffee (or any other cash crop) prices would increase the opportunity cost of diamond mining, thereby causing a rational farmer to embark on harvesting and processing of the season's coffee, cocoa or other cash crop. On the other hand, a fall in coffee prices will cause the farmer-miner to concentrate on diamond production for that year.

RER_t is the bilateral real exchange rate expressed in leones per US dollar adjusted by the respective countries' price indices (CPIs). Miners are paid in leones, but the diamonds are sold in foreign currency. In this case, a depreciation of the leone against the US dollar would likely raise the value of diamonds denominated in leones. Assuming all other things are held constant, this would likely create incentives to produce and export more diamonds. However, an appreciation of the leone could have the opposite effects because miners may have fewer incentives to offer diamonds through official channels, thereby increasing diamond smuggling to Liberia and other neighbouring countries. WINC_t is an index of real incomes (GDP) of industrialized countries. Z_t refers to other factors that affect diamond production in Sierra Leone, and $t = 1, 2, \ldots, n$ refers to annual time periods.

Because of data availability for all the variables required in our investigation, we limit the modelling exercise to reflect developments within the past five decades. This period encompasses different civilian and military regimes and the rebel war. We include dummy variables to capture the impacts of regimes and other changes in the economy. These dummy variables are defined below. $\mathrm{POLINST}$ is a dummy variable for war period/political instability in Sierra Leone, with $1 =$ occurrence of event, and 0 otherwise. APCREG is the dummy variable for APC-led government, with 1968–91 and 2007–9 $= 1$, and 0 otherwise. $\mathrm{SLPPREG}$ is the dummy variable for SLPP-led government/regimes in the country, so 1962–7 and 1996–2007 $= 1$, and 0 otherwise. $\mathrm{NPRCREG}$ is the NPRC regime dummy variable, with 1992–6 $= 1$, and 0 otherwise.

There are time lags involved in the interaction of miners, dealers and other participants in the diamond production and marketing chains in Sierra Leone and international market. We use the Johansen (1988, 2000) method in conducting our exercise within the cointegration framework. The model is estimated with the method of full information maximum likelihood, and the procedure has the advantage of permitting the joint determination of variables in the system. Furthermore, the method takes into account the short-run dynamics of the variables while allowing the system of variables to return to long-run

equilibrium. This makes the technique very useful for policy analysis (see also Johansen and Juselius 1990). The variables to be tested are specified in vector error correction form as:

$$\Delta P_t = \sum_{i=1}^{k-1} \Gamma_i \Delta P_{t-i} + \prod P_{t-k} + DZ_t + \nu_t, \tag{11.2}$$

where P_t is an m-dimensional vector of endogenous (non-stationary) variables (e.g. DIAPD_t, PRDIA_t, $\mathrm{OPEN}_t, \ldots, \mathrm{WINC}_t$) in the system. Simply put, endogenous variables have their values determined and interact with each other within the model, while exogenous or predetermined variables have their values determined outside the model. Endogenous variables are regarded as random or stochastic because their values are obtained from the measurement of some random process, while exogenous variables are treated as non-stochastic (see, for example, QMS 1998; Greene 2008). Z_t refers to the vector of stationary exogenous variables, including the dummy variables, D represents the matrix of parameters associated with the exogenous variables, Γ_i is a matrix of parameters for the lag process, k is the number of lags, and ν_t is the error vector, which is multivariate normal and independent across observations. Based on the Granger representation theorem, if the coefficient matrix, $\boldsymbol{\Pi}$ has reduced rank $r < m$, then there exists $m \times r$ matrices $\boldsymbol{\alpha}$ and $\boldsymbol{\Phi}$, each with rank such that $\boldsymbol{\Pi} = \boldsymbol{\alpha}\boldsymbol{\Phi}'$ and $\boldsymbol{\Phi}'\boldsymbol{P}$ is stationary (Engle and Granger 1987). The elements of α are called the adjustment parameters in the vector error correction model, and r is the cointegrating rank. Each column of $\boldsymbol{\Phi}$ is the cointegrating vector. Bear in mind that our series may have non-zero means and deterministic trends as well as stochastic trends. Likewise, the cointegrating equation(s) may have intercepts and deterministic trends. We used the *likelihood ratio (trace) test statistic* for testing the hypothesis of at most r cointegrating vectors in each model. An alternative test statistic is the *maximum eigenvalue statistic* (see, for example, Johansen 2000; Johansen and Juselius 1992; QMS 1998 for details).

11.5.1 Data Sources

The data for official nominal exchange rates, the index of gross domestic product (GDP) for industrialized countries, the total exports and imports of goods and services, the CPI, and the world market prices for coffee and cocoa was obtained from various issues of the *International Financial Statistics (IFS) Yearbook*, published by the International Monetary Fund. The data for diamond production and exports was from various Sierra Leone government publications and websites, such as Statistics Sierra Leone, which is available at www.statistics.sl/ and the Bank of Sierra Leone, available at www.bankofsierra leone-centralbank.org/. Supplementary data was obtained from Saylor (1967), Levi *et al.* (1976) and the World Bank Africa Database CD-ROM.

11.5.2 Empirical Results and Policy Implications

This modelling exercise has been done to demonstrate the importance of using quantitative techniques in designing effective policies for economic growth in Sierra Leone. This aspect of policymaking provides us information about the magnitudes of potential changes brought about by the implementation of various policies in the economy. In effect, this technique shows the linkages between various sectors of the economy, and thus, can serve as an effective planning tool in the practitioner's kit. Any serious attempts at effective policy formulation should include the use of quantitative methods whenever and wherever possible. The professionals that guide the country's politicians and leaders should be encouraged to use these quantitative techniques. Furthermore, where necessary, training should be provided to the policy advisers in the use of these quantitative techniques.

Prior to conducting the cointegration tests, we used the augmented Dickey–Fuller (ADF) and Phillips–Perron unit root tests to determine the stationarity of the individual variables used in our analysis. Having a stationary time series is very important for economic modelling and forecasting, coupled with the prevention of spurious regressions that are often found in the economics literature (see Engle and Granger 1987; Greene 2008; Kargbo 2010). Research has shown that a time series that is weakly stationary has its mean, variance and autocorrelation basically constant through time. However, non-stationary time series do not have valid error-correction representations, thereby making their use in policy analysis rather suspect as they could lead to misleading conclusions. Because a large number of economic time series variables are non-stationary, we difference them to achieve stationarity. Our unit root test results showed that all the variables are $I(1)$, which means stationarity was achieved after differencing the variables once.

The cointegration test results are presented in Table 11.4, and they show that there is only one cointegration relation amongst the variables in the system. The long-run parameter estimates for the impacts of changes on diamond production in Sierra Leone are presented in Table 11.5. The normalization centres on the variable (in this case, DIAPD) with the coefficient 1.000. These results suggest that reductions in world income (proxied by the incomes of industrialized countries (WINC)) brought about by, for example, a recession, have negative impacts on diamond production in Sierra Leone as it leads to reductions in demand for diamonds worldwide. Whilst emerging market economies, such as China, Israel and India are major diamond importers (see Table 11.6), we do not have sufficient data or a single income variable that captures all of these countries. But it is clear that since we live in an integrated global environment, a recession in or reduction in the incomes of industrialized countries is bound to affect demand for products from Sierra Leone and other countries. For instance, as shown in Table 11.5, a 1.0% reduction in world income (WINC) would lead to a 6.0% decline in Sierra Leonean diamond exports, assuming all other factors are held constant.

TABLE 11.4. Johansen cointegration tests and results for diamond production in Sierra Leone, 1962–2007.

Number of lags and DT	Hypothesized number of CE(s)	Eigenvalue	Trace (LR) test statistic	5% critical value	1% critical value	Rank (r)
1, CT	$r = 0$	0.541	92.950**	87.31	96.58	1
	$r \leqslant 1$	0.499	57.069	62.99	70.05	
	$r \leqslant 2$	0.223	25.246	42.44	48.45	
	$r \leqslant 3$	0.163	13.666	25.32	30.45	
	$r \leqslant 4$	0.112	5.466	12.25	16.26	

Notes: DT refers to the type of deterministic trends that are present in the data. For example, C indicates that a constant was included in the cointegrating equation (CE), and CT indicates that a constant and trend was included in the CE. r tests for the number of cointegrating relations against the alternative hypothesis of full rank, i.e. all series in the model are stationary. ** indicates rejection of the hypothesis at the 5.0% significance level. The number of lags was determined by minimizing the Akaike information criterion and Schwarz criterion. See QMS (1998) for further details.

TABLE 11.5. VEC estimates for diamond production in Sierra Leone, 1962–2007.

DIAPD	WINC	PRDIA	RER	PRCOF	Constant	Trend
1.000	−6.081	0.485	−0.438	1.058	3.305	0.124
	(2.114)	(2.063)	(2.151)	(2.874)		(1.754)
Adjustment coefficients						
−0.228	0.030	−0.115	0.071	0.068	—	—
(2.361)	(5.784)	(1.191)	(0.431)	(1.317)		

Notes: numbers in parentheses are absolute t-values. '—' indicates that data is not available. 'PRCOF' is the real price of coffee. All the variables are expressed in logarithms.

Increases in the real prices of diamonds (PRDIA) elicited a positive response from miners and dealers, thereby leading to increases in diamond production. The complexities of household economics and labour linkages may affect the level of competition for the farmer's or miner's labour hours devoted to farming or mining. Thus, the increase in real coffee prices may have led to reduction in diamond production, assuming the higher coffee prices were more attractive than diamond mining during the period. Officially recorded diamond production declined with the appreciation of the real exchange rate (RER) during the period under investigation. The adjustment to long-run equilibrium is borne by changes in diamond production (DIAPD) and world income (WINC).

Table 11.7 presents the short-run estimates for the impacts of changes in diamond production during the past five decades. The coefficients for variables that represent the various regimes seem to contradict the narrative laid out in the earlier sections of the paper. For instance, the coefficients show that the

TABLE 11.6. The world's top diamond importers, 2007–8.

Country	2007 US$ (million)	2007 % of world total	2008 US$ (million)	2008 % of world total
European Community	14,426.510	36.0	14,507.531	37.5
India	9,664.344	24.0	9,591.556	24.8
Israel	5,858.193	15.0	5,357.613	13.9
People's Republic of China	2,230.128	6.0	2,331.180	6.0
South Africa	2,113.895	5.0	—	—
Switzerland	—	—	1,560.438	4.0
United Arab Emirates	—	—	2,155.663	5.6
Other	5,779.210	14.0	3,171.797	8.2
Total	40,072.281	100.0	38,675.779	100.0

Source: based on data from Partnership Africa Canada (2008, 2009).

various regimes (e.g. APC, SLPP and NPRC) that have ruled the country during the post-independence period have positive impacts on diamond production. Indeed, while the impacts of the regimes may seem to contradict the negative image described earlier about the lack of widespread benefits from diamond production, a close analysis of the evidence in this chapter shows that only a few elites have benefited immensely from the nation's mineral wealth. Thus, it could explain why the regime coefficients are positive since a selected number of senior government officials have colluded with rogue operators over the years to maximize their benefits from diamond mining and access to other mineral rights at the expense of national development. In effect, the very senior policymakers or members of the regimes embarked on corrupt activities that sabotaged the government policies for personal gain (see, for example, Abraham 2004; *Cocorioko Newspaper* 2010a,b; Kargbo 2010).

Recently, there have been allegations surrounding Mr Usman Boie Kamara, the former Director of Mines and Mineral Resources who has been implicated in the smuggling in 2002 of the largest diamond ever found in Sierra Leone. The diamond weighed 1,444 carats. After the diamond dealers had gone carried out some elaborate plans and substituted the large diamond for a smaller one, President Ahmad Tejan Kabba and the nation were shown on national television a diamond that only weighed 110 carats, which was eventually sold for US$1.0 million. The *Standard Times Press* (2011a,b,c) has reported in a series of articles how Mr Usman Boie Kamara used his government position to conspire with the group of diamond dealers to smuggle the 1,444 carat diamond out of the country, thereby causing the nation to lose significant tax revenues that could have been used for development programmes. Despite repeated requests from the Parliamentary Sub-Committee on Mines and Mineral Resources,

TABLE 11.7. Short-run estimates for the determinants of diamond production in Sierra Leone, 1966–2008.

$$\begin{aligned}\Delta \log \text{DIAPD} = &- \underset{(0.108)}{10.315} + \underset{(7.447)^{*}}{3.230}\ \text{ACC} + \underset{(2.176)^{**}}{0.326}\ \text{SLPPREG} \\ &- \underset{(3.100)^{*}}{5.806}\ \Delta \log \text{WINC}_{t-1} - \underset{(6.129)^{*}}{0.519}\ \Delta \log \text{DIAPD}_{t-2} + \underset{(2.564)^{**}}{0.391}\ \text{APCREG} \\ &+ \underset{(0.079)}{0.017}\ \text{POLINST} + \underset{(4.813)^{*}}{1.427}\ \text{NPRCREG} - \underset{(1.366)}{0.360}\Delta \log \text{PRCOF}_{t-1} \\ &+ \underset{(2.313)^{**}}{0.112}\ \Delta \log \text{RER}_{t-1} + \underset{(0.956)}{0.094}\Delta \log \text{PRDIA}_{t-1} + \underset{(0.932)}{0.309}\Delta \log \text{PRCOA}_{t-1} \\ &- \underset{(1.143)}{0.468}\Delta \log \text{OPEN}_{t-1} - \underset{(5.657)^{*}}{0.482}\ \text{EC}_{t-1}\end{aligned}$$

R^2	0.551	ARCH: χ^2 (1)	1.404
Adj. R^2	0.326	WHET: χ^2 (21)	14.694
SER	0.531	JB statistic: χ^2	0.190
D–W statistic	2.245	RESET	$F(1, 28) = 0.053$
F-statistic	2.453^{**}	No. of observations	43
LM: χ^2 (1)	2.924^{***}		
LB Q-statistic: χ^2 (22)	28.257		

Notes: Numbers in parentheses refer to the absolute t-value. *, ** and *** denote significance at the 1% 5% and 10% levels, respectively. 'PRCOA' denotes the real price of cocoa. The regressions were corrected for heteroscedasticity and serial correlation. The auto-correlation coefficient is 0.992. 'LM' is the Lagrange multiplier test of residual serial correlation. 'ARCH' and 'WHET' are tests for heteroscedasticity based on Engle (1982) and White (1980), respectively. The LB Q-statistic is used to test whether the residuals are white noise. The number of lags is in parentheses. The Jarque–Bera (JB) statistic tests for normality in the residuals, and it is distributed χ^2 with two degrees of freedom. 'RESET' is a test for specification error. The degrees of freedom for the other tests are in parentheses adjacent to the distributions. The error-correction term (EC) is the lagged residual from the cointegration regression, and its coefficient measures the speed of adjustment. Δ is the first difference operator.

Mr Kamara has refused to appear in front of the committee and answer questions under oath. Other people who have been called by the committee have appeared and testified. Yet, Mr Usman Boie Kamara is one of the leading candidates for flag bearer to contest the presidential elections in 2012 under the Sierra Leone People's Party. Repeated calls by the press for the Anti-Corruption Commission (ACC) to investigate this diamond case have so far not yielded any response from the nation's crime 'watch dog'.

Moreover, while officially recorded diamond production and export figures may have shown a dramatic decline since the early 1970s due to smuggling, trade figures in Belgium and neighbouring countries show an entirely different picture. For example, between 1986 and 1996, The Gambia, which has no known diamond deposits, exported US$420 million worth of diamonds to Belgium. Some of the owners of the companies in Belgium that imported diamonds from

The Gambia had family members in Sierra Leone that operated similar lines of business and are deeply involved in smuggling. Gberie (2002) argued that some of these prominent Lebanese families are alleged to have used some of the proceeds from the diamond business in West Africa to fund fighting militias in Lebanon, support global terror and other Jihad networks (see also Reno 1995; PAC 2009a,b; Kargbo 2010; Smillie *et al.* 2000).

The establishment of the Kimberley Certification Process Scheme (KPCS) has positive impacts on officially recorded diamond production due to the reduction in smuggling. Recent government statistics showed that the value of diamond exports that passed through Sierra Leone's official channels increased from US$25.9 million to US$142 million over the 2001–9 period. Movement of diamonds in the international markets now requires detailed documentation as to the origin of the diamonds and other pertinent information on the exporter as required by the KPCS. The Kimberley Process Certification Scheme was initially designed to remove 'blood diamonds' or 'conflict diamonds' from the legitimate multi-billion global diamond market. Despite the fact that corruption and smuggling continues to plague the diamond industry, smugglers are now at a greater risk of having their diamonds confiscated at international borders if they are caught without a valid Kimberley Certificate. For example, the US Customs and Border Protection Agency seized 28 rough diamonds that weighed almost 1,200 carats from two US jewellers at JFK Airport in April 2009 because the jewellers did not have a Kimberley Certificate (see Cavaliere 2009; Kargbo 2010). The diamonds which were smuggled from Sierra Leone had a declared value of US$800,000. Furthermore, because of intense scrutiny by non-governmental organizations, the press and other agencies, some European countries have recently stepped up enforcement of the Kimberley Process (see Partnership Africa Canada 2008; Kargbo 2010). The Government Gold and Diamond Office (GGDO) estimates that at least 20% of the diamonds produced in Sierra Leone are not exported through official channels. Some estimates put the value of smuggled diamonds at between US$30 and US$70 million per year (see Partnership Africa Canada 2004, 2005; Gberie 2010; Kargbo 2010).

There have been discussions among the Mano River Union (MRU) countries to harmonize their fiscal regimes and mining codes as they strive to craft a coherent mineral development strategy that protects the interests of their countries and the MRU community during negotiations with mining companies (GoSL 2008). The harmonization will reduce the price differential of diamonds and other minerals in regional markets and thereby help to reduce smuggling. However, officials at the Government Gold and Diamond Office confirmed to Partnership Africa Canada that diamonds smuggled from Zimbabwe have been presented to them for certification under the Kimberley Process. The smuggled diamonds were simply returned to the would-be exporter because the GGDO has no authority to seize the diamonds. There is increasing fear that foreign criminal elements and terrorist organizations are using smuggled diamonds for money laundering and terrorist financing (see Kargbo 2010).

Table 11.7 also shows that diamond production (DIAPD), which has also been affected by the global financial crisis within the past two years, has negative impacts on current production. Diamond production increases with the depreciation of the real exchange rate (RER) in the short run in Sierra Leone. The coefficient for EC shows a fairly rapid adjustment to shocks in the diamond industry. About 48% of the deviation from long-run equilibrium levels is corrected within any given year. The diagnostic tests support the robustness of our model, thereby making it useful for policy formulation and analysis.

11.5.3 Impulse Response Functions

Figure 11.3 presents the impulse response functions (IRFs) which provide us with another perspective in analysing changes in diamond production in Sierra Leone. The estimates are derived from the vector-error correction model (VEC) used in Tables 11.4 and 11.5. Shocks to real diamond prices (PRDIA) and international coffee prices (PRCOF) have negative impacts on diamond production throughout the forecast horizon, while shocks to world income (WINC) elicit negative responses from diamond production during the first three years; thereafter, diamond production becomes positive for the rest of the forecast horizon.

11.5.4 Variance Decompositions

The VEC model that generated the results reported in Tables 11.4 and 11.5 also provided the variance decompositions (VCs) for shocks that influence diamond production in Sierra Leone. As shown in Table 11.8, the VCs show very strong feedback amongst the variables used in the model. These results reinforce the linkages revealed by the growth multipliers in Table 11.3. Note that the impacts of changes in commodity prices and exchange rates cut across various sectors of the economy. For example, shocks to real exchange rates (RERs) account for up to 18% of the forecast error variance (FEV) in diamond production, and 5–13% of the FEV in real diamond prices (PRDIA). Shocks to world income (WINC) account for up to 5% of the FEV in diamond production, while shocks to real diamond prices account for up to 10% of the forecast error variance in diamond production (DIAPD). Own-shocks account for the largest proportion of forecast error variance for all variables in the system. The forecast error (SE) displays a pattern that confirms the presence of stationary processes in the model.

11.6 Concluding Comments

We have presented a detailed analysis of the mining sector in Sierra Leone. Although the mining sector has made fairly significant contributions to the national economy over the years, corruption, greed and the war almost completely destroyed the economy during the 1990s. It is widely believed that

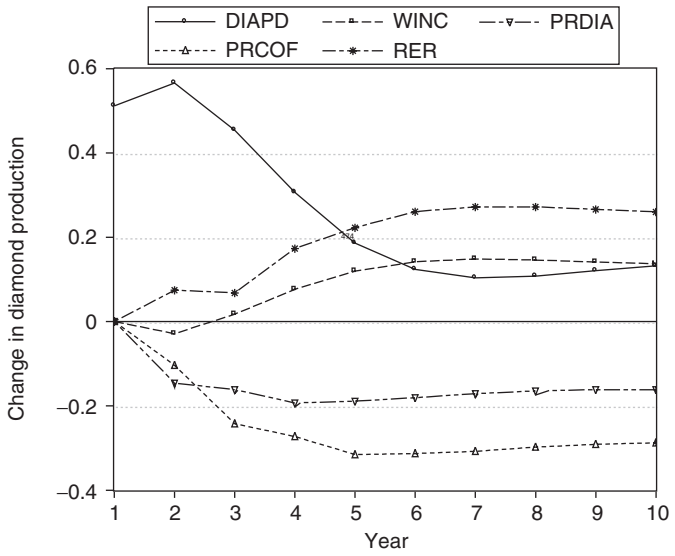

FIGURE 11.3. Response of diamond production to shocks in Sierra Leone.
Source: author's calculations.

TABLE 11.8. Decomposition of forecast error variance for diamond production in Sierra Leone.

Forecast error in	k years	SE	Shocks to DIAPD	PRCOF	WINC	RER	PRDIA
DIAPD	1	0.511	100.000	0.000	0.000	0.000	0.000
	3	0.957	85.977	7.618	0.124	1.104	5.175
	7	1.363	50.766	23.545	3.408	12.461	9.818
	10	1.584	39.318	27.655	4.908	17.680	10.437
PRCOF	1	0.274	1.318	98.681	0.000	0.000	0.000
	3	0.468	4.223	92.397	0.330	3.003	0.045
	7	0.804	13.123	78.357	1.409	7.091	0.019
	10	0.982	14.996	75.341	1.625	8.016	0.021
WINC	1	0.028	0.738	0.314	98.947	0.000	0.000
	3	0.043	14.284	2.439	66.751	14.539	1.985
	7	0.100	54.567	6.931	14.205	23.874	0.421
	10	0.127	58.585	6.324	9.443	25.376	0.271
RER	1	0.874	3.697	1.002	3.869	91.432	0.000
	3	1.585	4.733	0.448	3.718	90.389	0.710
	7	2.466	4.071	0.356	3.464	91.143	0.966
	10	2.956	3.878	0.332	3.399	91.379	1.011
PRDIA	1	0.512	18.852	0.756	0.296	4.895	75.202
	3	0.995	25.920	7.706	1.045	12.593	52.736
	7	1.586	27.234	8.053	1.078	13.226	50.408
	10	1.894	26.579	8.439	1.005	13.105	50.871

the people of Sierra Leone have not realized the full benefits to be derived from the mining sector. Rather, the minerals sector has been plagued by, and associated with, smuggling, corruption, security problems, environmental degradation and social upheaval in the country. Lack of fair prices paid to artisanal miners has contributed to smuggling of diamonds to neighbouring countries. Our empirical results show that commodity prices, the growth of incomes in industrialized countries, government regimes and government policies, including exchange rate and trade policies, had important impacts on diamond production in Sierra Leone.

To curtail corruption and improve revenue collection, transparency and other standards in the mining sector, the government should consider the following actions.

- The government must restructure the institutions that are responsible for managing the country's mineral resources and finances. It must set up an Extractive Industries Commission (EIC) that is independent and be responsible for the smooth operation of all aspects of the diamond, gold and other minerals produced in Sierra Leone. The EIC should also include the new oil, gas and any other minerals that are discovered in Sierra Leone. Activities of the Petroleum Resources Unit should be transferred to the EIC. This entity must establish a ring fence around the revenues derived from the mineral sector (i.e. establish a special fund) for specific development programmes widely accepted by the country, maintain an open-door policy to receive complaints from the general public and industry participants, collect and analyse data pertinent to the mining industry, publish periodic reports, including an annual report, and should have the necessary powers to launch investigations and resolve issues.

- A non-partisan and independent think tank or policy group should be established to help the policy formulation, discussion and implementation process in Sierra Leone. The politicization of almost every national issue, combined with patronage in appointments rather than qualifications and experience, make it difficult to adopt best practices in mining and other sectors of the economy. The think tank or policy group will help in educating the general public and holding the political leaders accountable for their actions.

- The EIC must work closely with the ACC and other law enforcement agencies to root out corruption and smuggling in the country. The current regulatory authorities (e.g. Ministry of Mineral Resources, and Government Gold and Diamond Office (GGDO)) should have no control over the new EIC. In fact, the GGDO should be transferred to the newly created entity. The creation of the new entity is imperative, in view of the fact that the vast majority of Sierra Leoneans have not benefited much from the diamond industry and other minerals after nearly 80 years of mining.

- The government must implement a fair market price policy, such as one that requires diamond dealers pay miners prices that are close to the world market prices, coupled with strict enforcement of the Kimberley Certification Process, border control, licensing and tax laws to minimize smuggling in the country.
- Strengthen law enforcement in relation to the Kimberley Certification Process. There should be strict controls over the granting and holding of mining and exporting licenses in the country. Any license owner that engages in activities that are detrimental to the development of the country, including violation of the rules and regulations of the mining industry should be tried, and if found guilty, be fined, sent to prison and/or stripped of his/her licenses. Also, government officials and others that exercise control over the mining industry must be prevented from participating in the industry's activities, e.g. being a miner, dealer and/or exporter. This is similar to the regulatory techniques employed worldwide in other corruption-prone industries, such as gambling, and the financial services industry, where individuals with certain sensitive information are limited to the type of activities they participate in, and ownership of shares in certain businesses is limited to a specific percentage.

We hope the issues discussed in this paper will serve as discussion points in the wider policy debates both within and outside Sierra Leone concerning the country's development trajectory.

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