

ZAMBIA ECONOMIC BRIEF

Making Mining Work for Zambia



The Economic, Health, and Environmental Nexus of Zambia's Copper Mining Economy



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Contents

Foreword	v
Acknowledgments	vi
Executive summary	vii
Section 1 Recent Economic Developments	I
Recent global and regional developments ¹	1
The state of the Zambian economy	4
Economic outlook, risks, and policy challenges	11
Section 2 Making Mining Work for Zambia	13
Mining and the Zambian economy	14
Analysis of mining taxation	17
The environmental-health nexus	24
The legacy of lead and the human cost of previous mines	26
Mining environmental governance	28
Conclusion: making mining work for Zambia	29
Annex A Economic Data	31
Annex B Mining	33
Mining sector employment	33
Elements of Zambia's mining fiscal regime	34
Mineral revenue forecasts	35
The potential impact of royalties on the Roan Tract	37
Notes	40
References	42
Boxes	
1 A partial resolution to VAT refunds	9
2 The return of fuel subsidies	10
3 The New Copperbelt investment boom	16
4 Potential distortionary impact of royalties on undiscovered copper potential in Zambia	23

Figures

1	Energy prices fell sharply, while prices of copper and other commodities remain low	1
2	Global growth remains soft	2
3	Growth in Africa is expected to slow	2
4	The region's major currencies have lost value against the U.S. dollar	3
5	Currency depreciation pushed up inflation in some countries	3
6	Sovereign bond spreads rose in December 2014 and remain elevated	4
7	Copper production and prices, 2005–2014	5
8	Evolution of the kwacha since mid-2014	5
9	Interest and inflation rates, 2013–present	6
10	Current account, 2005–2014	7
11	Budget trends since 2010	8
12	Contributions of the mining industry to the Zambian economy	15
13	Forecast of production and revenue by instrument, 2014–2030	20
14	Stylized investment, employment, and tax profile of a mining operation	21
B15	Forecasts total fiscal take by instrument under the 2014 fiscal regime	37
B16	Forecasts of total fiscal take by instrument under the January 2015 fiscal regime	38
B17	Comparison of future revenue by regime under current price projections	38
B18	Comparison of future revenue by regime if prices rise	38

Tables

1	Evolving features of Zambia's mining fiscal regime since 1997	19
2	Blood lead levels in children in Kabwe, by community	27
3	Estimated annual costs of lead exposure in Kabwe	28
A4	Growth by main sectors, 2000–14	31
A5	Government fiscal operations	32
A6	Balance of payments, 2009–14	32
B7	Direct and contract employment by operation	33
B8	Features of mining taxes, 1997–2015	34
B9	Mineral taxation rates around the world	34
B10	Summary of tax status and cost positioning by company	35
B11	Impact of high royalties on undiscovered copper potential in Roan Tract	39

Foreword

I am pleased to share the fifth Zambia Economic Brief with a focus section on mining. This Brief is part of a series of short economic updates produced twice a year by the World Bank. Each Brief includes two sections: the World Bank's assessment of recent economic developments and outlook in the short to medium term, and its analysis of a specific development topic or theme. Previous Briefs covered opportunities for human development, jobs, trade, and financial inclusion.

Many economic indicators are positive. Zambia continues to grow faster than many of its neighbors, even though the growth rate dipped in 2014. The authorities have succeeded in keeping inflation in single digits for the past five years. The value of Zambia's copper has increased despite sharply falling world prices.

But Zambia faces challenges. The rising fiscal deficit makes the economy more vulnerable at a time when world financial markets are becoming more turbulent. High levels of spending on government salaries and on farm and fuel subsidies leave little space for the government to expand cash transfers and other poverty reduction programs. Reducing the deficit and rebalancing

spending to support inclusive growth will require tough choices in the months and years ahead.

This Brief focuses on mining. Zambia is blessed with abundant deposits of copper and other minerals. Increased copper production has contributed much to Zambia's high economic growth rates. Recent geological analysis suggests that the deposits of copper in Zambia are larger than previously estimated. A new wave of investment in mining is needed to realize the potential of this wealth.

Making mining work for Zambia will also require careful thinking about the policies and institutions that govern the mining industry. What tax policies will attract long-term investors and ensure that they pay their fair share in taxes? What laws and regulations are needed to keep people safe from health and environmental hazards? What are the opportunities for mining companies to spend more of their procurement budgets on goods and services provided by Zambians?

We hope that the findings of this Brief will stimulate a healthy debate around these questions so that Zambia can make the most of its mineral wealth.



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The report was edited and laid out by Bruce Ross-Larson's team at Communications Development Incorporated, including Joe Caponio and Elaine Wilson.

Executive Summary

The state of the Zambian economy

After several years of strong economic performance, Zambia now confronts several important challenges that must be managed carefully to ensure sustained and inclusive growth in the future. On the one hand, the economy grew by an estimated 5.5–6.0 percent in 2014, somewhat above the average for African economies. Monthly copper production increased by an average of 8 percent during the second half of 2014, reversing the sharp slide in early 2014. Inflation fell to 7.2 percent in March and April, helped both by falling world oil prices and by the Bank of Zambia's monetary tightening. In the first half of 2015, the authorities adjusted several key economic policies to respond to serious problems: revising rules on VAT refunds in February, announcing a new mining fiscal regime in April, and raising fuel prices in May so that the government could recover import costs.

On the other hand, the kwacha has come under renewed pressure. It lost 17 percent of its value against the U.S. dollar from December 2014 through the end of March 2015. Since then it has recovered somewhat, but foreign exchange markets remain volatile. Interest rates have been rising since September 2014, due in part to increased government borrowing and in part to steps taken by the Bank of Zambia to tighten credit.

Over the medium term, growth should hold steady in 2015 and then accelerate to around 6–7 percent per year in 2016–2018. Although inflation is expected to rise towards the end of 2015, it should resume

falling in 2016. Low commodity prices, a more stable exchange rate, and adequate local harvests would help contain inflationary pressures and boost real disposable incomes. The resulting pick-up in private consumption, coupled with increasing copper exports, should help strengthen growth prospects.

Restoring fiscal prudence

Curtailing the growth in government spending and gradually reducing the deficit are major challenges in 2015. If fiscal policy is not managed carefully, the country could slip into conditions of low GDP growth, high inflation, and currency depreciation. Preliminary data show that the 2014 budget deficit was 6.0 percent of GDP on a cash basis. Arrears in payments to contractors, suppliers, and to the pension fund were equivalent to around 2.5 percent of GDP accumulated in 2014. Government debt grew to 35 percent of GDP from 20 percent in 2011.

When the 2015 budget was prepared, the authorities targeted a deficit of 4.6 percent of GDP in 2015 as the first step along a path of gradual deficit reduction. But by early 2015 it had become clear that, if the budget were not quickly adjusted, the deficit would more than double—due to arrears carried over from 2014, new arrears triggered by subsidized fuel prices, reduced revenue caused by lower copper prices, and higher interest payments caused by rising interest rates. The cabinet has now authorized the finance ministry to cut spending by K5 billion, increase revenue, and seek new sources of financing. Even after

including these measures, however, the deficit is still projected to reach around 7.6 percent of GDP in 2015.

Getting back onto the path of deficit reduction will require considerable discipline and dedication, particularly given the likely pressures to increase spending in an election year. Wage bill negotiations should adhere to the goal of containing real growth in total personnel spending. Greater selectivity in launching capital projects would also make an important contribution. Fully implementing cost recovery in fuel pricing is an immediate priority. Reducing costly farm subsidies (e.g., of fertilizers and maize) would create fiscal space to expand the coverage of cash transfers targeted at the poor. Finally, enhancing the government's systems for cash management, revenue administration, and public procurement would increase the efficiency of government spending.

Making mining work for Zambia

Zambia's rich mineral resources are one of the country's most important assets. During the past four years, copper has accounted for an average of 66 percent of total exports, the mining industry has contributed 11 percent of GDP, and mining companies have paid 16 percent of the taxes and other revenue that the government has collected. On the basis of estimates from the 2012 labor force survey, the mining industry accounts for 21 percent of formal private sector employment in Zambia. The large capital investments made over the past fifteen years boosted annual copper production by 350 percent between 2000 and 2013. As prices have come down from their highs in 2011, capital investment is slowing and along with it will come a reduction in the temporary employment associated with the investment. Nonetheless, the mining sector's fiscal contribution is expected to increase and with the extension of mines and expansion in supply will come continued operating employment and opportunities for further backward linkages.

As the country looks to the future, Zambia faces important choices on how to manage its mineral wealth. There are trade-offs in the design of a mining fiscal regime. For example, high royalty rates can generate revenue in the short run but reduce total collections over the long run. Mining inevitably entails

environmental and public health risks. Ultimately, the government sets the rules and regulations that can either encourage the mining companies to mitigate these risks or shift costs onto the general public. Mining firms make choices about procurement that influence the industry's overall contribution to the Zambian economy. Mining companies could take the initiative to nurture local suppliers' ability to meet the mining companies' large and diverse input requirements.

How can Zambia use its mineral resources to help the country achieve its economic development ambitions? In addition to detailed conclusions, this brief highlights five key messages:

1. Expectations must be rooted in the reality of Zambia's specific conditions. Much of the copper being mined in Zambia is either costly to mine or has only recently been placed in production. This implies lower economic profits, compared to mining operations in other countries, and therefore lower tax revenue than some have been expecting. The more recently developed mines need time to mature and will become major taxpayers in the future. Improved capacity to forecast would also make expectations more realistic.
2. Tax revenue is expected to grow significantly, and predictable policies will encourage further long-term investment and growth. Without continued investment in mine extensions and scale economies, Zambia's copper production will soon peak. As output falls, so will taxes, jobs, and other economic activity. The design of the mining fiscal regime plays a leading role in facilitating investment that can sustain future growth. With continued and expanded supply, there are opportunities to continue and increase employment and to stimulate backward linkages that have not yet been realized.
3. Laws and regulations should set the rules of the game so that private companies internalize the environmental and social costs of mining. Enforcement of current environmental standards should be strengthened so that mining companies mitigate pollution and undertake cleanup.
4. Mining companies need to play their part in areas of environmental management and local content. Performance in the

areas of environmental stewardship, provisions for future cleanup, and degree of procurement from Zambian producers has been lackluster. If mining companies put as much effort into tackling these issues as they have into overturning the recent royalty and VAT tax issues, Zambia would go a long way towards having solutions to these problems.

5. Improved capacity remains core to the solution of both fiscal and environmental issues. Zambia has a good fiscal and legal framework but its capacity to operationalize many of its policies is weak. Without solid tax administration, risk assessment, auditing, environmental monitoring, and regulatory capacity, even the best-designed policies will not work.

SECTION I

Recent Economic Developments

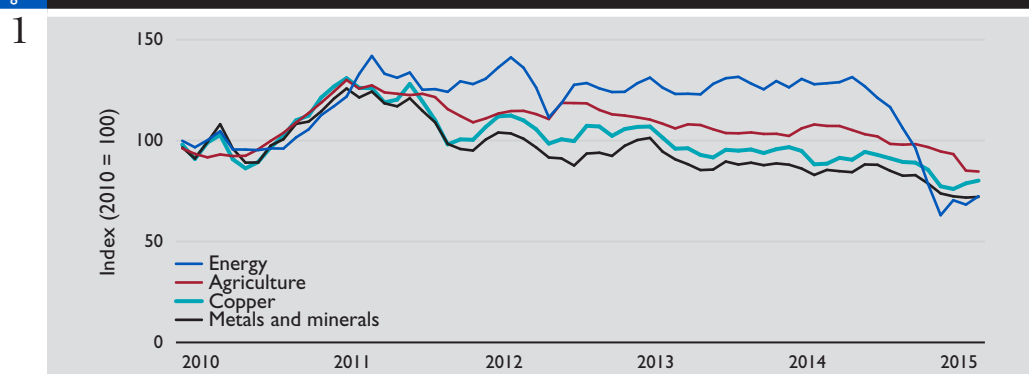
Recent global and regional developments¹

There have been major changes to the global economic environment in Zambia over the past year. Between June 2014 and March 2015, world oil prices fell by more than 45 percent, while the gradual decline in commodity prices persisted (figure 1). The plunge in oil prices was driven by increases in the production of unconventional oil, weakening global demand, a significant shift in OPEC policy, unwinding geopolitical risks, and an appreciation of the U.S. dollar. The price of copper, Zambia's key export, has also continued falling from its late-2010 peak, although prices remain well above historical levels. From June 2014 to January 2015, copper prices fell by 15 percent, reflecting weak demand from China, the world's largest consumer of metals. Copper prices have remained weak in the first quarter of 2015 on the back of continuing U.S. dollar appreciation, generally

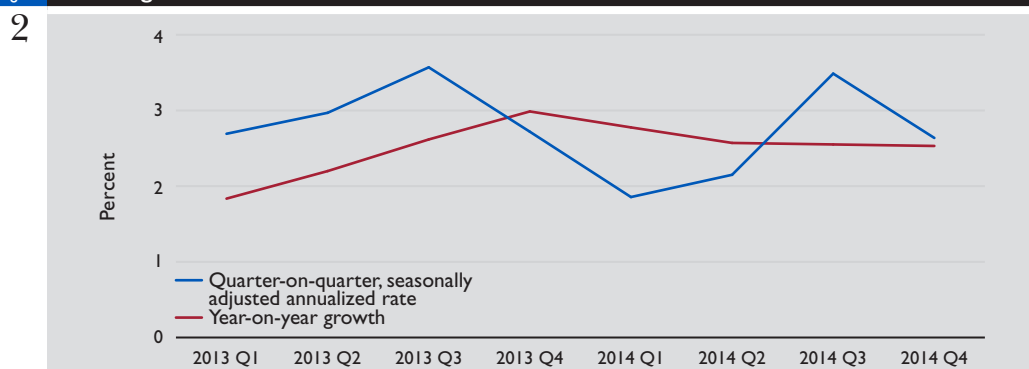
ample supply, and lackluster demand. In the near future, prices of copper are expected to rebound, remaining below the peak enjoyed in recent years, although above long-term historical levels.

Global economic growth has been somewhat weaker than expected. While the sharply lower oil price is reflected in a significant pick-up in retail sales and falling inflation across major oil importing economies, global growth has remained soft (figure 2), with increasingly divergent trends between oil importers and exporters. Prospects among Zambia's main trading partners were mixed around the turn of the year. Notably, growth in China slowed in the fourth quarter and, for 2014 as a whole, reached 7.4 percent, as projected. Recent data point to further softening in the Chinese economy. Real GDP grew 7 percent (year on year) in the first quarter of 2015, the slowest pace since 2009, as strong retail trade only partly offset the

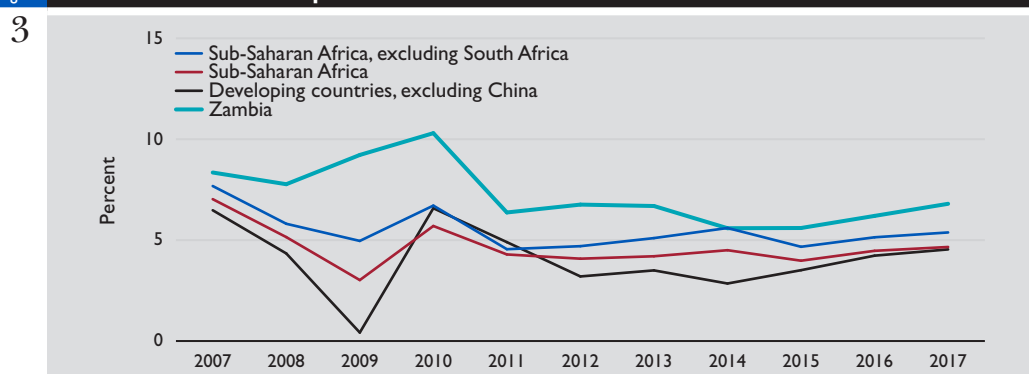
Figure 1 Energy prices fell sharply, while prices of copper and other commodities remain low



Source: World Bank

Figure 2 Global growth remains soft

Source: World Bank.

Figure 3 Growth in Africa is expected to slow

Source: World Bank.

weakness in the real estate sector and manufacturing activity. Global growth is expected to gain some momentum in the second and third quarters of 2015. Divergences across major economies are expected to narrow this year, as growth levels off in the United States while recovering in the Euro area. Oil-importing emerging economies are expected to gather strength in 2015.

Growth prospects in Sub-Saharan Africa as a whole are also weaker than initially forecast by the World Bank in January 2015.² Economic activity in the region is expected to slow in 2015, with real GDP growth averaging 4.2 percent, from 4.6 percent in 2014 (figure 3), a downward revision of 0.6 percentage points relative to the World Bank's January forecast. This reflects a reassessment of prospects among the region's oil and commodity exporters as sharp terms-of-trade changes are causing adjustments. Economic activity in South Africa, Zambia's largest trading partner in the region, expanded at a firmer pace in the fourth quarter of 2014. Among other

major regional trading partners, prospects remain weak in Zimbabwe but are generally favorable for the Democratic Republic of Congo.

Diverging monetary policy in major economies is becoming increasingly apparent, with implications for African economies' exchange rates and rates on sovereign bond issues. The European Central Bank launched its quantitative easing program in March, and the Bank of Japan has maintained its commitment to aggressive policy easing, in both cases contributing to maintaining favorable financing conditions globally. The U.S. Federal Reserve is expected to move in the opposite direction later this year, however, as it starts normalizing policy interest rates—possibly raising rates as early as September. While global interest rates remain at historically low levels, the expectation of divergent monetary policies has already led to a significant appreciation of the U.S. dollar, increased volatility in financial markets, and renewed pressure on emerging and frontier market currencies.

Partly reflecting conditions in the United States and partly as a reassessment of country risks and vulnerabilities, the region's major currencies have been losing value against the U.S. dollar since mid-2014 (figure 4). The kwacha depreciated by about 20 percent between end-2014 and mid-March 2015 before recovering some ground in April.

Currency depreciation is partly offsetting the disinflationary impact of lower world oil prices on domestic prices. Cheaper fuel prices helped lower inflation and improve current account and fiscal deficits in several net-oil importing countries in the first quarter of 2015, allowing central banks to keep interest rates on hold or to raise them at a slower pace than otherwise. Inflation rates fell slightly in Zambia during the first quarter of 2015, after more than one year of generally steady albeit low increases in inflation rates (figure 5).

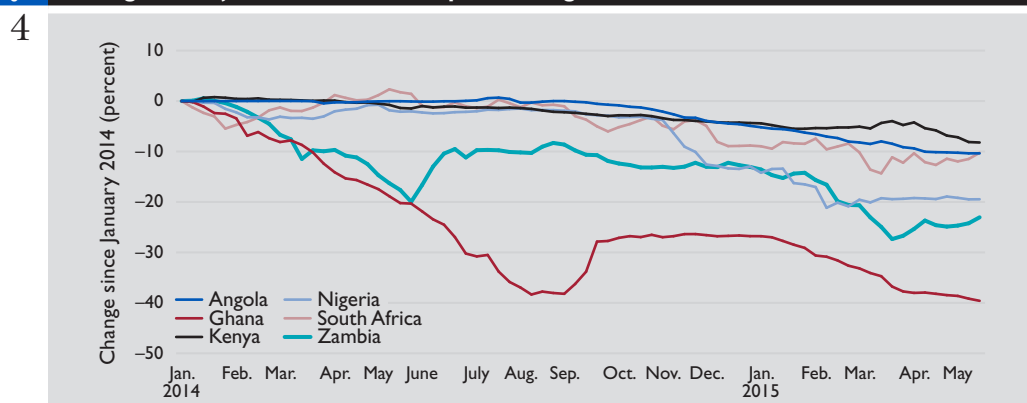
In this context, sovereign bond spreads rose sharply in 2015 for bonds issued by

Zambia and several other countries in the region (figure 6), suggesting that investors are discriminating among the region's frontier markets based on their economic outlook.³ The spreads also became more volatile. The sovereign spreads for Ghana, Angola, Gabon, and Nigeria, which are dealing with the oil-price shock, have remained considerably high, well above the peak of the 2013 "Taper Tantrum" caused by concerns about rising U.S. interest rates. The spreads for Zambia's two Eurobonds have also remained elevated, reflecting investors' concerns about soft copper prices and uncertainty over government policy, although they have narrowed in April and May.

Implications of falling oil and commodity prices

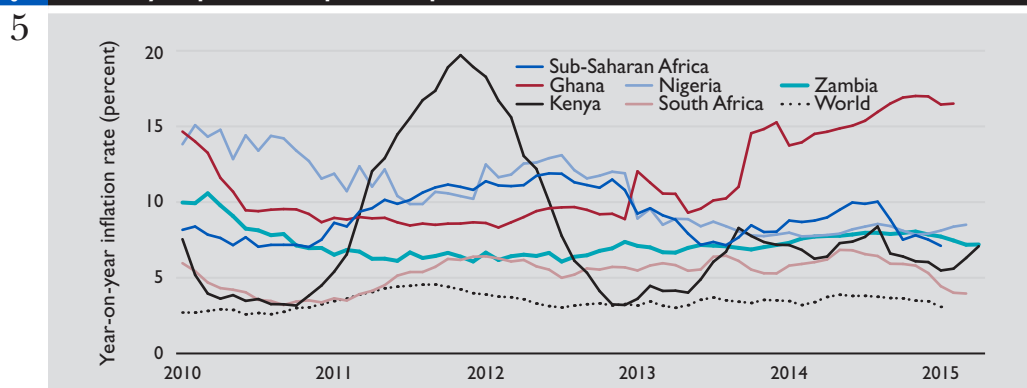
As mentioned above, recent sharp swings in commodity prices have had a significant impact on many countries in Africa. Most notably, the plunge in oil prices has created

Figure 4 The region's major currencies have depreciated against the U.S. dollar

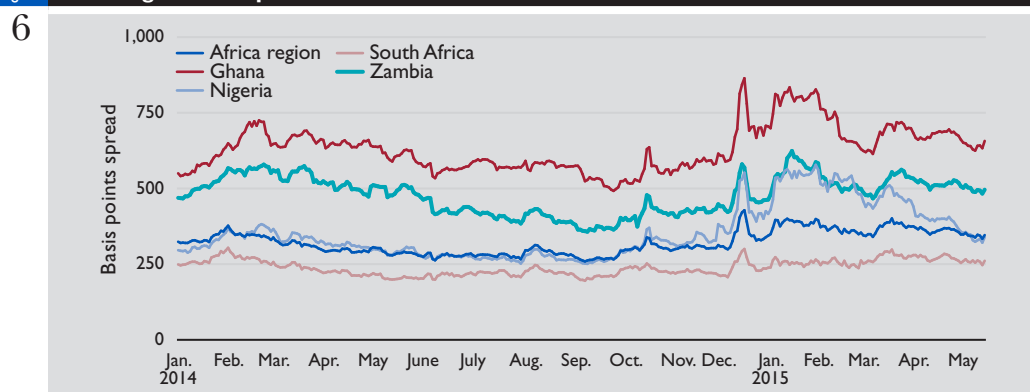


Source: Bloomberg.

Figure 5 Currency depreciation pushed up inflation in some countries



Source: World Bank.

Figure 6 Sovereign bond spreads rose in December 2014 and remain elevated

Source: Bloomberg.

severe budgetary and balance of payments problems for oil exporters like Angola, Chad, Gabon, Nigeria, and the Republic of Congo. On the other hand, it has benefited oil importers by drastically reducing their import bill.

To assess this impact, the World Bank has examined the estimated changes in countries' terms of trade—that is to say, the ratio of prices a country receives for its exports compared to prices it pays for its imports—resulting from movements in commodity prices.⁴ The net effect of changing commodity prices is an 18.3 percent deterioration in terms of trade for Sub-Saharan Africa as a region. This deterioration is mainly explained by the decline in oil and other energy commodities.

Oil-rich countries experienced the largest decline in terms of trade—which exceeded 40 percent. Resource-poor countries, on the other hand, showed a modest gain of 1.1 percent in the simulations. Twelve countries in Sub-Saharan Africa, including Zambia, experienced positive terms of trade shocks. Most of the countries in this group benefited from weaker fuel prices. These benefits were partly reduced by sharp swings in different commodity prices. South Africa, Botswana, and Zambia benefited considerably from lower fuel prices, but these gains were partially offset by losses due to declining international prices of iron ore, nickel, and copper, respectively. The net change in Zambia's terms of trade was an improvement of 3.5 percent.

The state of the Zambian economy

The picture of the Zambian economy is a mixture of contrasts. On the one hand,

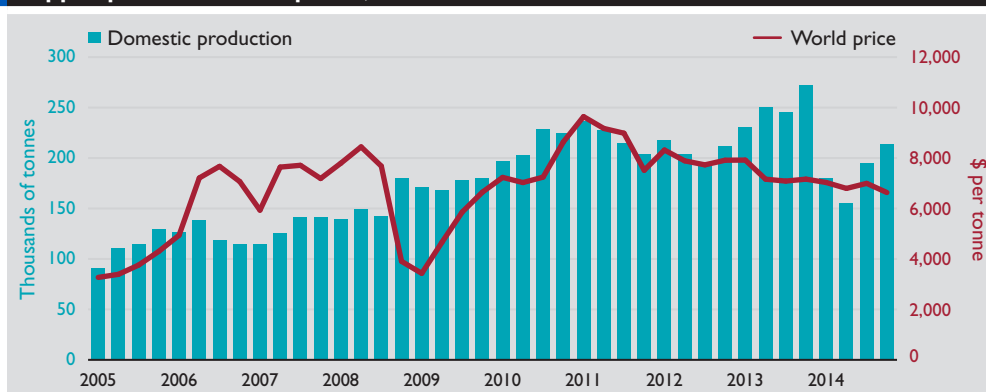
economic growth has been relatively high, and the authorities have succeeded in keeping inflation under control. The kwacha remains susceptible to periods of volatility, however, and depreciated rapidly in early 2015 before rebounding in April and May. The main challenge for the economy is strengthening control over fiscal policy—curtailing growth in spending and moving towards a path of gradual deficit reduction. If not managed carefully, the country could slip into conditions of low GDP growth, high inflation, and currency depreciation. We now turn to these issues.

Economic growth dipped in 2014 but remains strong

The Zambian economy continues to grow at rates faster than the region as a whole. Preliminary estimates suggest that the economy grew at around 5.5–6.0 percent in 2014, which is a slight decline from the 6.3–6.7 percent recorded during 2011–12 (see table A4 in annex A). The services sector accounted for around three-quarters of real growth last year, with logistics, communications, and financial services industries growing by more than 13 percent. Construction grew by 7.5 percent, stimulated by mining industry investment and the government's capital projects, and accounted for 15 percent of total growth last year. The record maize harvest pushed agriculture growth to 6.5 percent.

The mining industry, on the other hand, contracted by 7.2 percent in 2014. Domestic copper production fell by 25 percent in 2014 as world prices continued their steady decline since early 2011 (figure 7). Strict requirements for obtaining refunds of import VAT

Figure 7 Copper production and prices, 2005–2014



Sources: Bank of Zambia, Ministry of Finance, World Bank.

and the uncertainty over the mineral taxation regime contributed to lower production during 2014. Section 2 of this Brief analyzes the contribution of mining to the Zambian economy in detail.

The kwacha has come under renewed pressure

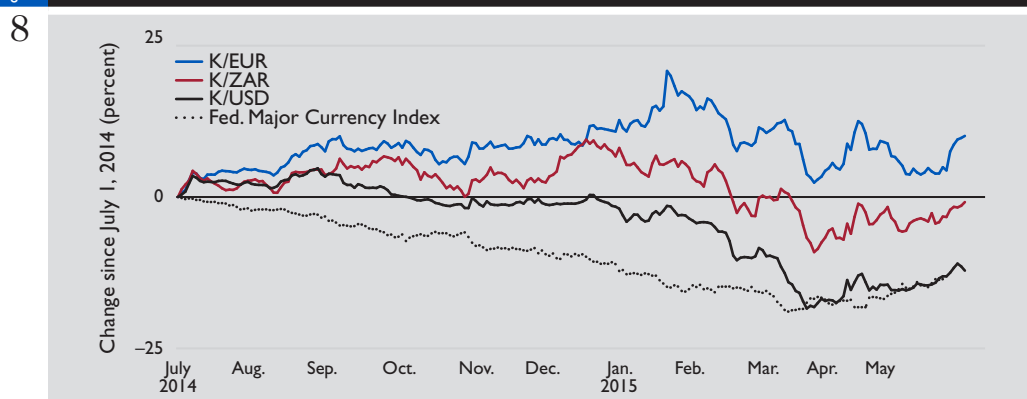
The kwacha lost 28 percent of its value measured in U.S. dollars between the end of August 2014 and late March 2015. In part this reflects appreciation of the U.S. dollar resulting from stronger growth of the U.S. economy and expectations that the U.S. Federal Reserve will raise interest rates. Figure 8 shows that major world currencies have been depreciating steadily against the U.S. dollar since July 2014, and that the kwacha was following this trend from roughly September 2014 through February 2015. During this period the kwacha appreciated against the euro and held steady against the rand.

In February and March, however, the kwacha depreciated against the U.S. dollar at a much faster rate, and lost value against the euro and rand as well. This recent decline stems from home-grown factors. Declining copper export revenue and expectations of lower production in 2015 are major factors, as both reduce the supply of dollars into the local foreign exchange market. Preliminary data from the Bank of Zambia show that monthly earnings from copper exports in January and February 2015 were 32 percent lower than the monthly average during 2014.

Inflation is under control, but interest rates are rising

Prices have been growing at a somewhat slower rate in recent months. The inflation rate fell to 7.4 percent (year-on-year) in February 2015 from 8.1 percent in November 2014, after having risen fairly steadily since February 2012 (figure 9). Food price inflation has continued to rise since mid-2014. In contrast, the rate

Figure 8 Evolution of the kwacha since mid-2014



Sources: Bank of Zambia, Federal Reserve Bank, World Bank staff calculations.

Note: The Federal Reserve's U.S. dollar index is computed as an average of major world currencies to the dollar. Negative values represent depreciation of these currencies relative to the U.S. dollar (i.e., appreciation of the dollar vis-à-vis other currencies).

of growth in transportation prices has fallen sharply to 2.7 percent (year-on-year) in February 2015 from 7.3 percent in January 2015 and 11.9 percent in February 2014. This reflects the Energy Regulation Board's decision in January to reduce pump prices of petrol and diesel fuel by 23 and 28 percent, respectively.⁵

The Bank of Zambia has revised downwards its forecast for inflation during 2015 to an annual average of 7.3 percent (from 8.0 percent forecast in late 2014) in light of falling world prices for oil and other commodities, the Food Reserve Agency's maize sales in the domestic market, and in light of low inflation rates in countries around the world. Nevertheless, the Bank of Zambia Monetary Policy Committee noted at its February meeting that inflation would likely rise later in 2015 and remain above the target of 7.0 percent at year's end, fueled in part by depreciation of the kwacha. It consequently raised the policy rate by 50 basis points in February, and in March announced that reserve requirements for commercial banks would be increased to 18 percent from 14 percent.

Meanwhile, government borrowing to finance the fiscal deficit has been pushing up interest rates. After falling during the third quarter of 2014, average yields at Treasury bill auctions have risen to 20.3 percent in February 2015 from 17.6 percent in October 2014. The small size of the local capital market imposes a constraint on the government's ability to finance any increase in the fiscal deficit through domestic borrowing.

International trade

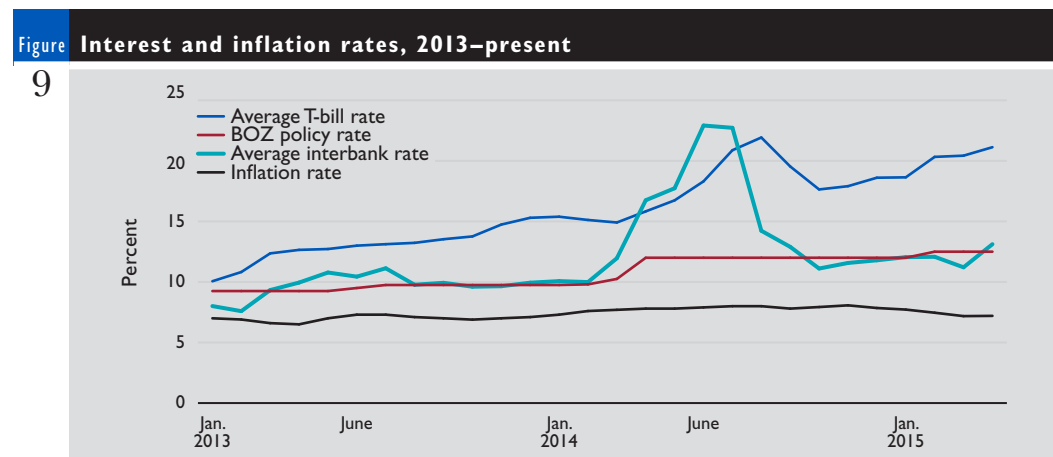
The current account surpluses that Zambia enjoyed between 2009 and 2012 have been

replaced with small deficits (figure 10). The most important reasons are that merchandise imports have increased substantially (growing to 32 percent of GDP in 2014 from 22 percent in 2009) and the services trade deficit has tripled. The U.S. dollar value of Zambia's oil imports grew by 20 percent per year between 2009 and 2014, partly a reflection of rising world oil prices, and oil accounts for 13 percent of the total increase in imports during this time. FDI and government road construction projects were important in boosting imports as well. Increased purchases of copper ore, civil engineering plants, metal structures, and commercial vehicles accounted for an additional 32 percent of import growth. Use of foreign transport services rose along with the rising goods imports, and make up 57 percent of the total increase in services imports.

In 2014 non-traditional exports (i.e., goods other than copper and cobalt) declined sharply, reversing a trend of previously steady growth. Falling exports of cement and lime, maize and maize seed, tobacco, and petroleum products account for 58 percent of the decline in total export revenue. Slower growth in South Africa and in economies of other trade partners explains some of this decline. Domestic factors were also important. Rising domestic demand displaced exports of cement and other construction materials, for example, and supply-side constraints resulted in a decline of tobacco exports.

Fiscal trends since 2010

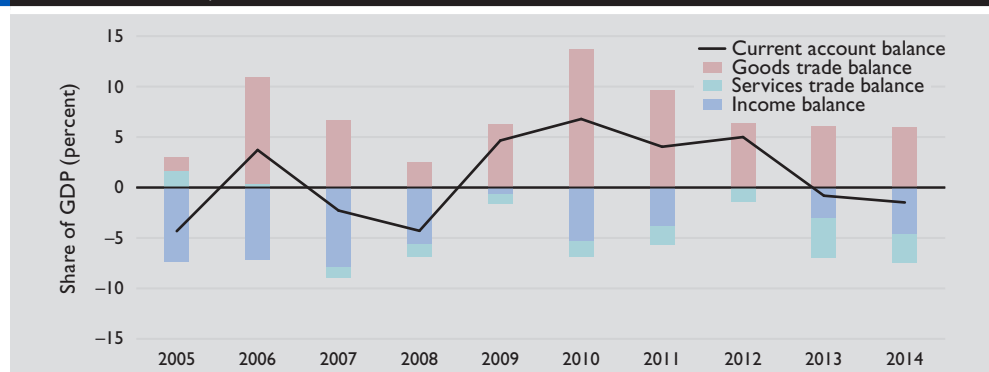
Fiscal policy has become increasingly loose during the past several financial years.



Sources: Bank of Zambia, World Bank staff calculations.

Figure Current account, 2005–2014

10



Sources: Bank of Zambia, Central Statistics Office, World Bank staff calculations.

Government spending has grown to around 25 percent of GDP (figure 11). As higher spending has not been matched by increased receipts of revenue and external grants—in fact, these declined relative to GDP in 2013 and 2014—the government’s overall budget deficit has widened, growing to 6.5 percent of GDP in 2013 on a cash basis. A large increase in capital spending starting in 2012 followed by the jump in government salaries in 2013 pushed up spending. Recent budgets have allocated somewhat more to social and economic programs, while budget allocations for general services have declined.

Although total revenue including external grants has remained essentially flat, the government has enjoyed some success in increasing the taxes, fees, royalties, and other revenue it collects. Domestic revenue grew to 17 percent of GDP in 2012 from 14 percent in 2010. Collection of mineral royalty and other non-tax revenues grew by an average of 13.6 percent per year on average between 2010 and 2014. VAT revenue also grew, even if one were to deduct disputed refund claims from the values shown in figure 11.⁶

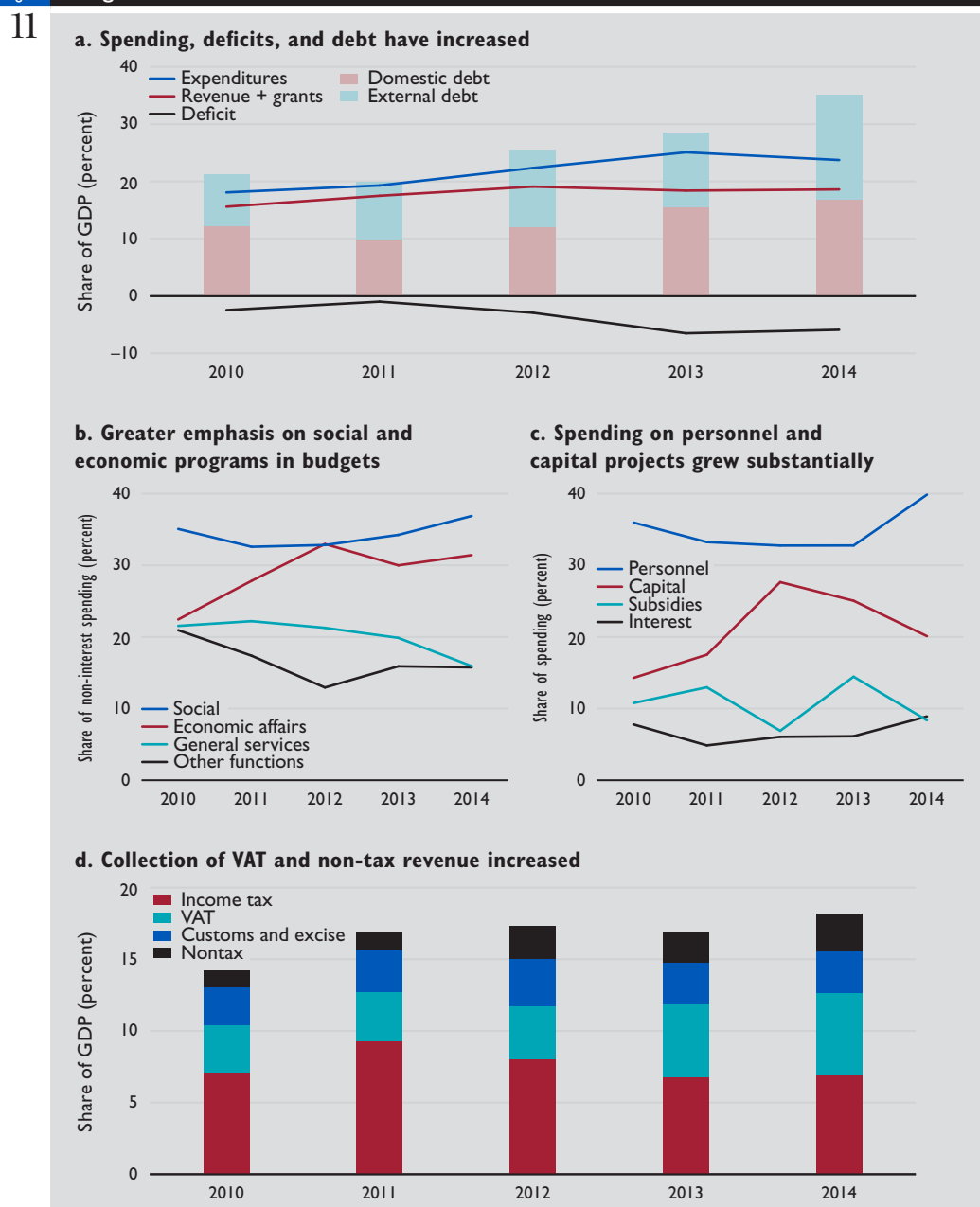
Zambia’s government debt has grown considerably in the past several years, rising to 35 percent of GDP from 21 percent in 2010 (figure 11, panel a). External debt has doubled as a share of GDP and accounts for most of this increase. There has also been a steady trend towards borrowing on commercial terms from domestic and international capital markets, reflecting both Zambia’s improved creditworthiness and the government’s increased financing needs. At the end of 2014, only 18 percent of outstanding government debt was owed to bilateral (i.e., government) creditors or multilateral

institutions, compared to 43 percent in 2010 and 19 percent in 2005, when the multilateral debt relief exercise was being completed.

Fiscal outturn in 2014: Accumulation of arrears

Although the budget came under severe pressure in 2014, the authorities were able to exercise a measure of discipline on spending. Reflecting strong political priorities, the Food Reserve Agency doubled its maize purchases, and the Farmer Input Support Program spent almost three times the amount originally budgeted. Increased domestic borrowing and rising interest rates pushed the government’s borrowing costs 22 percent above budget. Spending on basic personal emoluments was 3 percent greater than budgeted, but since personnel costs account for half of the government’s current expenses (and close to 10 percent of GDP), this overspending made a large contribution to the deficit. To keep a lid on the deficit, capital spending was cut by 37 percent and spending on procurement of goods and services by 11 percent. Small savings were also achieved through lower spending on intergovernmental grants, parliamentarians’ mid-term gratuity, and social cash transfers.

Higher than budgeted revenue helped to keep the deficit from ballooning in the face of these spending demands. Payroll tax revenue was 25 percent above budget, and collection of company income tax from businesses outside the mining industry was 10 percent higher than expected. VAT revenue exceeded its budget target by K1.4 billion, mainly as a consequence of the continuing dispute over VAT refund requirements (discussed in the December 2014 Zambia Economic Brief). By

Figure 11 Budget trends since 2010

Sources: Ministry of Finance, Central Statistics Office, IMF.

the end of December, the accumulated stock of unpaid VAT refunds claimed by businesses had reached K4.8 billion (box 1)

Spending was also controlled in part by restricting budget releases, however, rather than revisiting priorities and revising ministries' spending limits. Consequently, large payment arrears accumulated in 2014. The Ministry of Finance estimates that arrears on road construction and other capital investment projects total around K2.5 billion. An additional K900 million is due to suppliers and farmers for expenses related to fertilizer subsidies and maize purchases.

Making fiscal adjustments in 2015

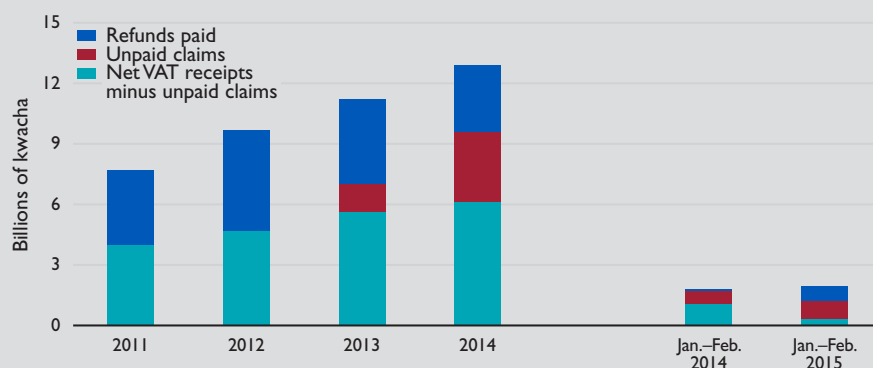
Achieving steady reductions in the fiscal deficit over the course of the current medium-term expenditure framework, as the government announced in October 2014 with the current budget, faces significant challenges. By early 2015, it became clear that meeting the deficit target of 4.6 percent of GDP would require adjustments to the 2015 budget. In addition to the arrears from 2014, several new developments added pressure to the budget:

- The government estimate for interest payments increased by 41 percent to reflect higher interest rates.

Box A partial resolution to VAT refunds

1

In an effort to combat fraudulent claims for VAT refunds, in 2013 the government tightened documentation requirements for exporters seeking refund of input VAT. Although some companies complied with new requirements, most exporters protested that meeting the additional requirements applied in 2013 was impractical. Some mounted legal challenges. Refunds fell to 26 percent of gross collections in 2014 from 50 percent during 2012–13, as shown in the figure below.



In February 2015, ZRA revised the rules to allow documents from transit countries to serve as proof of export, after considerable discussion with stakeholders. The amended rules address the complaints made by mining companies about the difficulties arising when metals shipments change hands several times before arriving in the final country of consumption.

Two concerns remain. The revised requirements remain more stringent than standard practice for VAT around the world, which discourages expansion of Zambia's non-traditional exports.¹ Smaller firms lack the capacity to obtain documentation from foreign governments that international mining companies possess. High costs of receiving refunds on input VAT makes it difficult for Zambian companies to enter export markets and expand their foreign sales over time.

A second concern is how to resolve the disputed claims submitted through February 2015. The stock of these refund claims was K5.76 billion as of end-February according to ZRA data. They cast a shadow over the country's business climate. And they represent a large potential financial liability to the government—equal to 3.5 percent of 2014 GDP. This liability could be realized if, for example, firms were to resubmit their claims with the required documentation, if new court decisions were to be handed down, or if the authorities were to agree to settle some or all of the disputed claims.

Prudence dictates that the Zambia should consider disputed claims as contingent liabilities in annual budget documents. It should implement any agreement to repay claims transparently and fairly. If the government agrees to honor claims but cannot repay them, it should convert these either into non-transferrable debt, which firms could carry on their balance sheets as assets, or into sovereign debt with a standard amortization allowing refunds to the firms.

1. A survey of selected exporters in the region and around the world finds that no country has such stringent requirements. See Zambia Economic Brief 4 for details.

- The forecast for customs duty collections fell by 44 percent.
- ZRA reduced the forecast for mining revenue by K2.3 billion to reflect lower copper prices and the new mining tax regime.
- MOF estimates that K2 billion is needed to close the Public Service Pension Fund's financing gap.
- Domestic fuel prices were set too low to recover the import cost, resulting in arrears in paying for imports that had already reached US\$257 million by the end of February 2015 (box 2).

The net effect of these developments was to more than double the 2015 budget deficit. In response, in May the cabinet authorized the finance ministry to cut spending by K5 billion, increase the rates for fees, and

seek new sources of financing. At the next sitting of Parliament, the ministry will present a revised budget that identifies specific cuts. Even after these fiscal adjustments, projections are that the budget deficit will still reach around 7.6 percent of GDP in 2015, which is a significant increase over the already-elevated levels of the past two years.

Looking ahead to 2016: Reduce deficits and manage debt

The release of the 2016 budget proposal is only a few months away. How can Zambia make fiscal adjustments? Public sector unions have already launched wage bill negotiations with the government. It is important that these aim to limit real growth in total personnel spending and take into consideration

Box The return of fuel subsidies**2**

Even though the government abandoned the formal policy of subsidizing fuel prices in 2013, fuel subsidies have returned and have thus strained the budget. How does this happen?

The Energy Regulation Board (ERB) sets wholesale and retail fuel prices according to a formula that marks up the landed price of each shipment of oil as it arrives in Dar es Salaam by the cost of transporting, refining, and distributing fuel in Zambia. The stated objective of ERB's cost-plus pricing model is to ensure that all costs relevant to procurement are recovered through sales of petroleum products. On January 15, 2015, the ERB reduced pump prices of petrol and diesel fuel by 23 and 28 percent, respectively, in response to falling world oil prices. This followed more modest reductions announced in November and December 2014.

Adjustment date:	Apr 2013	Apr 2014	Nov 2014	Dec 2014	Jan 2015	May 2015
Petrol	9.91	10.63	10.38	9.89	7.60	8.74
Diesel	9.20	10.01	9.73	9.18	6.59	7.59

Source: Energy Regulation Board press statements.
Notes: Prices are expressed as kwacha per liter.

Because fuel is sold in kwacha while imports are purchased in dollars, depreciation of the kwacha during the time that a cargo of fuel is being sold on the local market means that fewer dollars accrue from each liter of fuel marketed. This in turn creates a risk that the government will not have sufficient dollars to repay the import bill.

This risk materialized after the ERB reduced pump prices in January 2015. ERB's announcement on the price change noted that the exchange rate had been holding steady at around K6.50 per dollar. Within two months the kwacha had depreciated to K7.34, however, and domestic sales did not generate sufficient dollars to repay the import bill. The PTA Bank (which finances the government's imports of crude oil) claimed in a February 2015 letter to the Ministry of Finance that the government has accumulated arrears of US\$257 million. By May, the ERB projected that the extent of under-recovery during 2015 would become much higher.

The ERB raised prices on May 12, citing rising world oil prices and the need for full cost recovery. In terms of U.S. dollars—the currency needed to repay the import bill—pump prices are essentially the same as in January, however. The dollar price of diesel rose by 2 percent while the price of petrol is 2 percent lower than the January 15 price, even though world spot prices for crude oil have increased by 30 percent during this time.

More than two dozen countries have eliminated fuel subsidies during the past two years. Can Zambia join their ranks? Zambia's policy of full cost recovery is already in place. Implementation of this policy has fallen short, especially in providing for currency depreciation. Stronger mechanisms for monitoring cost recovery, institutional coordination, and adjusting prices between shipments are necessary. A stabilization fund that houses over-recovery during kwacha appreciation and applies savings during depreciation may be necessary. Zambia could consider an alternative adjustment model used by Namibia and South Africa. That model adjusts prices monthly in response to changing world market prices rather than only when new imports are received. This added adjustment provides greater predictability for consumers and reduces the strain on government budgets.

Source: Energy Regulation Board announcements and website www.erb.org.zm.

that salaries were already increased substantially in 2013–2014. Strengthening capital project appraisal, approval, and monitoring could inject greater selectivity into the public investment program. As discussions in previous issues of the Zambia Economic Brief indicated, reduced spending on farm subsidies would create fiscal space to expand cash transfers to the poor. Finally, enhancement of the government's systems for cash management, revenue administration, and public procurement would increase the efficiency of government spending.

It is also crucial to adhere to stated policy commitments, particularly as spending pressures will likely build as the 2016 election approaches. In 2014, the FRA expanded

maize purchases in excess of the 500,000 tonnes originally announced and well beyond the level necessary to ensure food security. Full implementation of the policy of cost recovery in fuel pricing is an immediate priority. The ERB raised fuel prices in May, announced its objective to “ensure that there is full cost recovery in the supply chain.”⁷ As box 2 states, this price hike seems unlikely to halt the accumulation of new arrears (let alone raise funds to compensate for the under-recovery of costs during the past year). Additional price increases will be necessary.

One must carefully consider how to finance the deficit and manage debt. Allowing net new borrowing from the domestic bond market to grow much larger risks drives

up interest rates and crowds out private investment. On the other hand, relying more on global creditors exposes the government to greater currency risk. If Zambia returns to the Eurobond market, issuing a bond with a staggered repayment schedule would reduce pressure on revenue and foreign exchange when the bond matures. The authorities should begin planning now to mitigate risks associated with repayment of the 2012 and 2014 Eurobonds.⁸ Should the government establish a sinking fund to save cash needed to redeem the bonds, roll over the debt by issuing a new bond, or somehow combine the two? Developing a debt management strategy that balances both the costs and risks of debt is essential to addressing this and other challenges.

In the current situation, borrowing sustainably means borrowing less. Policy makers therefore must seek ways to curtail the growth of government spending, to direct scarce public funds towards activities that contribute more directly to poverty reduction and economic growth, and also seek to cut down on the use of borrowed funds for government consumption. Targeting cash grants to reach the poor directly is a more cost-effective means of reducing rural poverty than fertilizer subsidies or interventions in maize markets. Approving only those proposed public investment projects that have a high rate of return, are closely aligned with national development priorities, and are ready to begin implementation, both of which will enhance the development impact of the public investment program. Finally, enhancing the government's systems for cash management, revenue administration, and public procurement will increase the efficiency of government spending.

Economic outlook, risks, and policy challenges

Medium-term outlook

The outlook for the Zambian economy is underpinned by two main trends: First, the current low price of copper, on which the economy depends for revenue and foreign reserves, will pressure fiscal and current account balances; second, uncertainty about the mining fiscal regime could reduce investment and production in the mining sector.

Low copper prices and policy uncertainty will weigh on the export sector, while the weak kwacha will push up prices, keeping inflation above target and dampening private consumption. Beginning in 2016, the economy should gradually strengthen as prices of copper begin to recover from their current low level, mining production expands, and inflationary pressures from currency depreciation subside.

Reflecting headwinds from low copper prices, predictions are that real GDP growth will remain at around 5.6 percent in 2015, increasing to around 6.2 percent in 2016 and possibly approaching 7 percent in 2017. The main driver of gradual increase in real GDP growth would be higher gross fixed capital formation, along with the resolution of uncertainties around government mining policies and a rise in FDI flows. Over the medium term, low commodity prices, a more stable exchange rate, and adequate local harvests would help contain inflationary pressures, boosting real disposable incomes. The resulting increase in private consumption, added to rising copper exports, should help strengthen growth in 2017 and beyond.

Risks to Zambia's economic outlook

The outlook is subject to significant downside risks, domestic and external. Output growth in China that is lower than predictions would weigh on demand for Zambia's exports, further reducing copper prices, and would severely affect Zambia's prospects. A protracted decline in metal prices would lead to a substantial drop in export revenues. A scaling down of operations and new investments in response to the low prices and persistent policy uncertainties would reduce output in the short run, and reduce growth momentum for a longer time period.

A sudden adjustment of market expectations to the upcoming tightening of monetary policy in the United States could adversely affect emerging and frontier markets in Sub-Saharan Africa, especially in countries that receive substantial portfolio inflows. Zambia is vulnerable to a certain extent, because around 12 percent of Zambian government securities were held by non-residents at the end of 2014, but is less vulnerable than larger emerging markets, such as South Africa or Malaysia, where foreigners hold around 30

and 45 percent of government securities, respectively.⁹ However, quantitative easing in the Euro Area should contribute to continued attractive borrowing conditions on Eurobond markets, allowing frontier-market governments to maintain market access. But recent episodes of capital market volatility suggest that countries with large macroeconomic imbalances would face strong downward pressure on the exchange rate, and hence an increased risk of inflation, further constraining policy.

Policy challenges

Commodity-exporting countries' policy makers face increasing challenges. In Zambia, the central bank has to weigh monetary and exchange-rate policy measures to support growth against those necessary to stabilize inflation and the kwacha. To date it has held to its mandate of maintaining price stability. The government needs to balance the need to preserve fiscal space amidst falling resource revenues with a desire to support activity.

With limited policy buffers, the government has less flexibility to respond to lower commodity prices by adjusting public spending. Allowing the kwacha to depreciate will provide a buffer against the impact of the weaker export prices. At the same time, a tightening of macroeconomic policy and strengthening of the monetary policy

framework may be necessary to prevent currency depreciation's constant threat of inflation. In addition, the commodity price shock highlights the need for Zambia to diversify its economy away from primary commodities, which will require the government to implement structural reforms that will remove impediments to private sector activity and improve the business environment.

Large fiscal deficits and inefficient government spending persist as sources of vulnerability for Zambia. Strengthening the fiscal position and restoring fiscal buffers are necessary to increase resilience against exogenous shocks. Fiscal consolidation should involve a shift in spending priorities that supports both the efficiency of public expenditures and long-term inclusive growth.

As in other countries in the region, there is an urgent need in Zambia for deep structural reforms to ignite and sustain rapid productivity growth. Rationalizing farm subsidies and other government interventions in agriculture markets can contribute to greater economic diversification, trade competitiveness, and rural income growth. Periodic trade bans (e.g., on maize exports and wheat imports), market distortions whose cause is FRA pricing and procurement policies, and a bias towards maize in the FISP discourage private sector investment in new agricultural production and food processing.

SECTION 2

Making Mining Work for Zambia

Zambia's rich mineral resources are an important asset which, with a supportive investment climate, can help the country achieve its economic development ambitions. Although the cost of extracting copper is higher than in many other countries, Zambia possesses some of the world's highest-grade copper deposits and was the world's seventh largest copper producer in 2014 (U.S. Geological Survey [USGS] 2015). The mining industry generates foreign exchange, government revenue, and jobs. With strong economic growth in the last decade traceable to significant investments in Zambia's copper mining sector, Zambia has reached lower-middle-income status. Despite this income growth, however, more than 60 percent of its people live below the national poverty line. In addition, a century of mining has imposed environmental and public health costs on the country and its people.

As it looks to the future, Zambia faces important choices on how to manage its mineral resources. Since 2000, mining companies have invested around \$10 billion to expand the productive capacity of Zambia's mines (ICMM 2012). This investment, along with growing world demand, boosted Zambia's copper annual output by 350 percent. Refined copper production from Zambia's own mines and from imports is expected to approach 1.5 million tonnes by 2019 but then taper off unless there is a new round of investment. There is good potential to attract investors; however, the challenge for policymakers is to create and implement tax and regulatory policies that balance the

short- versus long-term costs and benefits arising from the sector.

This special-focus section of the Zambia Economic Brief analyzes these issues and trade-offs facing Zambia. The Brief's objective is to stimulate public discussion about mining policies, not to prescribe which specific policies the authorities should undertake. Several broad messages emerge from the analysis:

1. ***Root expectations in the reality of Zambia's specific conditions.*** Much of the copper Zambia mines is either costly to unearth or has only recently been placed in production. This implies lower economic profits, in comparison to operations elsewhere, and therefore lower tax revenue than some have been expecting. The mines Zambia has developed more recently need time to mature and will become major taxpayers in the future. Improved capacity to forecast would also make expectations more realistic.
2. ***Expect taxes to grow significantly, and predictable policies to encourage further long-term investment and growth.*** Without continued investment in mine extensions and scale economies, Zambia's copper production will soon peak. As output falls, so will taxes, jobs, and other economic activity. The design of the mining fiscal regime plays a leading role in facilitating investment that can sustain future growth. With continuing and expanding supply, there are opportunities to increase employment

and to stimulate backward linkages that are not yet in place.

3. ***Internalize environmental and public health spillovers.*** Regulatory requirements should internalize the environmental and social costs of mining, and enforcement of current environmental standards should become stricter so that mining companies mitigate pollution and undertake clean-up.
4. ***Mining companies should play their part.*** Performance with respect to the degree of environmental stewardship, provisions for future clean-up, and the level of economic linkages has been lackluster. If mining companies put as much effort into tackling these issues as they have into overturning the recent royalty and VAT tax issues, Zambia would be a long way towards having solutions to these problems.
5. ***Be mindful that improved capacity remains core to the solution of both fiscal and environmental issues.*** Zambia has a good fiscal and legal framework but its capacity to operationalize many of its policies is weak. Without solid tax administration, risk assessment, auditing, environmental monitoring, and regulatory capacity, even the best-designed policies will not work.

This section of the Brief opens by reviewing how mining contributes to Zambia's economy, focusing on the growth of investment and output in the past decade and the potential for further growth in the future. It then turns to an analysis of the mining fiscal regime, which incorporates revenue simulations using a new model developed by the World Bank. In addition to revenue concerns, the focus section investigates the environmental and public health costs resulting from insufficient attention to these aspects of mining over past decades. Findings and recommendations conclude the section.

Mining and the Zambian economy

Mining has grown in importance during the past decade

Mining is a key pillar of the Zambian economy. During the past four years, copper has accounted for an average of 66 percent of

total exports, the mining industry has contributed 11 percent of GDP, and mining companies have paid 16 percent of the taxes and other revenue that the government has collected (figure 12, panel b and panel c). On the basis of estimates from the 2012 labor force survey, the mining industry accounts for 21 percent of formal private sector employment in Zambia.¹⁰

The mining industry also contributes to the economy through mining companies' procurement from firms in other parts of the economy and, to a lesser extent, through downstream processing of mining output. On the basis of ICM estimates, in 2012 the mining industry spent around \$1.8 billion on goods and services that Zambia produced (7 percent of GDP).¹¹

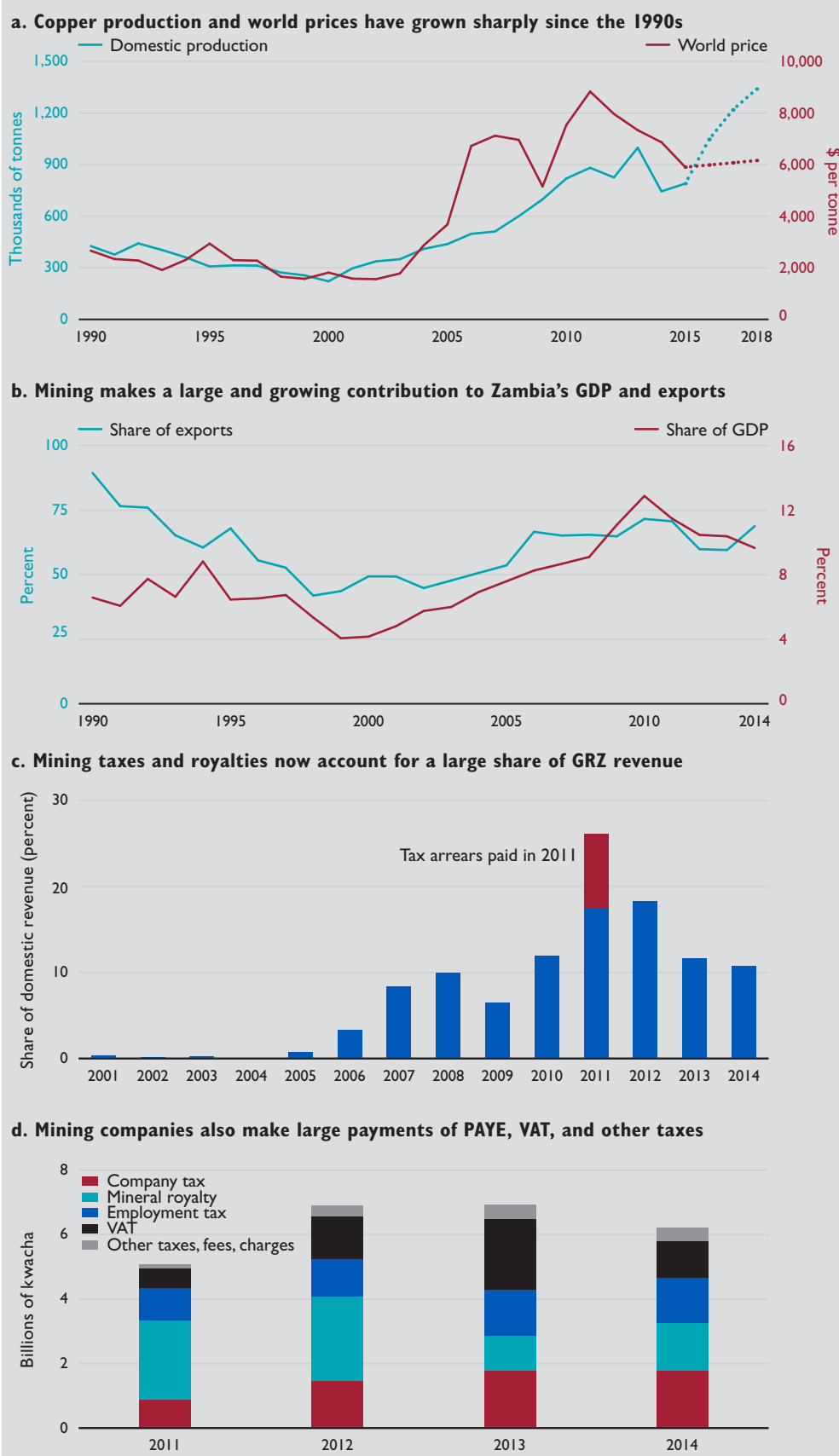
The volume of annual copper production in Zambia grew by 350 percent between 2000 and 2013—an average of 12 percent growth each year (figure 12, panel a). Several factors have made this possible. Privatization of state-owned mines in the late 1990s, record-high copper prices, and generous financial incentives opened the door to a wave of foreign investment into both existing and new mines. Nobody anticipated the increase in copper prices that resulted following privatization, including global commodity traders and mining companies. The increase in prices was accompanied by significant supply expansion as mining companies invested over \$10 billion in new production capacity. The boom has been most noticeable in the Northwest Province, informally named “the New Copperbelt” (box 3).

Along with production and prices, government revenue from mining has also grown (figure 12, panel c). Mineral royalty collections began rising around 2006 due to production, prices, and higher royalty rates. Mining profit-based taxation has increased as well, but with a longer lag because companies defer payment while they continue making investments.

The privatization process was instrumental in revitalizing the sector and its attendant increase in output and government revenue. However, the process also separated some of the mining assets from legacy environmental and social liabilities that were too large or insufficiently quantifiable to be transferred to the private sector as part of the sale process. As a result, the privatization left

Figure 12 Contributions of the mining industry to the Zambian economy

12



Sources: Panel a: Bank of Zambia, Ministry of Finance, World Bank; panel b: Bank of Zambia, Central Statistics Office; panel c: ZIPAR 2013, Zambia Revenue Authority; panel d: Zambia Revenue Authority.

Notes: Price and production data for 2015–2018 are forecasts by the World Bank and Ministry of Finance; production and export data are copper only; tax arrears paid in 2011 are excluded from panel d. PAYE stands for “pay as you earn.”

the state holding many legacy liabilities in ZCCM-IH, but with little financial resources to adequately address them. Furthermore, as a publically traded company listed on the Lusaka Stock Exchange, ZCCM-IH has had little incentive to address legacy liabilities beyond levels regulators enforce.

It is helpful to consider the copper mining sector in Zambia as two sub-sectors

comprising the New and Old Copperbelts (box 3). Most tax revenue (panel a) and new production (panel b) will likely accrue from the operations in the New Copperbelt, whose development largely resulted from the recent commodities boom and the equitable two-tier fiscal regime. Privatization and injection of new capital extended the life of many high-cost operations in the Old Copperbelt.

Box 3 The New Copperbelt investment boom

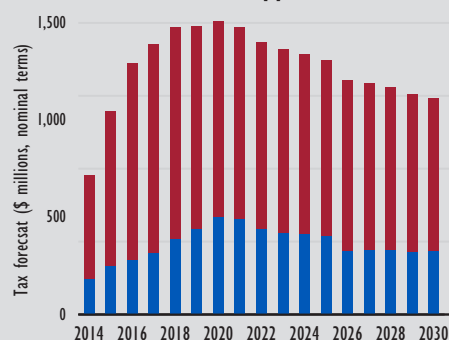
3

It is helpful to classify Zambia's copper mining sector into two distinct sectors: a new set of operations in the Northwestern Province (the "New Copperbelt," as the public sometimes refers to it), and the aging mining operations in the existing Copperbelt Province, which are the source of much economic activity and provide significant employment opportunities in the province.

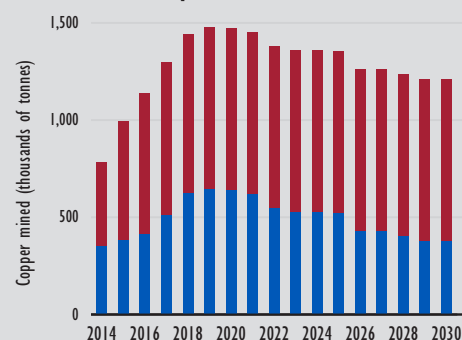
Largely the result of the most recent commodities boom and equitable two-tier fiscal regime, the operations in the New Copperbelt are generally open pit and use newer, less labor-intensive technologies. Because these operations were constructed more recently, they still have large capital balances to offset profits taxes, but once these balances depreciate, the potential high profitability of these operations, in particular Kansanshi, have the potential to generate significant revenue from profits-based taxes.

The older mines of the existing Copperbelt Province tend to be underground mines or dump retreatment operations. They face high production costs and are generally labor intensive. They require capital on an ongoing basis to develop new openings to sustain production, and the profitability of operations is highly sensitive to changes in costs and prices. Because these mines are marginal, they sometimes accrue operating (accounting) losses that accumulate and carry forward. Because they face higher production costs and use more inputs in production, they generate less tax revenue but offer more opportunities to stimulate backward linkages.

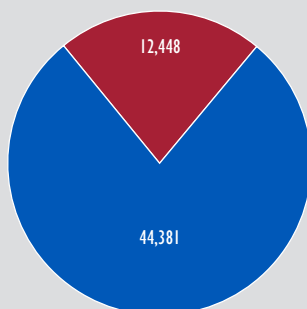
a. Most future mining revenues are expected to come from the new Copperbelt ...



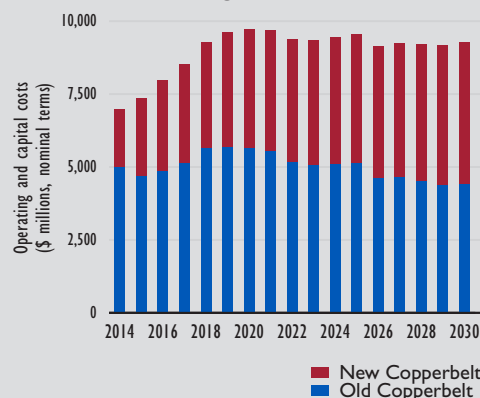
b. ... as is most production.



c. However, the jobs are largely in the old Copperbelt ...



d. ... as are the opportunities for backward linkages.



Source: Panels a, b, and d: World Bank staff calculations; panel c: derived from Chamber of Mines of Zambia (2014).

Although these mines generate lower tax revenues than mines in the New Copperbelt, they provide more jobs (panel c) and opportunities for backward linkages (panel d).

Unlocking a new wave of mining investment and production

Zambia's copper output, including the processing of imported ores, is likely to approach 1.5 million tonnes per year by around 2019. In the absence of new investment, production will flatten out and gradually decline over time, however. Nevertheless, there are good reasons for optimism about the potential for additional investment to unlock new increases in Zambia's copper production. A recent United States Geological Survey study of undiscovered copper resources in the region shows a significant quantity of undiscovered copper in Zambia (Zientek et al. 2014). The study estimates that 8,400,000 tonnes of undiscovered copper lie in the Roan arenite tract, which extends through the Copperbelt and Central provinces. This undiscovered copper is in deeper deposits, however and, when using known technologies, it will require more effort to discover and more capital to develop than existing mines. As a result, exploration of the undiscovered copper in Zambia is unlikely if companies observe that they cannot earn a return from the already-discovered deposits.

As the country debates how to unlock a new wave of copper production, it is important to note that there is a lot of variation in costs to extract copper across different mines, and that Zambian mines generally face high production costs relative to other mines around the world.

Mining is a long-term business that operates in an environment of uncertainty—uncertainty about the quality of minerals and where they will be found, and uncertainty about the direction of future world prices. Governments can add to this uncertainty where policies change in an unpredictable manner and without consultation. The long-term success of Zambia's copper mining industry will involve high-cost operations with long lead times to extract resources that lie deep underground. Zambia needs to lay the foundations for future expansion of the industry today by establishing a track record of stable fiscal and regulatory policies that

will attract partners who will develop these deep mining projects responsibly. We turn now to analyze Zambia's mining fiscal regime and how that can help stimulate future copper production and capture a fair share of the benefits for the Zambian people.

Analysis of mining taxation

The ultimate objective of a mining taxation regime is to maximize the benefits that a country's citizens receive from the country's mineral resources. The regime's tax instruments, their established rates, and the institutional arrangements must not discourage the investment that is necessary to give commercial value to Zambia's subsoil resources and that mitigates the environmental, health, and social costs of mining activities. The taxation regime must also enable the government to collect a fair share of the country's mineral wealth to support national development priorities.

In addition to jobs, government tax revenues from mining will continue to be the most important source of benefits for the economy. Since mining in Zambia is capital- and technology- intensive, the industry is likely to remain an enclave in the short term. The mines will continue to rely heavily on imports of capital goods and other inputs. The scope for local value addition beyond smelting and refining is limited, and mines will continue to sell the bulk of their output to foreign buyers. The fiscal regime determines the government's revenue take from the mines. It also establishes the incentives and disincentives a firm faces in deciding how much to invest, how many workers to hire, what ore to mine, and so forth. A deal that is equitable for both the country and the investor will inevitably be more stable than one that is too generous to either side. Knowing what constitutes a fair deal is, however, enormously difficult, even when the parties agree to the terms. Moreover, designing a fiscal regime that will achieve the anticipated sharing of benefits over a long-term, volatile, and inherently unpredictable investment life-cycle is immensely complex. The challenge of optimally mobilizing resource revenues requires the government to strike the right balance between encouraging revenue-generating investment and capturing an appropriate share of the resulting revenues.

Zambia's mining taxation regime has evolved in important ways since the government privatized the mines. The authorities have changed elements of the regime in response to changing market conditions, evolving public policy needs, and as the authorities have developed experience with regulating private businesses after the years of state ownership. This sub-section briefly reviews recent changes and analyzes the medium-term prospects of the new policies that will take effect in July 2015.

Important conclusions of this analysis are, first, that a variety of tax instruments are necessary to collect revenue from mines that have different cost characteristics and are at different stages in their lifecycles. A second message is that the government should build the institutional and human capacity to implement the regime effectively.

Evolution of Zambia's mining taxation regime

In trying to strike an optimal and equitable deal between mining companies, the government's fiscal take, and job creation, the government of Zambia has adjusted the mining fiscal regime several times since it privatized the mines (table 1). As world copper prices grew unexpectedly to record-high levels between 2004 and 2011, the government increased the effective tax rate on mining companies to capture more of the economic rents that these rising prices generated. The government negotiated

development agreements with individual mines at the time of privatization that often contained generous terms designed mainly to attract foreign investment. The 2008 Mines and Minerals Act annulled these development agreements and introduced a variable profits tax, a windfall tax, a withholding tax on services, and an export duty on concentrates. The corporate tax rate rose to 30 percent. Since the annulment of the development agreements, mineral royalty rates have steadily increased—to 3 percent in 2008, 6 percent in 2012, and to 8 and 20 percent (on copper from underground and open-cast mines, respectively) in January 2015—before being revised to 9 percent in July 2015. Zambia's mineral royalty rates have in recent years tended to exceed the global norm, even before the rate jumped temporarily to 20 percent on open-pit mines in 2015. Most major mineral producers charge less than 6 percent.¹²

The goals of the changes introduced in 2012 and January 2015 were to generate revenue to finance the government's development spending priorities and to respond to the widely shared view that the government had not been receiving its fair share from mining taxes.¹² The attempt to rely solely on the mineral royalty in the January 2015 regime reflected concerns that profits-based taxes are too difficult to implement effectively. A closer look suggests that the level of revenue collected from mines, particularly

Table 1 Evolving features of Zambia's mining fiscal regime since 1997

Mining fiscal regime	Key features
Development agreements negotiated with individual mines during privatization (1997 to March 2008)	Agreements were made between the Zambian government and each company that bought the assets of the former national company ZCCM. Each development agreement contained a fiscal stability clause.
The "2008 regime" (April 2008–March 2009)	The 2008 reforms passed as part of the 2008 Mines and Minerals Act ruled that the government should not enter into any special agreements for the development of large-scale mining licenses; the reforms also annulled the development agreements. The Act introduced a new tax regime with a higher tax burden: it set the company income tax rate at 30 percent; it introduced a variable income tax and raised the mineral royalty rate to 3 percent from 0.6 percent; and it set the withholding tax on services at 15 percent and introduced a windfall tax.
The "2009 regime" (April 2009–March 2012)	In response to the mining companies' concerns about the revocation of the development agreements, the government reversed the lower capital depreciation allowance and some other 2008 tax measures such as the windfall tax in its 2009 budget.
The "2014 regime" (April 2012–December 2014)	The government made further reforms to the mining tax regime in its 2012 budget. The two main changes for the mining industry were the increase of the mineral royalty rates for copper and cobalt to 6 percent, and separate treatment of hedging and operating income for income tax purposes.
The "January 2015 regime" (January 2015–June 2015)	Corporate income and profits tax rates descended to zero. The government also set the mineral royalty rate at 20 percent for output from open-pit mines and at 8 percent for output from underground mines.
The "July 2015 regime" (announced in April 2015)	The government set the corporate income and profits tax rates at 30 percent and the mineral royalty rate at 9 percent for output from all mines.

Source: Zambia EITI 2014.

Note: More detailed information on the tax rates and allowances applied under each regime is in table B8 in annex B.

through profits taxes, has been influenced by a number of additional factors:

- the high cost and resulting low overall profitability of Zambia's copper mining sector
- the stage of the mining operations in their lifecycle (either through the large potential capital depreciation allowances [CDA] that accrue immediately after start-up or through the high cost structure of the older, underground mines in the Copperbelt Province)
- historical fiscal incentives (tax holidays, royalty remission, accelerated depreciation) granted by government to induce investment
- the effects of the double taxation treaty between Ireland and Zambia: few firms pay withholding tax on dividends from non-mining-related activities¹³
- the carrying forward of large tax "assets" that resulted either from unredeemed CDA balances, purchased by companies as a result of the structural reorganization of Zambia's mining sector, or from operating losses carried forward

Some of these issues relate to the stage in the mining companies' lifecycle. Others stem from historical fiscal incentives. As companies move into a tax-paying position and as incentives expire in the years to come, these factors will become less important.

Revenue outlook of the July 2015 regime

In April 2015 the President announced a replacement of the royalty-only regime that had come into force in January 2015 with a regime that included profits taxes plus a single royalty rate of 9 percent on output from both open-cast and underground mines. To better clarify the implications of the new tax regime, the World Bank put together a forecasting model. The model incorporates information about the tax provisions the government applies to each mine, along with detailed financial data about the largest mining companies' cost structures as they are likely to evolve over the life of each mine. Information on cost assumptions in the model is presented in annex B. This allows the model to simulate annual output and profit margins into the future, taking into account the effects of differing levels of depreciation, capital redemption, and losses

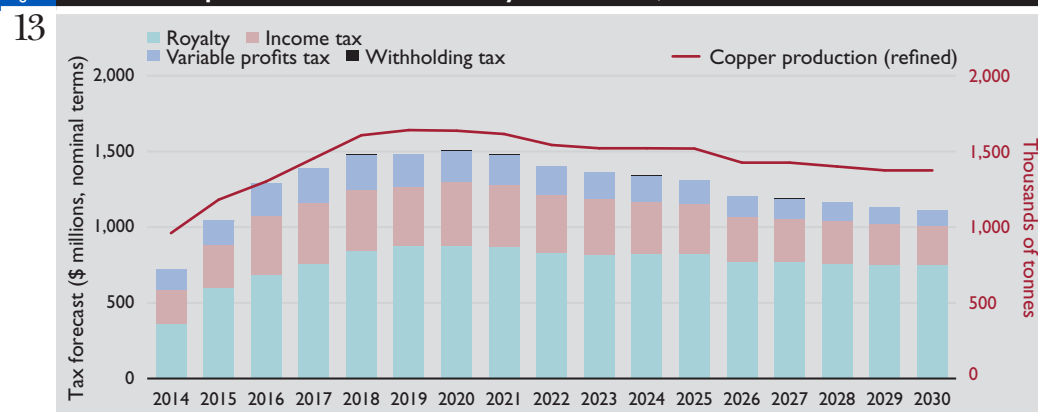
carried forward each year. We believe that the resulting model contains the best available estimates of costs, financing structures, and production.

The model estimates that revenue collected under the new tax regime will likely double between 2014 and 2017 as production volumes rise to just over 1.6 million tonnes per year (including copper processed from imported concentrate). Revenue collected from all instruments—royalty, company tax, and variable profits tax—increases during this period. Both production and government revenue level off around 2018–2021 and then taper off at approximately \$1.2 billion per year though a continuation of revenue growth is possible if one assumes further investment in the sector.¹⁴ Profits taxes generate a smaller proportion of total fiscal revenue after around 2021. As discussed in annex B, the model suggests that the July 2015 regime generates slightly less revenue in 2015 than the January 2015 regime, but afterwards generates more revenue. As it has the same profits-based tax framework but higher royalty rates, the new regime generates more revenue than the 2012–2014 regime, on the basis of current assumptions about future prices.¹⁵

The model's forecasts are sensitive to assumptions about world prices. Figure B20 in annex B shows that revenue would continue to rise over the modeled period if world prices were to be 15 percent higher than the current forecast rather than slowly declining, as projected under the base case figure 13 projects. Modeling a price decline poses challenges. According to current projections, the price of copper is close to the short-run costs of many mines, and in some cases lies below a mine's total costs, making many mines vulnerable to small changes in prices.

Despite these caveats, however, this model fills a gap in the analysis of Zambia's mining fiscal regime. In contrast, many forecasts tend to extrapolate from historical data rather than base their projections on projections of costs over mines' lifecycles.

Looking towards the future, the model projects revenue to increase significantly during the next several years under the July 2015 fiscal regime. This increase includes growing revenue collected from profits-based taxes, which proved disappointing in the

Figure Forecast of production and revenue by instrument, 2014–2030

initial years after privatization for reasons discussed above. Nevertheless, the growth in copper production that became possible due to the boom in investment after privatization will begin to slow after around 2019. Along with the decline in production, there will be a decline in government revenue, mining industry jobs, and foreign exchange. Production levels can increase over the long run if there is a new wave of investment. We turn next to considerations of how Zambia's mining taxation regime can chart a course that generates revenue for the government without jeopardizing future investment.

What should a mining tax regime consider for the long term?

The size of a mine's output, the number of employees, cash returned to investors, and therefore the amount of government revenue all vary over the life of a mine. All will eventually decline in the absence of investment to maintain existing mining infrastructure or to extend the life of the mine. The mining fiscal regime is important to this decision. As in all sectors of the economy, the types of policy instruments, the rates at which taxes are collected, their valuation base, etc., collectively establish the incentives and disincentives a firm faces in deciding how much to invest, how many workers to hire, what ore to mine, and so forth.

To illustrate this point, we first consider a stylized profile of a mining operation that is considering an investment to extend the life of the mine. Any mine has at a minimum an initial phase of investment. A period of

production follows after the mine is commissioned. During the investment phase, there is job creation but no production, and therefore investors receive no cash. The employment profile over the life of the project normally peaks sharply during construction. At this stage, mines hire contractors because work is temporary and, in comparison to operations, requires specialized skills. Following commissioning, employment and production are generally relatively stable over the life of the mine.

Government revenue under a fiscal regime with both royalties and profits taxes also has two distinct phases: an all-royalty phase and then a royalty and income tax collection phase. As mineral royalties are derived from the value of production, and are not linked to profitability, mineral royalty is payable from the first day of operations. By comparison, the profits-based tax is derived from a definition of profitability, which differs from cash flow. Under this hypothetical example, the firm is not "profitable" for tax-paying purposes because it has not yet recouped enough of its capital investment. Nevertheless, it generates a flow of cash to investors. Thus, a firm can be generating cash and investors can be declaring dividends while the firm is not profitable or only marginally profitable from a tax perspective. This difference between cash flow and profitability is common to all industries and is a feature of mining fiscal regimes across the world. The feature is more apparent in mining than in some other sectors because of the large capital investments

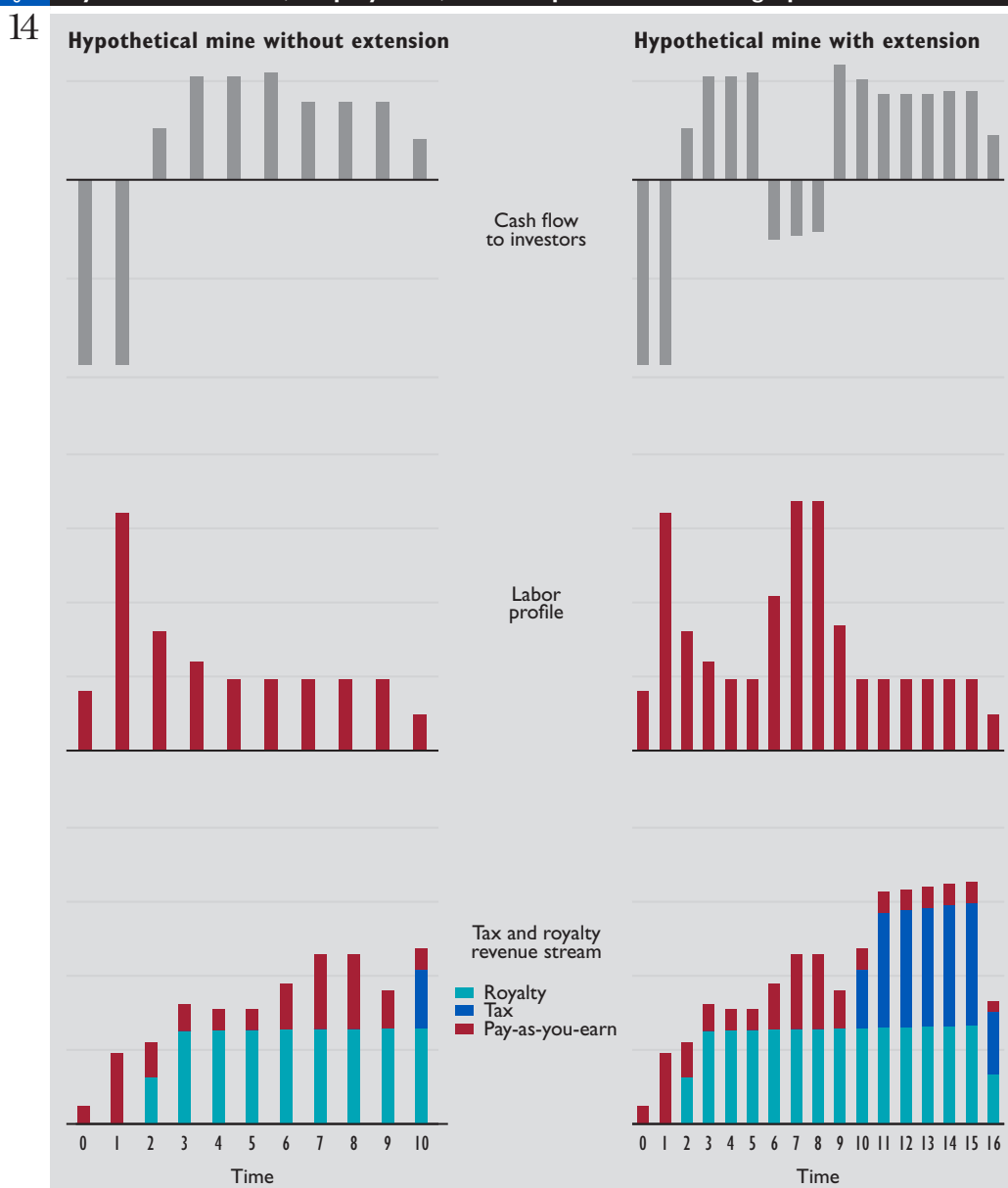
necessary and long lead times to production that often last several years.

These characteristics are illustrated in the charts in the left column of figure 14. Cash flow to investors (in gray) is negative during the investment phase, rises quickly after the commissioning of the mine, and eventually tapers off. In the bottom panel, the government collects revenue from the mineral royalty (in teal) simultaneously with the commissioning of the mine. Profits-based tax revenue (in blue) accrues only after the mining firm pays off the initial investment. The government also collects employment tax—the

PAYE tax—in red) that peaks during the investment phase.

Let us now turn to a case where new investment extends the productive life of the mine, which the charts in the right column of figure 14 illustrate. A few features are immediately noticeable. A second series of capital investments is necessary in the middle of the life of the mine, making the cash flow to investors negative for a short period. The life of the mine has thereby increased, and with that comes a continuation of royalty payments, exports, and employment. The labor profile now has two peaks, and the second

Figure 14 Stylized investment, employment, and tax profile of a mining operation



Source: World Bank staff.

coincides with the investment for mine extension. Finally, payment of income tax has been deferred because of the continued capital investment.

The picture of Zambia's mining industry is naturally more complex. Mines presently find themselves at different stages in their lifecycles. The quality of ore varies within and across mines. The cost structure of each mine is different. As a result, the size and timing of the variables in figure 14 differ with each mine. In addition, the case of the hypothetical mine is highly stylized and overly simplistic as it ignores important factors that make the trade-off far more complex than what the figure depicts. Governments often lack information from producers and thus information necessary to make long-term decisions. Prices are volatile and unpredictable and assumptions regarding global commodity markets can significantly affect the choice of optimal policy. The stylized example nevertheless highlights the key role of fiscal policy in determining whether a mine's life will continue.

The rate set for the mineral royalty is also critically important because it influences a firm's decision about what grade of ore to extract from a mine and whether to undertake new investment. High ad valorem royalty rates in particular reduce the amount of ore that can be economically produced from a mineral resource. As the royalty rate increases, a mine operator must restrict mining to only those ores with a higher grade (i.e., higher percentage of copper and therefore higher value per unit of rock extracted)

in order to maintain profitability, holding the world price and other factors constant. As miners preferentially extract the higher-grade ore, they reduce the remaining average grade of the ore they leave in the deposit. Consequently, the total amount of copper available for economic extraction over the life of the mine falls as the royalty rate increases. A stylized example of the potential distortionary impact of ad valorem royalties on the undiscovered copper potential in Zambia is included in box 4.

The examples of figure 14 and box 4 convey two important messages. The first is that a tax regime that encourages investment to extend the life of a mine delays collection of profits-based revenue but increases the total revenue that the government collects from the mine over its lifetime. Given the highly capital-intensive, geographically fixed, and long-term nature of the mining business, policies that introduce disincentives to capital expenditure will likely result in less investment in, and commercial development of Zambia's mineral resources.

A second message is that using both a royalty and a profits-based tax enables the government to collect revenue throughout the mine's lifecycle. A mineral royalty can generate revenue as soon as companies commission a mine. Relying solely on a royalty, however, requires setting the rate higher to replace revenue that the government could have collected with other instruments, and higher royalty rates lead companies to extract only the highest-grade ore and prematurely close the mine. In addition, a flat ad valorem

Box 4 Potential distortionary impact of royalties on undiscovered copper potential in Zambia

4

World Bank analysis using the recent USGS report of the undiscovered copper potential in the Roan Tract of Zambia shows the potential distortionary nature of high mineral royalties. More details are present in table B11 in annex B. This report estimates that around 8.4 million tonnes of undiscovered copper lie in Zambia's Roan Tract. Calculations show that the amount of copper that is profitable to mine at 20 percent mineral royalty is 21 percent lower than at a 6 percent royalty (and 24 percent lower if there is no royalty at all). At a price of \$3.00/lb, setting a royalty at 20 percent increases the cut-off grade by approximately 17% to 2.62% and reduces the value of copper economically available for extraction by \$7.6 billion, in comparison to setting a royalty at 6 percent. See annex B for more detail.

Potential copper extraction from the Roan Tract falls as the royalty rate rises

	Royalty rate			
	0 percent	6 percent	9 percent	20 percent
Cut-off grade of ore (percent Cu)	2.10%	2.23%	2.31%	2.62%
Copper available above cut-off grade (millions of tonnes)	5.5	5.4	5.1	4.2

Source: World Bank staff calculations based on grade information in Zientek et al. 2014.

royalty does not capture more revenue for the government during times when world prices rise and mining company profits are high.

This analysis of tax policies abstracts from real-world complexities of administering mining taxes. These bear partial responsibility for the lower-than-expected revenue outturn from the profits-based taxes in the 2008 and 2009 regimes during a time when world copper prices were rising quickly. We turn now to the need for improved capacity in Zambia's mining taxation regime.

The importance of tax administration capacity

Effective tax administration is a challenge for most countries, especially in the mining sector. Aside from capacity constraints, which are significant, the complexity of setting taxes on mining activities adds to the difficulty in effectively administering the fiscal regime. In addition, as most of the investment into Zambia is carried out by vertically integrated multinational enterprises, expertise is necessary to audit related-party transactions. One general challenge is that the revenue authority may not know the timing and application of certain instruments because these are negotiated with the mining authority. A number of more specific implementation challenges that accompany individual instruments follow below.

Royalties: While royalties are an essential component of a mining tax regime, overemphasis on them and differentiation of rates by mine type and between mining and processing operations are likely to introduce unforeseen administrative complexities. In theory, ad valorem royalties are perhaps the easiest to administer, as they are transparent and are a function of revenue streams. Revenue authorities can find it difficult to monitor mines' royalty payments, however, depending on the design of the royalty regime, e.g., on whether it levies the royalty on the mineral content of underlying ores, which in turn would require physical audits of production quantities in unrefined products. For example, questions remain about the calculation and audit of the royalty in the January 2015 all-royalty fiscal regime if the same mining license operates a combination of open-pit, underground, and/

or leaching mines simultaneously. Calculation and verification of the correct royalty will require an in-depth assessment of the metal content of the raw ores that companies will likely combine in the concentrator. This verification will be plagued with uncertainty because even mining companies find it challenging to accurately reconcile actual production with resource estimates (normally using mine call factors for reconciliation) for different mining areas, all which contain their own statistical uncertainties.

Income tax: The administration of profits-based taxes is complicated. Causes are the tax incentive schemes, offering tax holidays of varying lengths, and a suite of measures that are applied to companies operating in special economic zones. Use of tax holidays for both domestic and international investments increases the transfer (mis)pricing risk. Both legislation and tax auditors' knowledge are necessary to identify risk points to adjudicate related party transactions (especially in services, management fees, and intellectual property assignment of cost). In addition, deductions from income tax, loss carried forward, differing depreciation allowances, and capital allowances complicate the calculation and projection of profit over time.

Treaty provisions, withholding tax schemes, and double taxation agreements also add to administrative complexity. Mining companies seek tax efficiency on a global scale and design corporate and financing structures to maximize returns for shareholders. As with international tax, knowledge of treaty provisions and withholding tax schemes are important for assessing the applicability of the domestic tax regime to multinational enterprises. Zambia's tax treaty with Ireland allows companies to avoid paying withholding taxes on dividends.¹⁶

A general lack of both transparency and information for fiscal and regulatory authorities creates additional challenges for administering a mining tax regime. All mining companies need to become more transparent. Transparency in the industry differs from one mining company to another. The government should create the legal means necessary to obtain information from companies allowing the authorities to project

fiscal revenues from the mining sector into the future. The draft Mines and Minerals Act affords an excellent opportunity to effect the necessary changes, which should at a minimum require the annual reporting of long-term mine plans, costs, employment levels, and other relevant information in a well-defined and prescribed form.

To use this information, the revenue authorities must also possess strong abilities in financial analysis for forecasting, auditing, and policymaking. It is not enough to monitor the progress of the fiscal regime; authorities must also evaluate how the regime is likely to behave in the future under different world market conditions. Furthermore, mining has a distinctive life-cycle. The government therefore must understand how revenues from Zambia's mining sector will evolve in the medium to the long term as mines progress through their lifecycles.

The environmental-health nexus

In addition to balancing trade-offs across different tax instruments, Zambia must manage the trade-off between the mining sector's contributions to exports, economic growth, employment, and government revenue on the one hand, with a number of negative consequences of mining on the other: environmental damage and its cost to the people and the economy.¹⁷ The public health risks from mining fall disproportionately on the poor, and in particular its youth. If the current generation of Zambians do little to permanently address these liabilities, the financial burden will also fall on Zambia's children.

When mines were privatized in the late 1990s, the state-owned Zambia Consolidated Copper Mines (ZCCM) was burdened with the environmental liabilities it had accrued over 70 years of mining operations in Zambia. The privatization process did not succeed in transferring the legal responsibility for some of these historical environmental liabilities to new investors. In some instances it was not even possible to quantify the nature of environmental and public health liabilities. The government therefore made the strategic choice to retain a portion of the "environmental mortgage" to allow commercial mining and smelting operations to continue.

The problems attributable to privatization, particularly separating the historical and environmental liabilities of the public mining operations of ZCCM from the current operations of the private owners, are at the core of unattended environmental health risks. Neglected pollution hot spots can increase environmental health risks through both natural deterioration and poor development decisions.¹⁸ This part of the Zambia Economic Brief analyzes the environmental and health implications of the mining industry.

Environmental impacts of mining in Zambia

Since 2001, most of the previously state-owned and unprofitable copper mines have been revived through extensive investments by new owners. Many old tailing dams have been left both unremediated and unprocessed by the new owners due to fluctuating copper or lead prices and low metal content. The result has been continued environmental pollution and exposure to neighboring communities. Operating copper mines are directly responsible for a number of serious environmental impacts. We describe the most important ones here.

Air pollution: Copper smelters release substantial amounts of sulfur dioxide emissions into the atmosphere, which cause acid rain, soil erosion, and crop damage. Particulate matter less than 10 µm in size (PM10) originates from smelters; a smaller amount originates from the dust that tailing dams and unpaved roads release into the atmosphere. The Environmental Council of Zambia estimated that in the early 2000s, the total of sulphur dioxide emissions in Zambia was 346,700 tonnes/year, more than 98 percent of which the mining industry is the source, mostly the copper smelters (Environmental Council of Zambia 2008). Areas northwest and west of the large Nkana and Mufulira smelters have sulphur dioxide concentrations between 500 and 1000 µg/m, which exceed the Zambian guideline of 50 µg/m³ (Lindahl 2014).

Over the past couple of years, some of the existing smelters have been upgraded after change of licensee or due to pressure from the Zambia Environmental Management Agency (ZEMA). The 2014 upgrading of the

Mufulira Smelter is expected to reduce sulphur dioxide emissions by 97 percent.

Soil contamination and land degradation: When they combine with moisture in the air, sulphur dioxide emissions from the smelters convert to sulphuric acid, which damages soils and kills vegetation downwind. These emissions may also contain dust particles holding copper, nitrous oxides, and organic acids, which can enter streams and affect aquatic fauna. Further soil contamination from mining operations, chemical and oil spills may also persist, while wind-borne dust particles (from dry tailing dams) result in accumulation of metals (copper and cobalt and other elements) in soil.

A century of mining resulted in high levels of soil contamination. This contamination continues due to ongoing operations and is aggravated by closure of many old tailings dams. The Copperbelt districts of Kitwe, Mufulira and Chingola, and also to a lesser extent with Kalulushi, Chililabombwe and Chambishi, have the highest concentrations of many elements. Surface soil samples contain ten to fifty times higher concentrations of copper than subsurface samples in most of the Copperbelt (Lindahl 2014). Recent incidents of accidental breaks in leaching tanks of mining companies have resulted in over one hundred hectares of maize and vegetable crops being destroyed by sulphur dioxide emissions along the Kitwe-Chingola roads on the Copperbelt.¹⁹

Water pollution and siltation: The mining operations in the Copperbelt all lie within the catchment area of the Kafue River, which provides water for domestic uses, irrigation, and fishing. Runoff and leakage from existing waste rock dumps and tailings dams can cause widespread negative impacts downstream. The Kafue River has shown highly elevated concentrations of dissolved copper and cobalt within the mining areas (Pettersson and Ingri 2001). Elevated concentrations of dissolved sulfur can be traced all the way down to the confluence with the Zambezi River. Although the contamination is concentrated in hotspots closer to mining operations, secondary particles are re-suspended and transported downstream. Most monitoring stations have shown elevated

concentrations of many dissolved elements in the Kafue and its tributaries.

Ongoing mining activities in the Copperbelt severely affect the waterways through extensive siltation. Tailing dams and waste dumps further enhance this siltation (Lindahl 2014). Tailing material with high copper and cobalt concentrations dominate bed sediment in many places along the Kafue River. The catastrophic failure of old and unstable tailing dams is a further risk, which could cause extensive physical and ecological damage.

Despite the high concentrations of dissolved metals in streams and heavy siltation, the Copperbelt still produces potable water, since severe pollution is mainly concentrated in hotspots. Spills from leaching plants and other accidents have damaged health and well-being in neighboring communities, however (Chingola in 2006 and Mufulira in 2008). In 2006, the failure of a tailings slurry pipeline released highly acidic tailings into the Kafue River that produced high concentrations of copper, manganese, and cobalt. The supply of drinking water supply to communities downstream had to be shut down.²⁰ In another instance, following protracted litigation, a mining company paid two thousand residents K4 million for general damages and K1 million for punitive damages (Sibanda 2011). Most recently, in 2013, following complaints from farmers in the Chambishi area about crops that acid rain damaged with its sulphur dioxide fumes, one mining company had to compensate affected farmers and install online monitoring for oxides of sulphur and nitrogen.²¹

Pollution in food: The severe pollution in the Kafue River is damaging aquatic animal health. Several fish samples from the Kafue and various tailing dams have shown elevated concentrations of copper and cobalt compared to fish from unaffected waters upstream from the mining operations. When assessing metal concentrations in fish compared to guidelines values for oral intake, there is no immediate health risk associated with consumption of fish from the Copperbelt (Lindahl 2014). Regarding agriculture, however, people residing in some areas in Kitwe on the Copperbelt are unable to grow backyard vegetable gardens

because the accumulation of heavy metals in the soil and sulphur dioxide on plant leaves leads to the risk of necrosis infection (Ncube et al. 2012).

The legacy of lead and the human cost of previous mines

Zambia, and in particular the city of Kabwe, has a long history of lead mining. The historical mining activities led to the establishment of the then Broken Hill mine and town. The Kabwe Mine has experienced various changes in ownership since 1904. Over its initial life span of 88 years, the mine produced approximately 1.8 million tonnes of zinc, 800,000 tonnes of lead, and 64 tonnes of copper. In 1994, the mine was shut down by ZCCM due to low resource prices and the exhaustion of ore reserves.

Continued and unmitigated exposure to high levels of lead can harm health. Airborne exposure and direct ingestion of soil and dust are the dominant exposure pathways for lead with extended pathways through groundwater or surface water and irrigated crops (Plumlee et al. 2013). Studies show that the primary pathway of lead exposure among children in Zambia is the ingestion of soil and soil dust (Van Geen et al. 2012). Lesser but still significant pathways include the consumption of water and contaminated foodstuffs. Although acute lead poisoning of young children is the most immediate and severe consequence, others are also at risk, including older children, adult workers, pregnant women and their unborn children.

Due to the long history of mining and lack of remediation of the mining area following closure of the Kabwe mine, the content of lead in soils surrounding the mining area is as high as 26,000 mg/kg in the most polluted areas. Land up to 14 km from Kabwe has been found to unsuitable for agricultural purposes (Czech Geological Survey 2007). A 2013 study indicated that mean concentrations of lead and cadmium in the tissues of free-range chickens exceeded the maximum recommended levels for human consumption. Levels in commercial broiler chickens were lower (Yabe et al. 2013). Average lead concentrations in cattle from the Kabwe area were 90.6+/-67.6 µg/kg dry weight, suggesting prominent toxicological effects. Ikenaka et al. (2012) demonstrated

that lead contamination causes immunological alterations in cattle blood, both in vivo and in vitro. Atmospheric lead pollution is a major contaminator of food crops, particularly maize, the primary staple food crop the people often grow in their backyards (Tembo 1993). Soils used to make adobe bricks from old mining areas also have the potential of having lead levels as high as 58,900 ppm (Ikenaka et al. 2012). Finally, in Zambia, there is a cultural tradition whereby pregnant women ingest soil (or other substances such as dirt, clay, ashes, etc.), which adds to the blood lead levels and also has a secondary impact on infants.

Environmental health impacts of lead

Lead reduces intellectual function and increases various neurobehavioural barriers to learning such as irritability and “distractibility.” Literature reviews suggest that intelligence quotients (IQs) decline by 2–3 points for every 10 µg/dL lead in early childhood. Additional studies have shown evidence of lead-related intellectual deficits among children who had maximal blood lead levels less than 7.5 µg/dL (table 2).

Investigations show that the average blood level of children is between 60 and 120 µg/dL. Exposure to lead has many known health effects, which include neuropsychological impacts in children and increased blood pressure and cardiovascular disease among adults, as well as chronic kidney disease, anemia, and gastrointestinal symptoms.

Health and public services costs

Exposure to environmental pollution and associated impacts on public health entail cumulative and long-term economic, social, and ecological costs. The public health costs associated with lead exposure have been well documented. They range from direct economic and health care costs to affected individuals to the effects on provision of public services (Swinburn 2014).

Economic and health care costs: High lead levels can cause learning disabilities, attention deficit–hyperactivity disorder, mental retardation, stunted growth, seizures, and coma. These tend to reduce an individual’s cognitive abilities and lifetime earning potential. Thus, in addition to imposing costs on

Table 2 Blood lead levels in children in Kabwe, by community

2

	Minimum	Mean	Maximum
Chowa	8.9	26.1	55.0
Kasanda	10.1	34.8	79.4
Makand	14.9	45.3	87.0
Makululu	6.7	30.2	74.2
Mutwe	19.0	29.2	42.5
Railways	6.5	19.2	47.2
Riverside	14.0	34.9	72.1
Waya	6.7	30.0	62.6

Source: Estimated from the report on blood sampling in Kabwe that was conducted within the “Copperbelt Environment Project” over 2004–2009 by NewFields.
Note: Values in µg/dL.

the public health care system, exposure to lead hampers individuals’ ability to escape poverty.

To estimate the possible magnitude of lost earnings, the World Bank estimated the expected risk of IQ losses in children less than five years old in Kabwe (World Bank 2015).²² Established empirical evidence indicates that an individual’s IQ score is associated with her or his lifetime income, and studies have further estimated that a decline of one IQ point is associated with a 1.76–2.37 percent decline in lifetime income.²³ Combining these results with assumptions about the labor force participation rate and average lifetime incomes in Zambia, the estimated total cost of lead exposure in Kabwe is between K250 and K580 million, as shown in table 3. This is equivalent to between 9 and 19 percent of Kabwe’s GDP.

These estimates include the indirect effects of lower educational achievement and workforce participation in addition to the direct effect of lower hourly wages. In addition to the cost of lost income born by individuals, with every loss in lifetime earnings

comes an associated loss in potential tax revenue for the government.

Evidence suggests lead is the main environmental cause of damage to children’s cognitive potential. However, co-exposures to other contaminants such as lead–arsenic, lead–manganese, and lead–methylmercury can also result in synergistic toxicological effects on neurodevelopment in early childhood.

Effects on other public services: Zambia’s water supply and sanitation companies must spend funds to treat polluted water—to provide clean and safe water to communities living around the mining areas and tailings dams. This requirement imposes a financial burden on the public utilities companies, although in some cases the concentration of manganese remains beyond treatable limits.²⁴ The excessive silting of local rivers, which kills off the plant-life and fish stocks, imposes additional responsibilities and additional costs to water and sewerage companies in affected areas around mining operations. These financial and administrative costs have not

Table 3 Estimated annual costs of lead exposure in Kabwe

3

	Low estimate	High estimate	Mid-point estimate	Source
Lifetime income loss (percent of income)	1.76	2.37	2	Schwartz 1994 and Salkever 1995
Lifetime income (U.S. dollars)	45,000	60,000	52,500	Estimated based on Zambia Institute for Policy Analysis & Research 2013; WDI 2014
<i>Total cost of estimated IQ loss:</i>				
millions of U.S. dollars	47	107	77	Estimation
millions of kwacha	252	579	416	Estimation
percentage of GDP in Kabwe	8.5%	19.4%	13.9%	Estimation

Source: World Bank estimates.

Notes: This estimate assumes a labor force participation rate of 80 percent of the population aged 15–64, which is the rate modeled by the ILO. The report on the 2012 labor force survey released by the Central Statistics Office estimates labor force participation rates of 74 percent in Central Province and 75 percent nationwide, suggesting a somewhat lower total cost.

been totally ascertained, and there is always the additional risk of stormwater drains overflowing, flooding, and all of the associated challenges and costs.

Mining environmental governance

A history of unsustainable mining practices adds to the challenges of poverty, economic growth, and human development that Zambia faces, through increased environmental degradation and the associated health damages and socioeconomic implications.

Zambia has a reasonable set of environmental acts, regulations, and institutional mechanisms to mitigate, monitor, and manage environmental pollution from individual projects. The Environmental Management Act establishes ZEMA as a statutory body within the Ministry of Land, Natural Resources and Environmental Protection and establishes the mandate to prevent and control environmental pollution and environmental degradation. A new Environmental Management Act, which was signed into law in May 2011, provides for more stringent penalties for non-compliance than the previous Environmental Protection and Pollution Control Act. The responsibility to monitor and enforce environmental, health, and safety aspects of mining activities lies with the Mine Safety Department as empowered under the Mines and Minerals Development Act. One of the main tools for internalizing the negative environmental costs of mining is through the Environmental Protection Fund (EPF). However, the urgency for improved management of environmental health risks is not yet matched by current regulatory capacity and there are significant capacity gaps in enforcement and compliance of environmental regulations.

Fully operationalizing the Environmental Protection Fund: The draft Mine and Minerals Bill provides an opportunity to improve the effectiveness of the EPF. The EPF is managed and administered by an Environmental Protection Fund Committee consisting of both private sector and government representation. It operates similarly to an escrow account: each miner's contribution to the fund is earmarked for use against environmental liabilities on his own license areas. It is designed in this manner so that mining companies fully

internalize the environmental costs of their own mining operations.

The contributions to the EPF for which each developer is responsible is guided by the Mines and Minerals (Environmental) Regulation No. 66. Although calculations of the EPF contributions depend on mine closure costs reflected in the approved environmental impact assessments, the full value of environmental liabilities measured in these assessments is not currently provided by mining companies through the EPF. The state-owned mining company ZCCM-IH is among the companies that have failed to provide for their full environmental liabilities.

A primary reason given for compliance failure is that the magnitude of some liabilities of cash deposits and bank guarantees are too onerous for some companies and are beyond the scale of local Zambia banks. However, failure to comply with the EPF is also attributable to governments' leniency in enforcing the requirements of the Act. The latter results from an underlying tension between, first, enforcement of the EPF requirements, which would fully internalize the costs of environmental degradation with license holders (but in some cases may force closure of operations) versus, second, keeping open the option to develop old mine workings (either formally or informally) at some point in the future, which would in theory generate the associated income and jobs. One cause of this tension is that the full rehabilitation of mine tailings can hinder the economic viability of potentially feasible tailings resources. The government is thus reluctant to eliminate possible opportunities that could generate future employment given the right commodity prices and technology. Here again we see another trade-off facing the government: requiring financial provision for clean-up and risking the feasibility of ongoing producers or old mining areas, versus allowing ongoing environmental degradation in return for ongoing economic activity and the prospects of redevelopment of old mining areas.

Transfer of environmental liabilities between private parties and to the state: As the law currently stands, unless private parties expressly agree in a binding legal agreement, environmental liabilities are transferred along with mining licenses.

In some cases large, multinational mining companies with deep financial capacity to address current and historical environmental liabilities have transferred licenses to smaller companies with limited financial capacity. Smaller companies are interested in the licenses as they often see speculative value in reprocessing old mine tailings. This pattern poses a significant risk to the state since, many of these environmental liabilities are not provided for under the EPF. As a result, should these smaller companies abandon their properties and associated liabilities, the liabilities and responsibility for clean-up could become a burden of the state.

To avoid obliging the government to assume unfunded environmental liabilities, the law should require that cash deposits and bank guarantees required under the EPF be received in full prior to the issuance or transfer of a mining license. Where a domestic bank guarantee is not possible to obtain due to the size of liabilities, the government should relax restrictions and permit fulfillment of this obligation through international bank guarantees or by the parent companies of investment grade organizations. Where the liability has not been provided in full, it should remain with the large parent organization, which has the financial capacity to remedy the liability.

Conclusion: making mining work for Zambia

Similar to many other resource-rich developing countries, Zambia faces several trade-offs in setting its mining fiscal regime and mitigating the negative environmental and health effects of mining. Some trade-offs involve the optimal extraction of the nation's finite sub-soil wealth, while others relate to an issue of fiscal receipts today versus tomorrow, or creating the incentive for mines to mitigate environmental spillovers today versus paying for clean-up and suffering potential lost incomes in the future. In all cases the decision boils down to optimizing the social value of mining to Zambians over the long term. Some of this is intuitive, but the trade-offs and process for decision making are surprisingly complex—especially when considering that future generations of Zambians do not yet have a voice with which to influence the debate.

The government has many fiscal options, but the optimal choice requires a holistic assessment. One must strike a balance between the short-term immediate revenue needs of Zambia against its long-term objectives. Attracting long-term investment requires policy stability. Investors value stability and therefore are willing to pay for it though higher taxes. There is no guarantee of stability, however. It must be established through a track record and different types of fiscal instruments, such as profits-based taxes, which are better suited to building that record.

It is important to undertake the analysis necessary to establish a fiscal regime that will be sustainable in the long run. An ideal review of the fiscal regime should be inclusive and yield unambiguous fiscal policy. It should include consultation, have its basis in robust analytics (financial models), and have production assumptions that mining companies corroborate.

Mining companies, on the other hand, must be more transparent. The government should create the legal means necessary to obtain information from companies and to allow its authorities to project fiscal revenues from the mining sector into the future. The draft Mines and Minerals Act affords an excellent opportunity to effect the necessary changes. Furthermore, the authorities should strengthen the financial modeling capacity to utilize information accessible from the previous recommendation for (i) auditing, (ii) forecasting, and (iii) policy-setting purposes.

Unsustainable mining practices have added to Zambia's challenges of poverty, economic growth and human development, through increased environmental degradation and the associated health damages and socioeconomic consequences.

In accordance with global good practice, mining companies must fully internalize the environmental and social costs of their operations. The draft Mine and Minerals Bill provides a significant and timely opportunity to improve the effectiveness of one of the government's key instruments for doing so, the Environmental Protection Fund (EPF).

Zambia's environmental liabilities are large. In some cases large, multinational mining companies that possess deep financial

capacity have transferred licenses and associated liabilities to smaller companies with limited financial capacity. To protect the state from having to assume these unfunded environmental liabilities, the law should require that compliance with the EPF become a prerequisite to the issuance or transfer of mineral rights.

Finally, mining companies must do their part. In some instances they should take the

lead in offering solutions. Their participation in environmental stewardship, including providing financial resources for future clean-up, and in establishing linkages to Zambian inputs suppliers has been lackluster. In general the large mining companies have capacity and should apply it to maintain their social license to operate. If they refuse to, they risk government intervention to set this policy trajectory for them.

ANNEX A

Economic Data

Table Growth by main sectors, 2000–14

A4

(percent, unless otherwise indicated)

	Average annual growth 2005–2010	2011	2012	2013	2014 Preliminary	Contribution to growth in 2014
Primary sector	7.6	0.6	1.7	–0.6	–1.0	–0.2
Agriculture, forestry, and fishing	–1.8	8.0	6.8	–7.4	6.5	0.6
Mining and quarrying	20.8	–5.2	–2.7	5.9	–7.2	–0.7
Secondary sector	5.8	8.5	10.3	8.4	6.2	1.4
Manufacturing	4.6	8.0	7.2	4.5	5.2	0.4
Electricity, gas, and water	2.8	8.2	4.1	5.9	2.3	0.0
Construction	7.3	8.9	13.6	11.4	7.5	0.9
Tertiary sector	9.8	7.8	7.1	8.6	8.1	4.5
Wholesale and retail trade	7.0	7.5	4.0	5.2	6.8	1.2
Restaurants, bars, and hotels	3.8	7.9	–2.6	2.2	6.9	0.1
Transport, storage, and communications	24.1	13.7	12.8	12.4	13.1	1.2
Financial institutions and insurance	–0.3	4.9	12.0	12.2	13.2	0.6
Real estate and business services	8.0	2.9	3.7	3.1	3.1	0.2
Community, social, personal, and other	14.5	8.4	9.4	12.8	7.4	1.2
GDP	8.7	6.3	6.7	6.7	6.0	
GDP less mining	7.4	8.0	8.0	6.8	7.5	
<i>Memorandum items:</i>						
GDP at current market prices		115,352	128,370	144,722	166,480	
GNI at market prices (millions of current kwacha)		109,727	126,654	138,510	157,139	

Sources: Government authorities, IMF, and World Bank staff estimates.

Table Government fiscal operations**A5**

(percent of GDP)

	2012 Actual	2013 Actual	2014		2015 Budget	2016 MTEF	2017 MTEF
			Budget	Prelim.			
Total revenues and grants	19.1	18.4	18.6	19.3	18.8	17.8	18.3
Tax revenues	15.0	14.7	14.7	15.8	13.4	12.8	13.2
Income taxes	8.0	6.8	6.5	7.0	6.2	6.2	6.3
Value-added taxes	3.7	5.1	4.9	5.8	3.5	3.6	3.9
Excise and customs duties	3.3	2.9	3.4	2.9	3.7	3.0	3.1
Non-tax revenues	2.4	2.2	3.1	2.7	4.7	4.3	4.3
of which (o/w) Mineral royalty	1.1	1.2	1.3	1.0	3.1	3.4	3.6
Grants	1.7	1.5	1.2	0.8	0.6	0.7	0.7
Expenditures	22.3	25.1	24.2	24.8	23.4	23.1	22.8
Expense	16.2	18.8	18.3	19.4	17.8	18.1	17.9
Wages and salaries	7.3	8.2	9.3	9.6	8.8	8.9	8.5
Goods and services	3.6	3.3	3.5	3.1	3.5	3.1	2.9
Interest payments	1.4	1.5	2.0	2.3	1.8	2.7	2.9
Grants, subsidies, transfers	4.2	6.2	3.6	4.5	3.8	3.5	3.7
o/w Fertilizer subsidies	0.7	0.8	0.3	0.9	0.7	0.5	0.5
o/w Strategic food reserve	0.2	1.6	0.6	0.9	0.5	0.5	0.5
o/w Fuel subsidy	0.7	1.3	0.0	0.2	0.0	0.0	0.0
Acquisition of nonfinancial assets	6.2	6.3	5.9	5.4	5.6	5.0	5.0
Overall balance (cash)	-2.9	-6.5	-5.2	-6.0	-4.6	-5.3	-4.6
Financing	2.9	6.5	5.2	6.0	4.6	5.3	4.6
External (net)	3.7	0.4	1.1	5.3	2.9	3.5	2.8
Domestic (net)	-0.8	6.1	4.1	0.6	1.6	1.8	1.7

Sources: Government authorities, IMF, World Bank.

Note: 2015 figures are based on the approved budget; 2016 and onwards are from the Medium-Term Expenditure Framework (MTEF).

Table Balance of payments, 2009–14**A6**

(millions of U.S. dollars, unless otherwise indicated)

	2009	2010	2011	2012	2013	2014 Preliminary
Current account	714	1,377	958	1,248	-218	-401
Merchandise trade balance	958	2,774	2,299	1,595	1,648	1,625
Goods exports	4,372	7,483	8,754	9,521	10,843	10,220
Copper	3,179	5,768	6,660	6,294	6,911	7,619
Nontraditional exports	953	1,260	1,690	2,852	3,558	2,272
Goods imports	3,413	4,710	6,454	7,926	9,195	8,595
Petroleum	536	618	530	931	1,083	1,421
Services trade balance	-143	-317	-428	-344	-1,058	-794
Balance on primary and secondary income	-101	-1,080	-913	-3	-808	-1,233
Capital account	237	150	151	223	278	51
Financial account	601	1,564	970	1,268	277	-698
FDI and portfolio investment inflows	350	350	350	350	350	350
Overall balance of payments	342	-65	109	171	-247	331
<i>Memorandum items</i>						
Current account (percent of GDP)	4.7	6.8	4.0	5.0	-0.8	-1.5
Gross international reserves	1,758	1,896	2,167	3,044	2,684	3,078
in months of prospective imports	3.7	3.0	2.8	3.3	3.1	3.8
GDP (millions of current U.S. dollars)	15,323	20,265	23,725	24,956	26,865	27,029

Sources: Bank of Zambia, Central Statistics Office, IMF, World Bank.

ANNEX B

Mining

Mining sector employment

Table B7 Direct and contract employment by operation

Operation	Ownership (as of 2014)	Direct employees (2014)	Contract labor (2014)	Other (expansion project)	Total
Mopani	First Quantum 16.9%, Glencore 73.1%, ZCCM-IH 10%	10,000	10,000		20,000
Konkola	Vedanta 79.4%, ZCCM-IH 20.6%	7,000	9,000		16,000
Lumwana	Barrick Gold 100%	1,882	2,054		3,936
Kansanshi	First Quantum 80%, ZCCM-IH 20%	4,781	3,731	5,407	13,919
Albidon		63			63
Lubambe	VALE 40%, Africa Rainbow Resources 40%, ZCCM-IH 20%	1,200	1,000		2,200
Chibuluma	Jinchuan Group 90%, ZCCM-IH 10%	602	345		947
Chambishi Metals	CNMC 85%, ZCCM-IH 15%	741	147		888
Chambishi Copper Smelter	NMC 60%, Yunnan Copper Group 40%	1,600	400		2,000
NFCA	CNMC 85%, ZCCM-IH 15%	1,064	1,219		2,283
Total		28,933	27,896	5,407	62,236

Source: Zambia Chamber of Mines (Sikamo 2014), CNMC 2012, ZCCM-IH 2014 website, Wood Mackenzie 2014 (cited in Sikamo 2014).

Elements of Zambia's mining fiscal regime

Table Features of mining taxes, 1997–2015

B8

	Development agreement	2008	2009	2012–end 2014	January 2015
Corporate tax rate (% of the profit base)	25%	30%	30%	30%	30% on tolling income and processing of 3rd party ores. 0% on mining activities or processing of own ores.
Variable Profit Tax in effect	No	Yes (if taxable profits / sale revenue > 8%)	Yes (if taxable profits / sale revenue > 8%)	Yes (if taxable profits / sale revenue > 8%)	No
Hedging activity considered part of the mining business (rate)	Yes	No (30%)	Yes	No (35%)	No
Capital depreciation allowance (% of annual capital expenditure)	100%	25%	100%	25% (from January 2013)	25%
Loss carry forward (maximum years)	15 to 20 years (depending on company)	10 years	10 years	10 years	10 years
Allowable debt-to-equity ratio	2:1	3:1	2:1	2:1	2:1
Mineral royalty (base metals)	0.6%	3%	3%	6%	8% underground mines; 20% open-pit mines
Mineral royalty (precious metals)	N/A	5%	5%	6%	
Mineral royalty (gemstones)	N/A	5%	5%	6%	
Windfall tax	No	Yes	No	No	No
Customs duty	Exempt in most cases	Rebate	Rebate	Rebate	Rebate
Export duty on copper and cobalt concentrates	No	15% (but with some waivers)	15% (but with some waivers)	10% (but with some waivers)	10% (but with some waivers)
Export duty on all other unprocessed or semi-processed mineral ores	N/A	No	No	10%	10%

Source: ZEITI 2014.

Table Mineral taxation rates around the world

B9

Country	Royalty rate	Royalty base	Corporate income tax rate
Argentina	3%	Net earnings	35%
Australia (NSW)	4%	Ex-mine value	30%
Australia (NT)	18%	Net value of mineral	
Canada (BC)	15%	2% net current proceeds + 13% net revenue	Federal rate 18% in 2010, 16.5% in 2011
Canada (Sask.)	5/10%	Net profits based on unit sales	(B.C. 10.5% in 2010, 10% in 2011; Sask. 10%)
Chile	0–5%	Total sales, varies by volume	20% First Category Tax + Global Complementary + Additional tax on nonresidents
China	2% + Rmb 7/tonne	Ad valorem royalty + per unit charge	25%
DRC	2%	Net sales value	40%; 30% for mining companies
Ghana	5%	Gross sales	35%
Indonesia	4%	Net sales	25%
Kazakhstan	5.7%	Mineral Extraction Tax based on revenue	20%; branch profits of 15%
Mexico	None	None	30%
Mongolia	5% (base rate)	Sales value	10% up to MNT 3 billion; 25% thereafter
Peru	1–3%	Gross sales	30%
Russia	8%	Value of mineral resources	20%
South Africa	Unrefined: $0.5 + (\text{EBIT}/(\text{gross sales} \times 9)) \times 100$, max 7% Refined: $0.5 + (\text{EBIT}/(\text{gross sales} \times 12.5)) \times 100$, max 5%	EBIT (Earnings before income taxes and gross sales)	28%; branch profits tax of 33%
US (Arizona)	At least 2%	Gross value	15–35% on residents/ 30% branch profits tax (Ariz. 6.97%, Nev.—no tax)
US (Nevada)	Up to 5%	Net proceeds	
Tanzania	4%	Gross sales	30%
Zambia	Up until end 2014: 6%. Between January to June 2015: underground 8%; 20%. From July 2015: 9%.	Gross value	30% for mining companies + 0–15% variable profits tax; 30% for toll treating

Source: Derived from own sources, Conrad (2012), and Ernst and Young (2014).

Mineral revenue forecasts

To better understand the tax situation in Zambia's copper mining sector, the World Bank has undertaken a preliminary analysis of Zambia's mining fiscal regime using information for five companies operating in Zambia and subsidiaries under their control: First Quantum Minerals Ltd. ("FQM"), Vedanta Resources Plc ("Vedanta"), China Nonferrous Mining Corporation Ltd. ("CNMC"), Glencore, and Barrick Gold. The models are believed to contain the best publicly available estimates of costs, financing structures, and production.

Tax and cost assumptions of the model

Tax and cost assumptions used in the model are summarized in table B10. The "C1" and "C3" costs shown in the table can be interpreted as short- and long-run costs, respectively. They are the US\$/lb cash costs of refined copper including the benefit of by-product production on a "paid copper" basis.

- Net Direct cash cost (C1) includes the cash cost incurred at each processing stage to delivery to market, less net by-product credits if any. That is, mining, ore, freight, and milling costs; mine-site

administration and general expenses; concentrate freight; smelting and smelter general and administrative costs; marketing costs.

- Production cost (C2) includes all of net direct costs (C1) plus, if applicable, depreciation, depletion, and amortization.
- Fully Allocated Cost (C3) include all of production cost (C2) plus indirect costs such as corporate overhead research and exploration, royalties and "front-end" taxes (excluding income and profit-related taxes), and net interest charges including short-term and long-term loans and corporate bonds.

The relative sizes of these different cost components vary from mine to mine. This has implications for profits tax collection under different rules about which costs can and cannot be deducted.

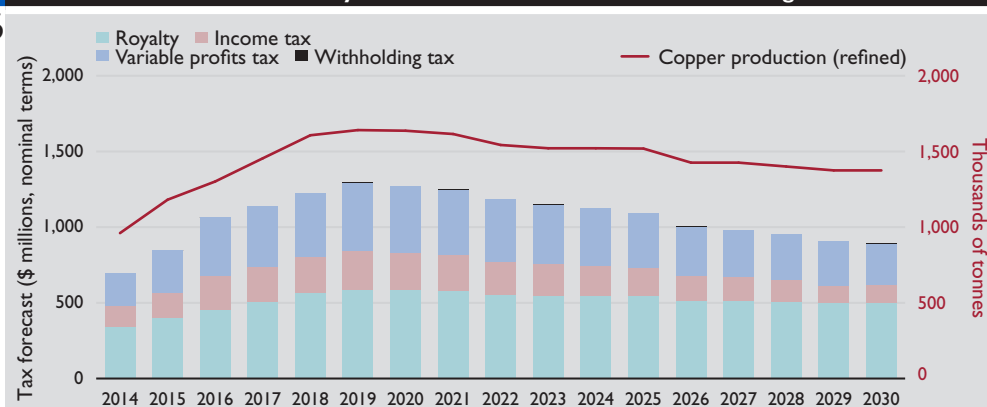
Also of note is that short-run costs lie above the currently projected long-run world price. A firm's real-world decision whether to open or close a mine is based on considerations not easily captured in a simple model. Consider, for example, that this model considers only mines in Zambia, whereas an international company will

Table Summary of tax status and cost positioning by company

B10

Controlling (parent) mining company	FQM	Vedanta	CNMC	Glencore	Barrick Gold
Mining operations	Kansanshi, Sentinel	Konkola Copper Mines (KCM): Konkola, Nchanga, and Nampundwe.	Chambishi (Main, West, & SW); Luanshya (Baluba Center, East, North, and South and Muliashi North).	Mopani Copper Mines (MCM): Nkana; Mufulira Mine, concentrator, smelter, and copper refinery in Zambia.	Lumwana Mine
Type of activities undertaken	Open-pit mining, concentrator, and future smelting operations.	Underground and open-pit mining (at Nchanga); various smelting processing operations.	Underground mining, smelting.	Underground and open-pit mining; concentrating, smelting, and refinery operations.	Open-pit mine and concentrator.
Cost positioning (C1 & C3).	Mid costs / mid profitability: C1: \$1.6—\$2.04/lb C3: \$2.24—\$2.73/lb	High costs / low profitability: C1: ~\$2.65/lb C3: ~\$3.55/lb	Mid to high costs / Mid to low profitability: C1: ~\$1.90—\$2.90/lb C3: ~\$2.81—\$3.44/lb	Mid to high cost / Low to mid profitability C1: ~\$1.84—\$2.17/lb C3: ~\$2.95/lb	High cost, low profitability: C1: \$2.08/lb C3: \$2.76—\$3.23/lb
Estimated effective tax rates	66% (2014); 71% (avg. 2014–2019)	57% (2014); 64% (avg. 2014–2019)	44% (2014); 34% (avg. 2014–2019)	52% (2014); 76% (avg. 2014–2019)	47% (2014); 100% (avg. 2014–2019)
Summary of specific tax issue	Large tax assets from pre-production investments. No withholding tax payable.	Large historical tax assets carried forward. New investments in mine life extension. High-cost and low-profit operations.	Beneficiary of tax holidays and royalty rebate. No withholding tax payable.	High cost structure, ongoing capital expenditure, and capital depreciation allowances.	High cost structure. New investments to optimise mine results in capital depreciation allowances.
ZCCM-IH shareholding	20% in Kansanshi.	20.6% in KCM.	20% in Luanshya, 10% in Chambishi Metals Plc, and 15% in NFCA.	10% in MCM.	0%. ZCCM-IH sold its shares in Equinox as part of Barrick's acquisition in 2011.

Source: World Bank

Figure B15 Forecasts total fiscal take by instrument under the 2014 fiscal regime

Note: Nominal copper prices of LME grade copper cathode used in the analysis are taken from the World Bank's January 2015 edition of Commodity Markets forecast. "Copper production" refers to refined copper and includes imports of concentrates from the DRC. Models are based on company forecasts for five mining companies with operations in Zambia: First Quantum (FQM); Vedanta; China Nonferrous Mining Corporation (CNMC); Glencore; and Barrick Gold. These five companies account for more than 90% of Zambia's copper production.

Figure B16 Forecasts of total fiscal take by instrument under the January 2015 fiscal regime

Note: Nominal copper prices of LME-grade copper cathode used in the analysis are taken from the World Bank's January 2015 edition of Commodity Markets forecast. "Copper production" refers to refined copper and includes imports of concentrates from the DRC. Models are based on company forecasts for five mining companies with operations in Zambia: First Quantum (FQM); Vedanta; China Nonferrous Mining Corporation (CNMC); Glencore; and Barrick Gold. These five companies account for more than 90% of Zambia's copper production.

take into account conditions in its operations around the world when making a decision about a particular mine it operates in Zambia.

Copper price assumptions

The model assumes the following world price of copper for 2014 through 2020. The price increases by approximately 0.45 percent per year after 2020. We draw these estimates from the World Bank's January 2015 commodity price forecasts.

2014	2015	2016	2017	2018	2019	2020
6,863	6,500	6,529	6,559	6,589	6,618	6,648

Revenue forecasts of the model

The figures below show the model's forecast of production levels and revenue collection

by instrument under the 2012–2014 regime and the January 2015 regimes under the current assumptions about future world copper prices. Copper output includes production using concentrates imported from the Democratic Republic of Congo as well as domestic production.

Several points are worth noting. Revenue from the company tax and variable profits tax would have grown steadily had the 2014 regime remained in place, based on the price and cost assumptions in the model. Total production is lower under the January 2015 regime of high royalties than under the 2014 regime with both profits taxes and royalties, but the total revenue collected is higher in the short run. Finally, the model suggests that revenue collected under the July 2015 regime is higher than under either

of the previous two regimes from 2016 until around 2027.

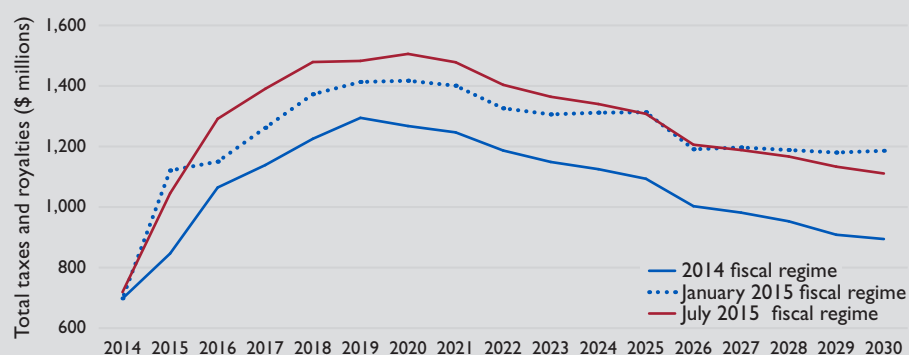
As a sensitivity analysis, an alternate scenario where world prices are 15 percent higher over 2015–2030 than are currently forecast was also modeled. Revenue collected under the royalty-only regime flattens out around 2019, while revenue from the regimes using a combination of profits taxes and royalties continues to increase. Modeling a scenario where world prices are 15 percent lower proved challenging because this would entail the world price falling below the break-even price implied by the cost assumptions used in the model for a number of mines.

The potential impact of royalties on the Roan Tract

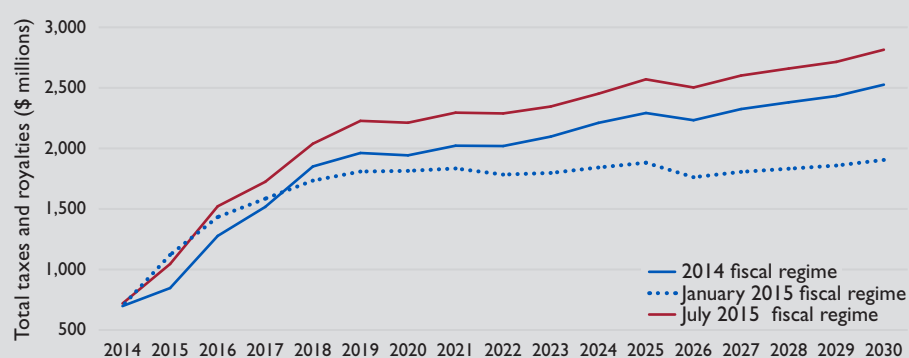
The U.S. Geological Survey (USGS) recently assessed undiscovered resources in sediment-hosted stratabound copper deposits in the Roan Group in the Katanga Basin, Democratic Republic of the Congo and Zambia (Zientek et al. 2014). The part in Zambia is named the Zambian Copperbelt. The Roan Group contains the world's greatest concentration of copper found in sediment-hosted stratabound copper deposits—about 150 million tonnes of copper—the undiscovered copper in the Copperbelt was estimated to be slightly more. Sediment-hosted stratabound copper deposits consist of fine-grained,

copper sulfide minerals that form stratabound to stratiform disseminations in sedimentary rocks. The concentration of sulfide minerals approximately conforms to stratification of the host rocks. Subtypes of sediment-hosted stratabound copper deposits are distinguished by host lithology and the nature of organic material in the sedimentary strata. In Zambia, two subtypes are recognized as the deposits in the Ore Shale and the Roan Arenite parts of the Roan Group.

The following analysis of undiscovered copper is limited to the Roan Arenite formation, which the USGS report estimates contains approximately 8.4 million tonnes of undiscovered copper. World Bank calculations in table B11 show that, before estimates for capital costs and with estimates of operations costs for Zambia's existing underground mines, approximately 5.5 million tonnes of copper could cover operating costs when the royalty is set at 0 percent. Conversely, the amount of copper that is profitable to mine at a 20 percent mineral royalty is 21 percent lower than at a 6 percent royalty and 24 percent lower than if there is no royalty at all. At a price of \$3.00/lb, setting a royalty at 20 percent increases the cut-off grade by approximately 17% to 2.62% and reduces the value of copper extracted from the mine by \$7.6 billion compared to setting the royalty at 6 percent.

Figure B17 Comparison of future revenue by regime under current price projections

Note: Models are based on company forecasts for five mining companies with operations in Zambia: First Quantum (FQM); Vedanta; China Nonferrous Mining Corporation (CNMC); Glencore; and Barrick Gold. These five companies account for more than 90% of Zambia's copper production.

Figure B18 Comparison of future revenue by regime if prices rise

Note: Under a base case price +15% scenario and royalty of 9%, all mines remain profitable and so the "with" and "without closure" profiles of the fiscal take are exactly the same. Models are based on company forecasts for five mining companies with operations in Zambia: First Quantum (FQM); Vedanta; China Nonferrous Mining Corporation (CNMC); Glencore; and Barrick Gold. These five companies account for more than 90% of Zambia's copper production.

Table B11 Impact of high royalties on undiscovered copper potential in Roan Tract

B11

Assumptions (derived from Wood Mackenzie (cited in Sikamo 2014), Zientek et al. 2014, ARM 2014)

Underground mines	C3 cost (\$/lb Cu)	C3 cost (\$/t Cu)	grade %	(t mined/t Cu)	C3 cost (\$/t milled)
Chibuluma	2.18	4,806	4.02%	24.88	193.20
Mufulira	2.95	6,504	2.16%	46.30	140.48
Nkana	2.96	6,526	1.88%	53.19	122.68
Chambishi	3.34	7,363	1.80%	55.56	132.54
Baluba RLE Feed	3.44	7,584	1.50%	66.67	113.76
Konkola	3.55	7,826	1.40%	71.43	109.57
Lubambe	3.57	7,870	2.02%	49.50	158.98
Average	3.14	6,925.66	2.11%	52.50	138.75
		0% royalty	6% royalty	9% royalty	20% royalty
Total cost (\$/t treated)		138.75	138.75	138.75	138.75
Cut-off grade (COG) %Cu		2.10%	2.23%	2.31%	2.62%
Total cost (\$/t Cu)		6,614	6,217	6,019	5,291
Total cost (\$/lb Cu)		3.00	2.82	2.73	2.40
Price (\$/lb Cu)		3.00	3.00	3.00	3.00
Royalty (% , gross)		0%	6%	9%	20%
Net Price (\$/lb Cu)		3.00	2.82	2.73	2.40
Price—cost (break-even)		0.00	0.00	0.00	0.00
Proportion of undiscovered copper above grade		65%	64%	61%	50%
Tonnes of undiscovered Cu above cut-off grade (mn)		5,500,000	5,350,000	5,100,000	4,200,000
Copper difference (mn lbs) (from 0% royalty)			—331	—882	—2,866
Value difference (mn \$) (from 0% royalty)			—992	—2,645	—8,598
Copper difference (mn lbs) (from 6% royalty)				—551	—2,535
Value difference (mn \$) (from 6% royalty)				—1,653	—7,605

Source: World Bank staff calculations using data derived from USGS (Zientek et al. 2014).

Notes

1. This section draws on World Bank, *Africa's Pulse*, vol. 11 (April 2015). http://www.worldbank.org/content/dam/Worldbank/document/Africa/Report/Africas-Pulse-brochure_Vol11.pdf.
2. World Bank, *Global Economic Prospects* (January 2015).
3. Spreads are measured as the difference between the yield on a country's sovereign international bonds and on the ten-year U.S. government bonds.
4. This section draws on World Bank, *Africa Pulse*, vol. 11 (April 2015).
5. The Energy Regulation Board raised pump prices in May by 15 percent to reflect rising world oil prices and currency depreciation.
6. The partial resolution of the dispute over VAT refund claims is discussed in more detail below in box 1.
7. ERB press statement, May 12, 2015.
8. Eurobonds typically require repayment in a single installment. The Ministry of Finance's June 2014 debt sustainability analysis projects that the ratio of debt service payments to government revenue could rise to uncomfortably high levels in 2022 and 2024, when Zambia's two Eurobonds come due (Ministry of Finance 2014).
9. Bank of Zambia, Monetary Policy Statement, February 12, 2015; Credit Suisse, Emerging Markets: Non-Residents' Holdings in Local Currency Government Bonds (November 7, 2014).
10. The industry's share of total employment, formal and informal, is around 2 percent. See table B7 in annex B for employment at the major mines in 2014.
11. Services make up almost all of this amount—ICMM estimates that mines spent only \$87 million on goods that firms in Zambia manufactured. The mines' total procurement was \$3.75 billion. This sum includes goods and services that mines imported directly from abroad, goods manufactured abroad but purchased through Zambian distributors, and goods and services that were produced/provided in Zambia.
12. The speech tabling the FY2012 budget presented the higher taxes on mining as one means to finance the newly elected Patriotic Front government's pro-poor development agenda. The FY2015 budget speech motivates the January 2015 regime as necessary to finance public expenditure needs and, more generally, to ensure that the government receives its fair share of benefits from the industry.
13. Companies that hold mining licenses do not pay withholding taxes on dividends. Those that do not hold large-scale mining licenses and do not carry out mining activities (i.e., smelting, refining, or technical services activities) must pay the usual corporate tax at 35 percent per annum. They must also pay a withholding tax at a rate of 15 percent on dividends, rentals, royalties, bank interest, and management and consultancy fees.
14. The model aims to simulate the evolution of revenue over the medium-term. It makes no assumption about mines'

major new investments in productive capacity beyond what companies had already planned at the end of 2014.

15. The basis of this conclusion is the assumption that no mines close. The modeling for mine closures is crude. Real-world decisions about whether to open and close mines are more complex and are difficult to capture effectively in a model of this nature.
16. As highlighted by CNMC (2012): “Zambian subsidiaries are entitled freely to repatriate to Ireland any dividends and any other distributions subject to Zambian withholding tax deductions currently at the rate of 15 percent. However, in the opinion of our Zambian counsel, pursuant to the Convention between the Republic of Zambia and Ireland for the Avoidance of Double Taxation and the Prevention of Fiscal Evasion with respect to Tax on Income, distribution of dividends to CNMH, an investment holding company incorporated under the laws of the Republic of Ireland, from its Zambian subsidiaries are exempt from such withholding tax.”
17. These can occur in the form of land degradation, contamination of land and water, or health hazards, relocation, alteration of the social structure, etc.
18. For example, due to poor maintenance, residential encroachment by tailing dams in Kitwe, or permitting residential development on known lead-contaminated land in Kabwe.
19. *Lusaka Times*, “Sulphur dioxide emitted from smelter destroys crops,” January 16, 2013.
20. World Information Service on Energy, Nchanga [a mine], Chingola [city in Zambia’s Copperbelt].
21. *Lusaka Times*, “Sulphur dioxide emitted from smelter destroys crops,” January 16, 2013.
22. The analysis uses data collected on blood lead levels in Kabwe and findings from international research into neuropsychological impairment in children from lead exposure, measured as IQ losses.
23. World Bank calculations: The low and high bounds reflect the estimated loss of income in Salkever 1995, weighted by the labor force participation rates in Zambia. See also Schwartz 1994.
24. National Water Supply and Sanitation Council, Zambia, Annual Report, 2010.

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