

Ninth Time Lucky: Is Zambia's Mining Tax the Best Approach to an Uncertain Future?

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INTRODUCTION

After enjoying one of the greatest mining booms in their country's history, Zambians are suffering. From a peak in 2011, copper has lost more than half its value. For a country still dependent on mining copper for much of its livelihood, this drop has resulted in the loss of thousands of jobs and deteriorating government finances. The shopping malls, stadiums and 3-D cinemas built when copper prices and expectations for the future were high are emptying and hopes of an emerging middle class in Zambia are fading.¹ The situation deteriorated so badly that in late 2015, President Edgar Lungu, seemingly looking for any help he could get, arranged a national day of prayer for better economic times.²

The challenge facing the Zambian government is not unique. Like many mineral-rich countries facing the prolonged commodities slump, Zambia is stuck. The country must preserve government revenues from the mining sector to fund the budget. At the same time, it must avoid further mine closures and a drop in investment required to drive growth in the sector.

Facing these challenges, the government has already changed the tax regime three times in the last 12 months, and nine times in the past 15 years. Now, a new reform is underway. It contains three significant changes: the removal of the 9 percent royalty on copper; the introduction of a "price-based royalty," the rate of which varies according to the copper price; and the removal of the variable profit tax.

The Zambia Chamber of Mines—the mining industry association—supports the proposed tax regime and had initially proposed the idea of a price-based royalty.³ However, industry watchdogs Publish What You Pay Zambia and Zambia Tax Platform oppose the changes and have urged the government to "consider engaging in a more consultative and participatory process in developing taxation regimes".⁴ Further, Moody's stated that the proposed tax reform was a risk to sovereign stability.

1 Patrick McGroarty and Joe Parkinson, "Mining Collapse Cripples Africa's Dreams of Prosperity," *The Wall Street Journal*, 4 March 2016, <http://www.wsj.com/articles/mining-collapse-cripples-africas-dreams-of-prosperity-1457104328>.

2 Lusaka Times, "Zambia Observes a National Day of Prayer and Fasting," *Lusaka Times*, 18 October 2015, <https://www.lusakatimes.com/2015/10/18/zambia-observes-national-day-of-prayer-and-fasting>.

3 Chris Mfula, "UPDATE 1-Zambia to bring in variable tax on mining royalties," *Reuters*, 22 December 2015, <http://www.reuters.com/article/zambia-mining-idUSL8N14B1EP20151222>.

4 Zambia Chamber of Mines, "Proposed MRT regime will enhance tax collection," accessed 26 May 2016, <http://mines.org.zm/category/press-statement>; Lusaka Times, "Proposed Mineral Royalty Tax is Retrogressive and will Compromise Revenue Collection-CSOs," *Lusaka Times*, 23 May 2016, <https://www.lusakatimes.com/2016/05/23/civil-society-maintains-position-mineral-royalty-tax-bands>.

Such debate is encouraging and a testament to the strong history of democracy in Zambia. However, there has been little public analysis to inform the debate. This is important, because tax policy is a complex affair that requires understanding of how specific changes impact the entire structure of a tax regime, not just a narrow focus on individual tax instruments.

This paper offers such an analysis and does so following the principles of open data: the model and data used to substantiate assertions made here are available on the Natural Resource Governance Institute website.

The results of this analysis show the government will fail to capture sufficient rent⁵ when prices rise. This is because the price-based royalty does not have price brackets and rates at prices higher than USD 6,000 per tonne of copper cathode, while the removal of the variable profit tax eliminates a useful mechanism to ensure flexibility in the tax take. While Zambia remains highly exposed to the risks of falling mining revenues, a tax regime that provides greater progressivity than the one proposed is sensible. Previous regimes used the variable profit tax to provide this progressivity. Given Zambia's challenge in collecting profit-based taxes in the past, the government no longer supports this mechanism. Instead, it sees the price-based royalty as a better alternative.

However, this comes with its own problems: the current price thresholds set by the government are too low to capture rent when prices rise, and the price-based royalty is not sensitive to how mining costs might change in response to copper price changes.

ZAMBIA'S MINING TAX POLICY HAS BEEN VOLATILE IN RECENT YEARS

This latest fall in copper prices is not the first one suffered by Zambians. As is common in many other resource-rich developing countries, Zambia has been battered by commodities volatility over much of its modern history. (See Figure 1.) The country's mining industry was effectively crippled at the end of the last commodity supercycle in the 1990s, leading to the end of state control of mines.⁶ Another long-term surge in prices, lasting from the turn of the millennium to 2011, afforded the country the opportunity to benefit from its mineral extraction. Meanwhile, the slump following the global financial crisis in 2008 caused a significant, if only short-lived, strain on the industry and government, and a sharp reversal in tax policy. The latest slump in commodity prices may signal the end of this supercycle.

5 Rent is the value of the mineral less the costs of extraction and the costs of capital necessary to extract the mineral; put another way, the value of the resource in the ground is the rent.

6 David Manley, *Zambia Votes President: What Will the Winner Do About Copper Tax?* (Natural Resource Governance Institute, 2015).

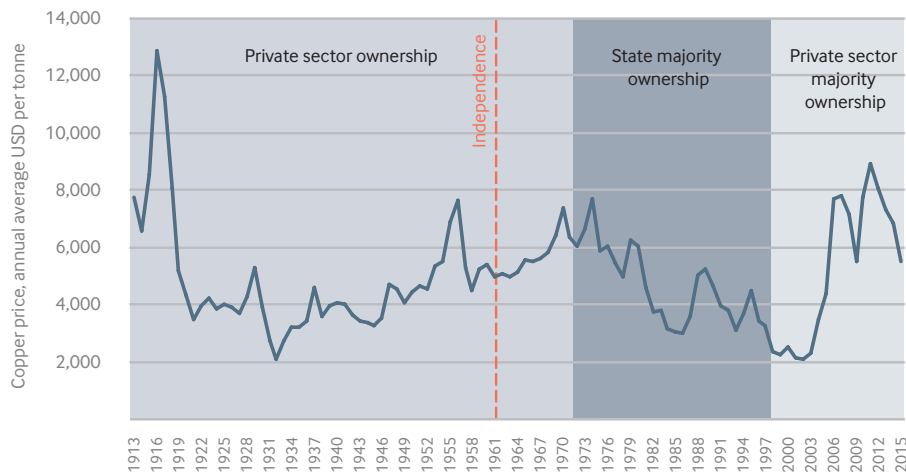


Figure 1. Short- and long-term fluctuations in the real copper price (base year = 2015)

Sources: IMF Primary Commodity Prices, IndexMundi and author's calculations

None of these price movements were generally predicted, so there is no reason to think forecasting will be better in the future. Prices could fall lower still but may well rise again. Government policy must be responsive to this uncertainty. This challenges Zambian officials to set a consistent tax policy that both captures a reasonable share of income from copper mining and attracts investment to allow continued production in the future. Unfortunately, instead of setting a regime that proactively and automatically adjusts to changes, as Figure 2 shows, the Zambian authorities have changed the tax regime nine times since they signed the development agreements with companies in 2001; these changes have tracked the peaks and troughs of the copper price.

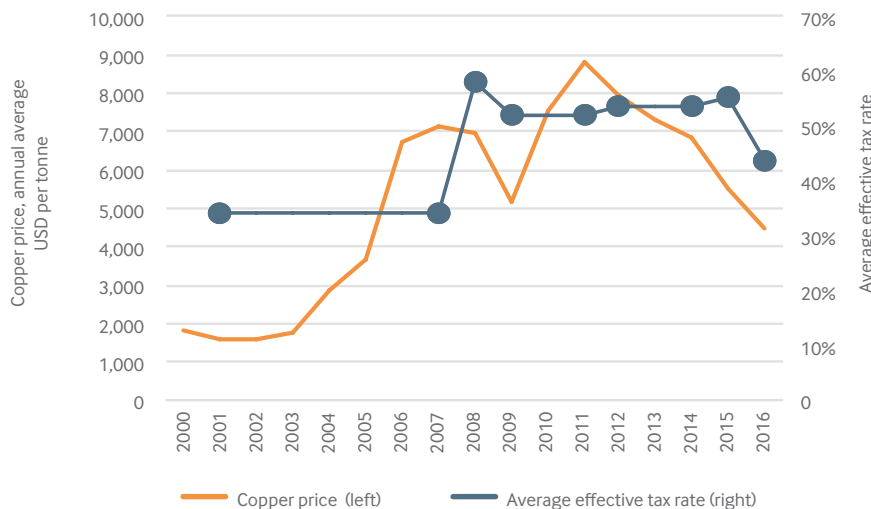


Figure 2. Copper price and tax reforms measured by the average effective tax rate for each

Sources: IMF Primary Commodity Prices, NRGi mining tax model and author's calculations

Note: The average effective tax rate is the state's share of income over the lifetime of a mining project. See appendix for details on how the average effective tax rate is calculated.

In the most recent price fall in 2011, late President Michael Sata's government sought to increase taxes in a bid to fund boosted government spending. President Edgar Lungu's government did likewise. Even as late as 2015, when copper had lost more than a third of its value compared with the peak of 2011, the government tried to push through a reform including a high 20 percent royalty rate on open-pit mines and an 8 percent rate for underground mines. The industry and the International Monetary Fund roundly criticized the government's policy.⁷ The government settled for a comparatively high royalty rate of 9 percent for both open-pit and underground mines. In the model used for analysis in this paper, this equates to the whole tax regime providing an average effective tax rate of 55 percent.⁸

7 International Monetary Fund, *Zambia Selected Issues*. IMF Country Report No. 15 (2015), 153.

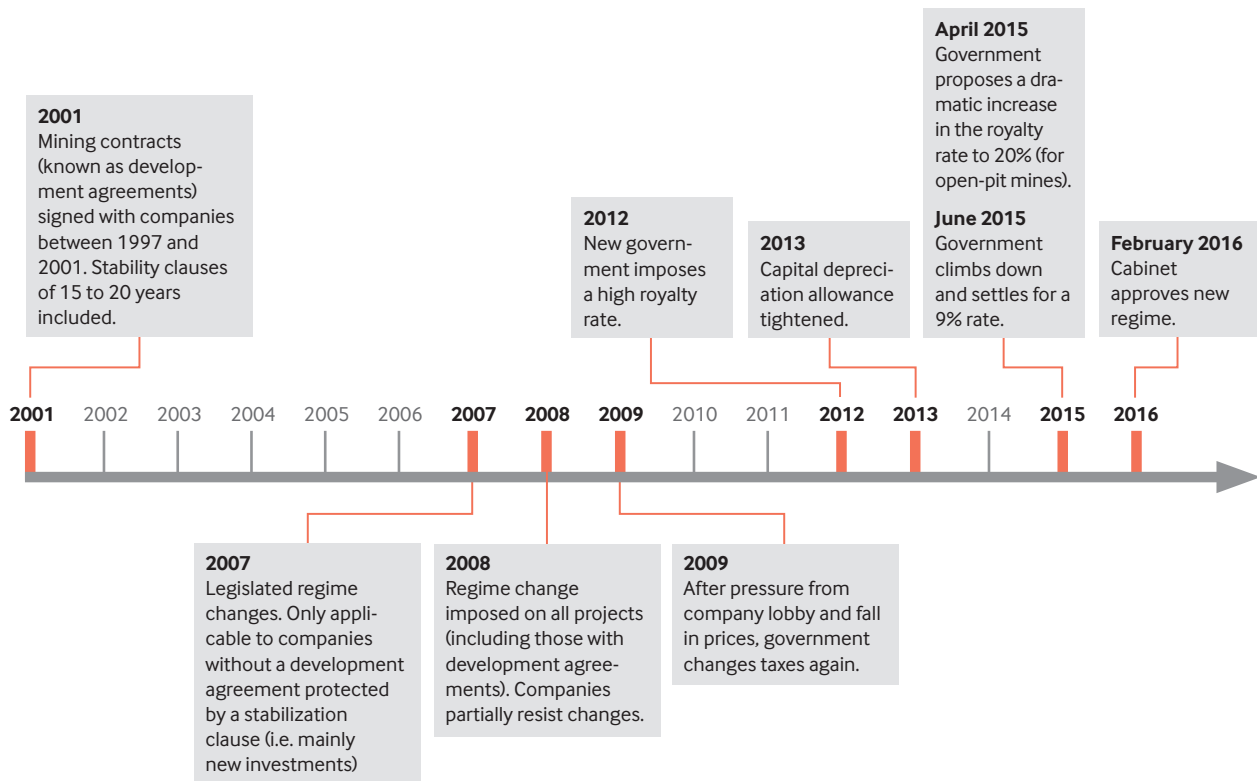
8 For the modeled low-cost mine using a discount rate of 10 percent. The equivalent AETR for the "high-cost mine" is 81 percent. The appendix describes the approach to making these calculations.

Less than 12 months later in February 2016, as the price of copper slid toward USD 4,000, the Zambia cabinet approved the new tax regime and a bill was subsequently presented to parliament in April. This time, the regime set a significantly lower effective tax rate on mining companies. The average effective tax rate fell from 55 percent to 44 percent, and closer to the relatively low 34 percent of the development agreements that governed mining taxes from 2001 to 2007.

Figure 3. Fifteen years of mining tax reforms in Zambia

Sources: Manley 2013, Manley 2015 and Bloomberg 2016.

Note: See appendix for details on each tax regime.



ZAMBIA'S GOVERNMENT SHOULD FIND A TAX REGIME THAT IS ROBUST TO CHANGING CIRCUMSTANCES.

The Natural Resource Charter, a guide to resource governance, suggests that the tax regime should be robust to changing circumstances.⁹ But this is a particularly difficult objective to achieve. Changes to tax regimes are quite common, with many governments adjusting taxes as circumstances—particularly commodity prices—change. For example, Mansour and Nakhle show that changes are frequent in petroleum taxation and follow the oil price,¹⁰ while a preliminary set of results tracking tax changes on gold mining in Africa suggest a similar result.¹¹

It is not clear how much a government should be worried about frequent reforms. It is probably not the case that changes in taxes always negatively affect investment in a country. Sachs et al show in the countries they study that investment continued rising despite the rhetoric of companies in the face of tax increases during the recent

9 Precept 4 of the Natural Resource Charter reads, "Tax regimes and contractual terms should enable the government to realize the full value of its resources consistent with attracting investment, and should be robust to changing circumstances." See Natural Resource Governance Institute, *Natural Resource Charter*, 2014:17.

10 Mario Mansour and Carole Nakhle, *Fiscal Stabilization in Oil and Gas Contracts: Evidence and Implications* (Oxford Institute for Energy Studies, 2016).

11 Bertrand Laporte, Céline De Quatrebarbes and Yannick Bouterige, "Taxing the extractive sector in low income countries: A new database and research initiative," paper presented at the annual meeting of the International Centre for Tax and Development, Addis Ababa, Ethiopia, 10–12 February 2016..

boom.¹² Zambia's experience may be similar. Fraser Institute Mining Survey and the Behre Dolbear survey also show a general improvement in investor sentiment toward Zambia—at least until 2015, when the mining industry roundly criticized the rise in royalty rates.

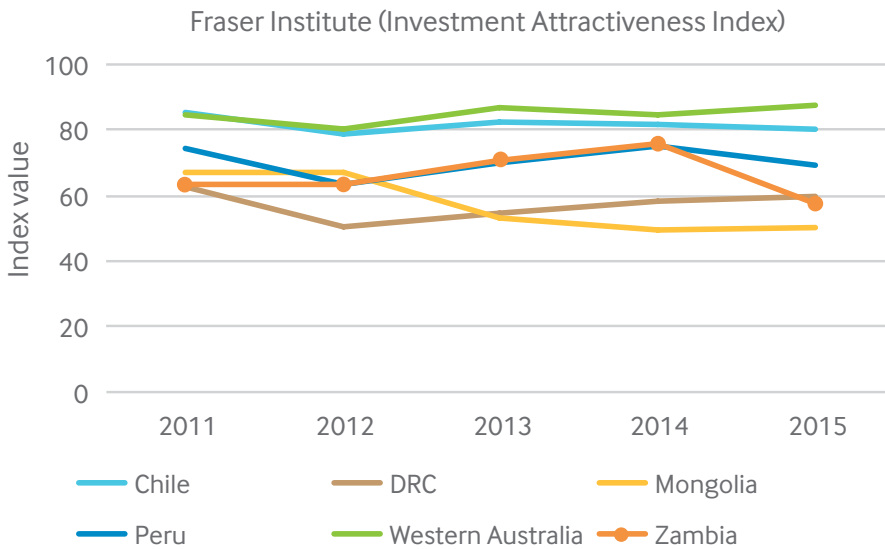
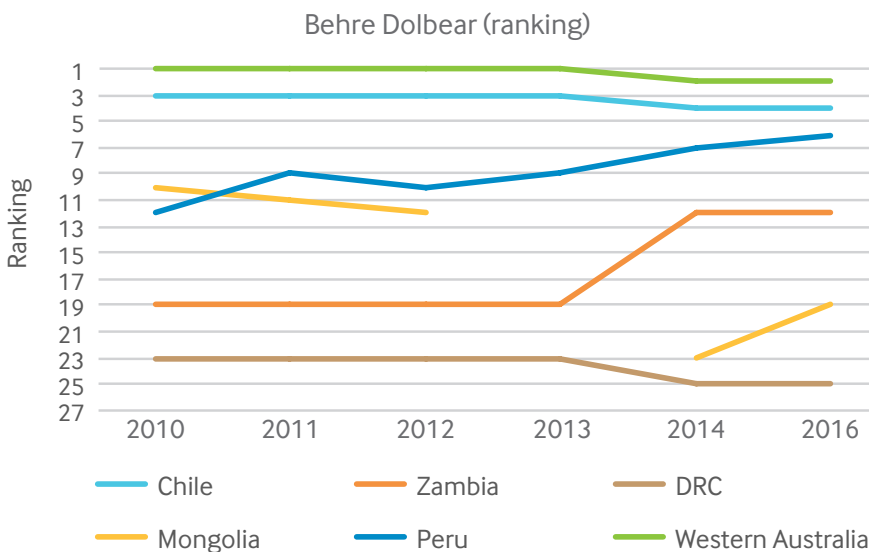


Figure 4. Surveys of mining investor sentiments on Zambia

Sources: Behre Dolbear 2015, Jackson and Green 2013, Wilson and Cervantes 2015



While these results suggest that policy stability is not the most important factor determining investment in these countries, it still matters in Zambia for three reasons.

First, companies and their investors care about the threat of tax increases after sinking capital into projects. They worry that a government is in a position to raise taxes or expropriate an asset entirely after investment, a phenomenon known as the time inconsistency problem.¹³ A government must demonstrate it will not raise taxes or expropriate assets once investment decisions have been made. It might

12 Lisa Sachs, Perrine Toledano and Jacky Mandelbaum, "Impacts of Fiscal Reforms on Country Attractiveness: Learning from the Facts," in *Yearbook on International Investment Law and Policy 2011–2012*, ed. Karl Sauvant (Oxford: Oxford Press, 2013), 345-386.

13 Philip Daniel and Emil Sunley, "Contractual Assurances of Fiscal Stability," in *The Taxation of Petroleum and Minerals: Principles, Problems and Practice*, ed. Philip Daniel, Michael Keen and Charles McPherson (Oxford: Routledge, 2010), 405-424.

do this by avoiding a history of significant tax increases, building a trustworthy approach to policy-making, offering lower taxes and, if all else fails, writing clauses into contracts and legislation that make it illegal to change taxes on a project. The latter is a frequent resort of many resource-rich developing countries.¹⁴

Setting taxes too high or too low also matters. Companies may realize that a tax regime offering a particularly good deal for investment is not likely to be stable if prices rise and the public pressures the government to increase taxes. Taxes that are too high are also unstable—pressures from companies and lack of investment might force policy changes.

Instability also matters in collecting rent. Figure 2 shows that Zambia changed taxes in response to price movements, but typically two or three years after those movements. The lagged policy response means that during upturns in profits, the opportunity to tax available rent is wasted, while in a downturn, companies are under greater financial pressure and may decide to close operations. A tax policy that is constantly seeking to catch up with events opens the door for these inefficiencies.

A third reason why policy instability matters is that any change in policy allows opportunities for the government to make mistakes and for companies and other stakeholders to lobby for incentives. The conflict that frequently arises from policy changes also damages relationships with companies and with other stakeholders.¹⁵

THE PROPOSED TAX REGIME REDUCES THE TAX BURDEN WHILE PRICES REMAIN LOW BUT WILL FAIL TO CAPTURE RENT WHEN PRICES RISE

It is important for the government to set a tax regime that is robust to future changes in circumstances, and to avoid setting a tax regime that would need to be altered when prices change significantly. Unfortunately, the latest tax proposal is not likely to meet either of these objectives.

The proposed tax regime contains three significant changes: the removal of the 9 percent royalty on copper; the introduction of a “price-based royalty” whose rate varies according to the copper price; and the removal of the variable profit tax. A fourth change—the removal of an export duty on copper concentrate—would be significant if many companies had been paying it, but most companies were already exempt from this duty. In the following analysis, I show that these changes reduce the overall tax take for the government and, under certain assumptions, reduce progressivity—the tax regime’s ability to collect a greater share of income when profits rise and to provide relief to companies when profits fall. Given the regime’s relative lack of progressivity, Zambian authorities may come under pressure to change taxes again to capture the growing share of profits if and when the copper price rises in the future.

The price-based royalty is a new tax instrument (although the windfall tax levied in 2008 followed a similar approach with a much higher set of rates). Figure 5 gives the rate schedule for the new royalty. A 4 percent rate applies on the whole tax base when the price is below USD 4,500 per tonne, 5 percent when prices are between USD 4,500 and USD 6,000, and 6 percent when the copper price is above USD 6,000 per tonne. This is lower than a previously proposed 3 to 9 percent range.¹⁶

14 See Mansour and Nakhle, *Fiscal Stabilization*, on stabilization in oil and gas.

15 Mansour and Nakhle, *Fiscal Stabilization*; Paul Stevens, Jaakko Kooroshy, Glada Lahn and Bernice Lee. *Conflict and Coexistence in the Extractive Industries* (Chatham House, 2013).

16 Mfula, “Zambia to bring in variable tax.”

Copper price (USD per tonne)	Rate
Up to 4,500	4 percent
4,500 to 6,000	5 percent
Above 6,000	6 percent

Figure 5. Zambia’s price-based royalty rate schedule

Source: Mines and Mineral Development (Amendment) Bill

To evaluate the impact of the recent changes, I used a discounted cash flow financial model similar to the IMF’s Fiscal Analysis for Resource Industries (FARI) model. (This is commonly used by industry and other analysts to understand tax regimes.) This model is available on the NRGi website and assumptions made are summarized in the appendix to this paper.

The modeling exercise suggests that the removal of the variable profit tax and the inclusion of the price-based royalty will have three main effects. The first is to significantly reduce the expected tax take. Figure 6 shows the results of the modeling exercise: no matter what the copper price, the average effective tax rate for the latest proposed regime is lower than for the current regime (Zambia 2015), and, for the “low- cost mine” set of assumptions, in the lowest quartile of Zambia’s peer group.

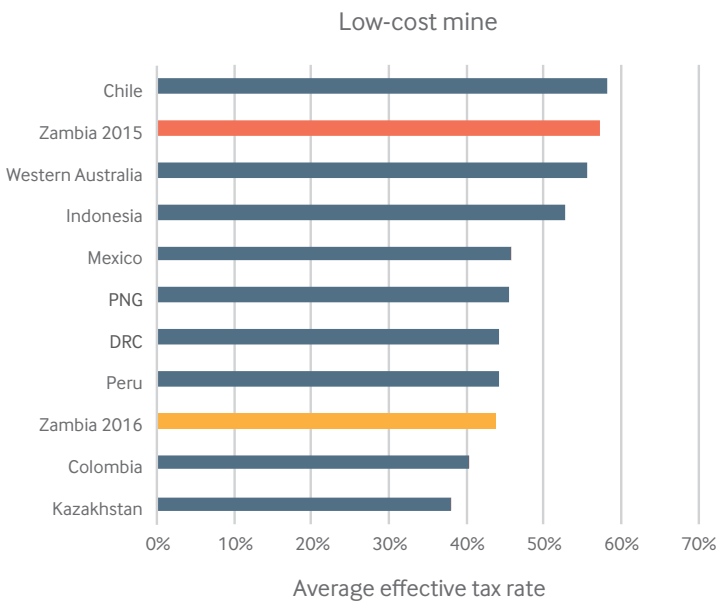
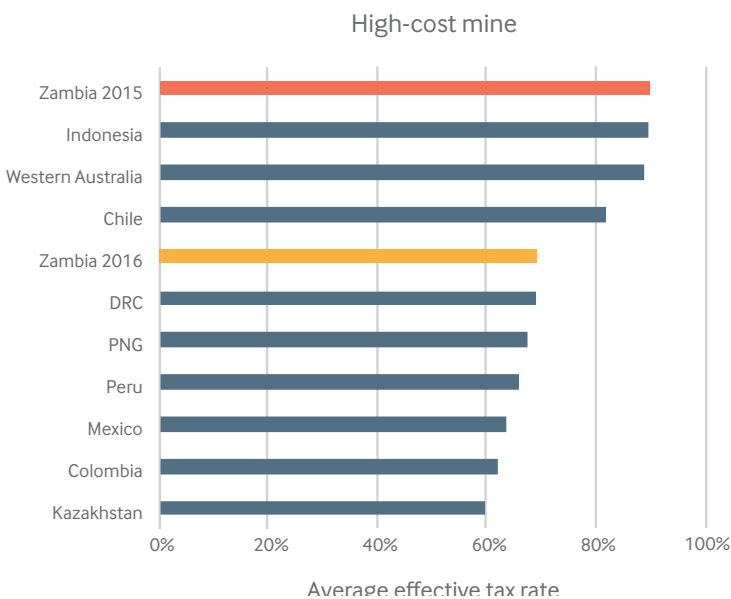


Figure 6. Estimated tax burden (average effective tax rate) for Zambia’s tax regimes and copper producing peer countries

Source: NRGi Mining Model. See Appendix for details.



Some reduction in taxes is probably sensible given the high burden imposed by the 2015 regime and the fact that Zambia's mining companies face high and rising costs. Figure 7 shows the majority of mines operate in the top third of the global cost curve for mining. High costs imply lower profit margins and thus a greater impact on profits given a change in prices. Given the relatively high cost of production of most Zambian mines and copper's price, this fall in the tax burden provides relief for many companies and might allow previously closed mines to reopen.

However, while most mines in Zambia have relatively high production costs, some do not. Kansanshi in particular produces a large portion of total Zambia output, but as an open-pit mine, it has relatively low costs. These reforms therefore give too much relief to low-cost mines.

U.S. cents per pound

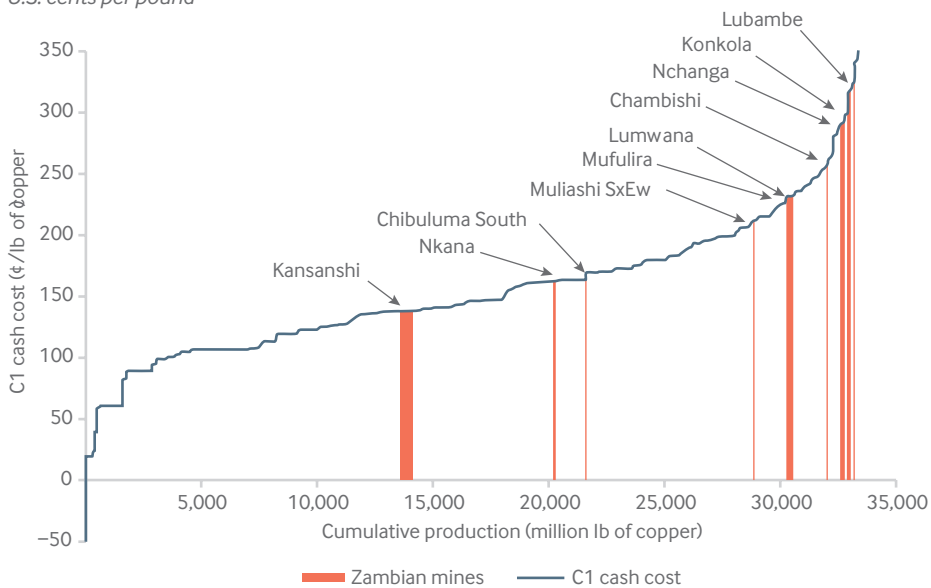


Figure 7. Zambian mines copper cash operating costs in 2013, USD per pound of copper sold within the global cost curve

Source: World Bank 2011.

The second effect of the proposed tax reform is to make the regime less progressive with respect to price. Figures 8 and 9 show how the government share of total benefits from a mining project changes as price changes in comparison to previous regimes in Zambia and Zambia's peer countries.¹⁷ Figures 8 and 9 illustrate progressivity by showing the change in government revenue per tonne of copper for a price increase and decrease of 20 percent. The new tax regime has the second smallest dispersion of revenue in Figure 8. While this means that the government is relatively well protected from the risk of a fall in revenue, the proposed regime is likely to fail to capture as much revenue as previous regimes when prices rise. This equates to many millions of dollars' difference in government revenue when scaled up for the whole industry.

17 The appendix includes the equivalent results for the low-cost mine model.

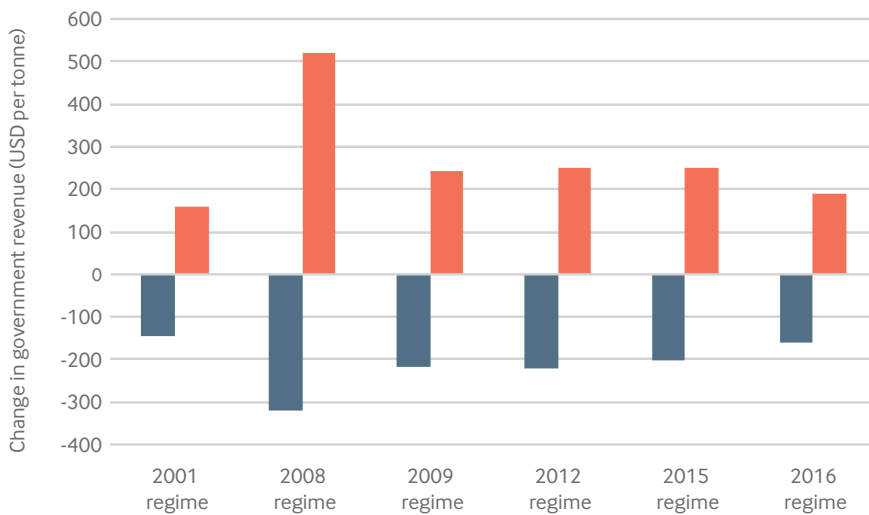


Figure 8. Modeled change in government revenue given a change in the copper price for each of Zambia's tax regimes

Source: NRGi Mining Model: High-cost mine project, initial price assumed USD 7,000 per tonne. See Appendix for details.

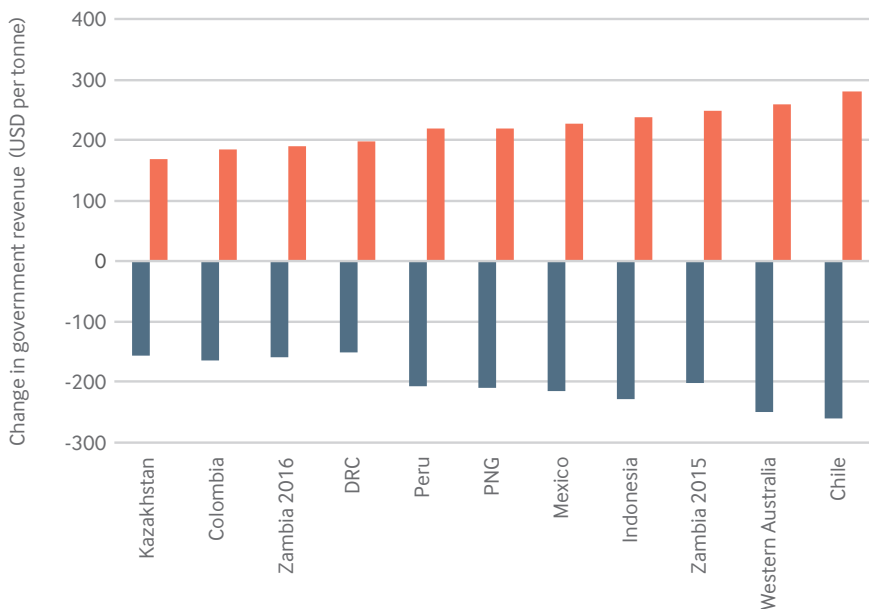


Figure 9. Modeled change in government revenue given a change in the copper price for Zambia's tax regime relative to copper producing peer countries

Source: NRGi Mining Model: High-cost mine project, initial price assumed USD 7,000 per tonne. See Appendix for details.

Progressivity is an important characteristic of a tax regime for two related reasons.

First, progressivity is a second-best—but practical—approach to taxing rents. In an ideal world, the government would levy a tax targeting almost all the available rent generated by a mining project. This is all but impossible to do, as rent is difficult to measure. However, changes in profitability from year to year will indicate some change in the available rent of a project. So, in the absence of this ideal, a progressive tax regime is likely to tax some of the rent. In other words, when mining companies make few profits, a progressive regime taxes them lightly. When mining companies are doing well, a progressive regime taxes them more heavily.

Second, progressivity mitigates some of the need to change tax rates as conditions change.¹⁸ This automatic flexibility to changes in profits also allows a tax regime to capture more revenue when profits are high and allows immediate relief to companies when profits falls. As discussed above, the Zambian reforms chased the copper price, but were typically two or three years delayed as the process of government officials recognizing the market movement then responding to it with a new policy takes so long. (See Figure 2 above.)

18 Mansour and Nakhle, *Fiscal Stabilization*; Sachs et al., "Impacts of Fiscal Reforms."

However, while some progressivity may be desirable for a government, greater progressivity implies a greater exposure to downside revenue risk (see Figure 9). While a progressive regime such as Chile's captures a large share of profits when prices rise, when prices fall, government revenues fall more than in other countries' tax regimes. Governments that rely heavily on their mining sector for government revenues may wish to avoid this downside risk and seek a slightly less progressive tax regime.

THERE WILL BE RENEWED PRESSURE TO INCREASE TAXES IN THE FUTURE

The Zambian government therefore faces a trade-off between the benefit of a progressive tax regime and protection from a large fall in mining revenue. What factors might the government consider in navigating this trade-off?

The first is the likely boost in pressure to increase taxes if prices rise in the future. While prices are relatively low now, some forecasts suggest that they will rise again over the next decade. For example, the World Bank forecasts copper prices to be USD 7,000 in 2025.¹⁹ As Figure 10 shows, because of relatively low progressivity, the proposed regime is likely to provide a relatively low tax take when prices are high, despite mining companies likely earning higher profits. (This is not a certainty, as costs are also likely to rise to some extent. See the next section for more details.) Indeed, the 2009 iteration is the most progressive of the three tax regimes shown in Figure 9.

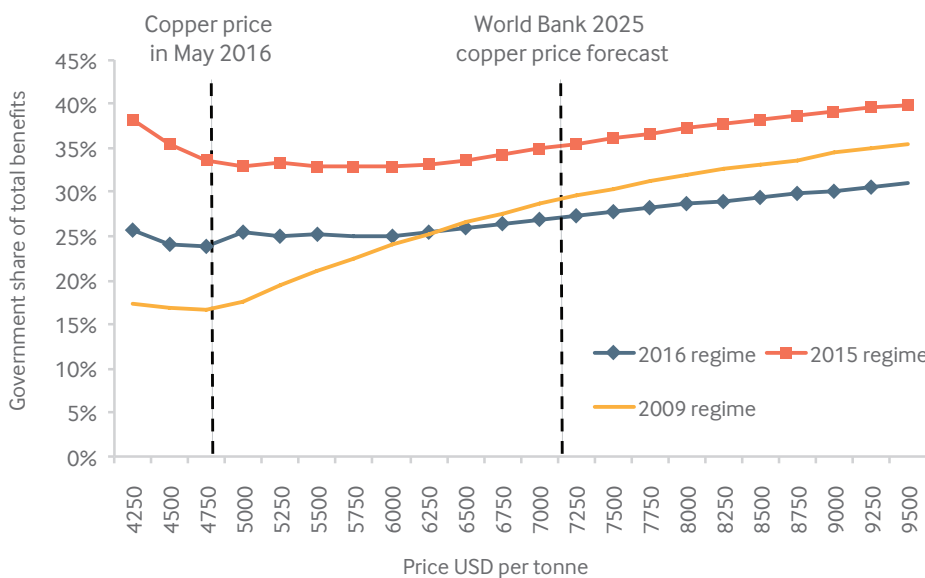


Figure 10. Modeled government share of total project benefits for different copper price assumptions
Source: NRGi Mining Model: High-cost mine project.

19 World Bank, *Commodity Markets Outlook: Resource Development in an Era of Cheap Commodities*, April 2016.

Second, a more progressive regime implies less risk for companies and less risk of mine closures. Closures impose a cost on Zambia both in terms of the lost production—and therefore government revenue—but also a fall in employment. Mining employment is not as dominant a portion of total employment as mining revenue is in terms of Zambia's total revenue. It is, nonetheless, probably an important concern to Zambia's policy-makers. In total, across the industry in Zambia, 15,000 miners have so far been made redundant,²⁰ significant in a country where only 400,000 employees earn enough to register for personal income tax, and where each mining job is estimated to support 15 other Zambians.²¹ Further, many businesses in Kitwe, Chingola and other mining towns in the north of Zambia that supply the large mining companies are also suffering. Electoral implications of this must be weighing on politician's minds: the mining district of the Copperbelt has been a significant political district in past elections,²² while the next general election is scheduled for August 2016.

On the other hand, greater progressivity implies a greater exposure to downside revenue risk for the government. This is a concern—the mining sector in Zambia contributes 35 percent of total government revenue, a significant proportion relative to most countries. Further, of this 35 percent, over two thirds of mining revenue is collected from just five mining companies.²³

If Zambia has the ability to weather a shortfall in revenues, some risk exposure would be acceptable. However, this is not the case. Public spending in Zambia has been high since 2011 and has not been easy to rein in. Consequently, the government's finances are growing weaker. Mining revenues contributed 26 percent of government revenues in 2014.

Until recently, the promise of a continued boom prompted the government and local authorities to borrow from banks and international markets. Public debt, having averaged 22 percent of GDP before 2011, is forecast to reach 45 percent this year. (See Figure 11.) This level is sustainable if the government can afford repayment costs. While previous governments were able to issue a sovereign bond at interest rates lower than those of some European countries in 2012, yields on government bonds are increasing. Attracting more capital to sustain spending and roll over old debt may require higher interest rates.²⁴ The kwacha has also lost half its value since 2011, making interest payments denominated in dollars relatively more expensive. As a final indicator of the fiscal crisis, the government is currently negotiating with the IMF for support on the balance of payments.

20 McGroarty and Parkinson, "Mining Collapse."

21 David Manley, "Caught in a Trap: Zambia's Mining Tax Reforms," Working Paper 12 (International Centre for Tax and Development, 2012).

22 Manley, "Caught in a Trap."

23 ZEITI (Zambia Extractive Industries Transparency Initiative), *Seventh report of the Zambia Extractive Industries Transparency Initiative (ZEITI): Final Report* (ZEITI, 2014), 15.

24 Fitch Ratings, "Fitch Revises Zambia's Outlook to Negative; Affirms at 'B,'" *Fitch Ratings*, 24 February 2016, <https://www.fitchratings.com/site/fitch-home/pressrelease?id=999909>.

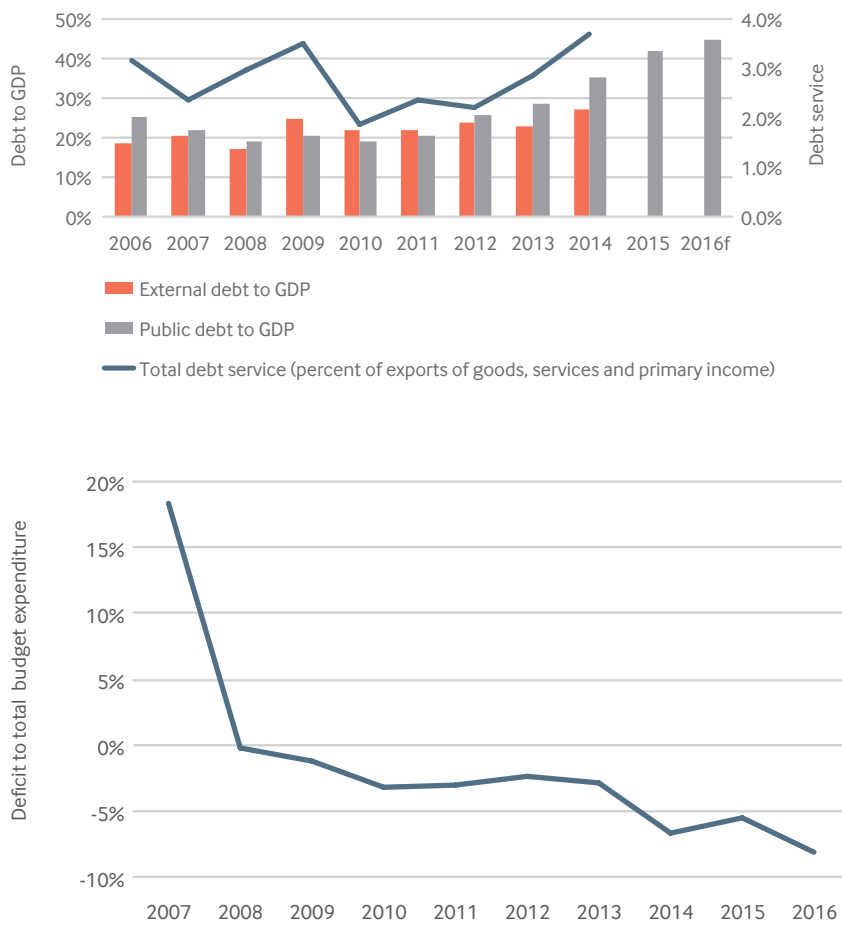


Figure 11. Zambia's debt to GDP and budget deficit ratios

Source: IMF eLibrary, World Bank Development Indicators, Trading Economics

Zambia might be trapped. The economy is less diversified than many countries and the government's finances are too tight to withstand a significant drop in revenues. This suggests the government should opt for a tax regime that limits its exposure to mining revenue risk. However, as previous governments have seen, when the copper price rises, the public are likely to pressure the government to tax the resulting profits by raising tax rates in the future. This suggests the government should opt for a tax regime that allows a more variable revenue stream, essentially increasing its exposure to mining revenue risk.

A PRICE-BASED ROYALTY ALLEVIATES ONE PROBLEM BUT INTRODUCES ANOTHER

The previous section suggests that at least some progressivity (more than what's being offered on this tax regime) is appropriate for Zambia. Notionally, the variable profit tax provided a relatively high level of progressivity. So why would the government remove it in favor of the price-based royalty?

My argument so far has not addressed a key factor: tax avoidance and the efficiency of tax collection. While difficult to measure, episodes such as the leaked audit on mining operations at Mopani²⁵ and various reports from civil society activists

25 Econ Poyry and Grant Thornton, *Pilot Audit Report – Mopani Copper Mines Plc.: International Export Team Report to the Commissioner Domestic Taxes, Zambia Revenue Authorities* (2010), accessed 23 June 2016, http://www.amisdelaterre.org/IMG/pdf/report_audit_mopani-2.pdf.

suggest tax avoidance practices have at least previously existed in the Zambian mining sector. It is certainly an issue that the Zambian authorities have been concerned with. In 2015, for instance, Zambia's finance minister, Alexander Chikwanda, told parliament:²⁶

...before the introduction of the 2015 tax regime, the tax system was vulnerable to all forms of tax planning schemes such as transfer pricing, hedging and trading through "shell" companies, which are not directly linked to the core business. Sir, it has been a challenge for the revenue administration to detect and abate such practices.

Further, provisions on capital allowances and carry forward of losses eliminated potential taxable profits. Mr. Speaker, the tax structure was simply illusory as only two mining companies were paying company income tax under the previous tax regime as most of them claimed that they were not in tax-paying positions.

Mr. Speaker, it has therefore become imperative for the government to restructure the mining tax regime by replacing the profit-based tax system with a simple mineral royalty based regime that is final so that we insulate ourselves against tax planning schemes which are structured to wipe out taxable profits.

This fear of large-scale tax abuses was probably particularly valid in the past, but is perhaps slightly overblown now. While it is quite possible that mining companies were legally avoiding corporate and variable profit taxes for much of the period since privatization at the turn of the century, corporate income tax payments have risen recently. This is probably partially due to mining companies having paid off their development costs and becoming profitable, but also to recent increased efforts by the Zambian Revenue Authority (ZRA) to collect.

In any case, while the removal of the Variable Profit Tax removes an element of progressivity, it also removes a tax that is easier to avoid than the price-based royalty. Revenue-based taxes are typically easier to administer than profit-based taxes. They are certainly not easy, though, as the immense efforts of ZRA attest and as the IMF suggests.²⁷ Revenue-based taxes require the tax authority to measure three principal categories of information about a taxpayer: the units of sales, the composition of the mineral product sold (the grade and inclusion of associated minerals) and the realized price of these sales. Profit-based taxes require a fourth bit of information—costs—which are by far the hardest item to measure accurately. As the frequent changes to the royalty rate in Zambia show, policy-makers in Zambia do need some understanding of mining costs to ensure the royalty rate is neither too high nor too low.

26 Alexander Chikwanda, "Government Position on Mining Taxation," *Zambian Economist*, 26 February 2015, <http://www.zambian-economist.com/2015/02/government-position-on-mining-taxation.html>.

27 International Monetary Fund, *Fiscal Regimes for Extractive Industries: Design and Implementation* (IMF, 2012).

Over time, the tax regime has tended to rely more on revenue-based taxes and less on profit-based taxes. Figure 12 shows the share of total government revenue by tax type for each of the recent tax regimes in Zambia. Taxes based on some measure of profit are red; taxes based on some measure of revenue are blue. The regime in 2008 was heavily reliant on revenue-based taxes under certain price assumptions, but short-lived.

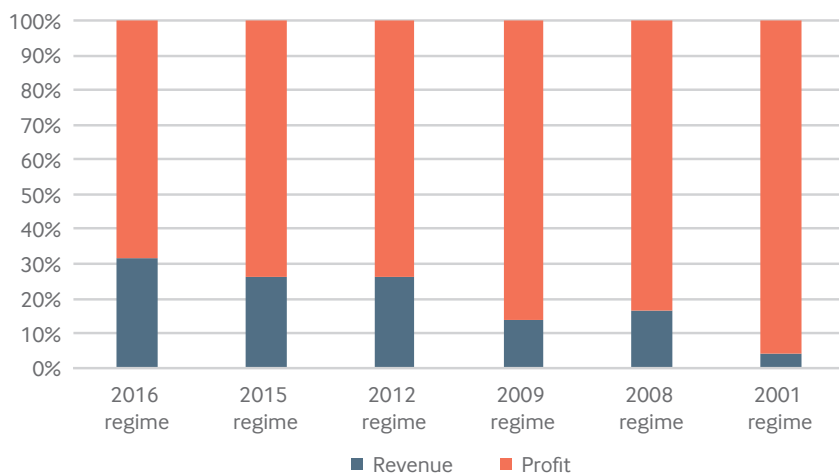


Figure 12. Modeled split of government revenue between revenue and profit-based tax types

Source: NRGi Mining Model: High-cost mine project, see appendix for details.

Notes: Modeled at price of USD 7,000, so the price-based royalty rate in the 2016 regime is set at 6 percent.

Relying on revenue-based taxes is a costly response to the threat of tax avoidance. While revenue-based taxes make the life of a tax administrator easier, there are significant downsides too, even for variable rate price-based royalties. Because royalties do not account for costs, mines with high costs may make significant after-tax losses. This either forces a mine to cease operations (such as the Mopani mine owned by Glencore); incentivizes a mine to “high-grade” the ore body (i.e., only mine deposits that are relatively cheap to extract) and so reduce the total resources extracted from the reserve;²⁸ or deters projects from starting on high-cost areas.

While there are other ways to make tax administration easier, Zambia has already implemented quite a few. The country had tried the separate treatment of hedging income and operational income and the use of a reference price to value production for tax purposes (i.e., the London Metal Exchange price for copper), among others. Further, the ZRA also has a transfer pricing capacity building program provided by the African Tax Administration Forum and the Organisation for Economic Co-operation and Development (OECD). Building tax administration capacity may help alleviate some of the concerns of the government. It is unclear, though, how successful this program will be or how quickly an impact can be made.

With these low-hanging fruit already picked, relying on revenue-based taxes is an understandable next step, although as mentioned already, these taxes are not sensitive to changes in costs. If a metals price rise is not accompanied by a rise in costs, the increase in the tax rate allows the government to capture some of the increase in profits. However, as Figure 13 illustrates, during the previous boom mining costs did increase somewhat alongside the increase in copper prices. If this pattern continues and profits do not rise as price rises, then a variable rate royalty whose rate rises with prices is somewhat regressive. (The corollary of this is that governments need not be so quick in giving tax incentives to companies in downturns, as costs may also fall in time.)

28 Havard Halland, Martin Lokanc, Arvind Nair and Sridar Padmanabhan, *The Extractive Industries Sector: Essentials for Economists, Public Finance Professionals, and Policy Makers* (World Bank, 2015), 15, <http://hdl.handle.net/10986/22541>.

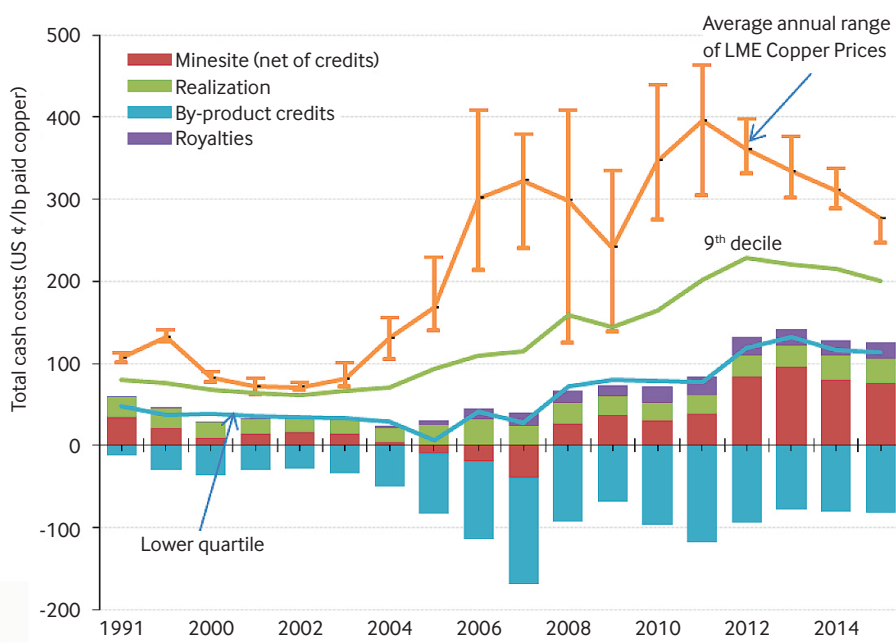


Figure 13. Mining operating costs and copper price over time
 Source: SNL Metals & Mining via PR Web 2015.

Surprisingly, there are few academic studies on how mining costs vary with mineral prices. The most promising is from Clausing and Durst,²⁹ which provides evidence against the point illustrated in Figure 13. They find that for mining, a 1 percent rise in mineral prices corresponds with a 1.12 to 1.38 percent rise in profits (depending on the statistical method the authors use). In other words, a price-based royalty might not be regressive. However, this finding stands against frequently voiced industry concerns of cost escalation during the recent price boom and efforts to cut costs during the price slump. Clausing and Durst do not offer a theoretical explanation to why mining and petroleum profits respond differently to price changes. Further, their study does not look at differential costs between firms, nor changes across the investment cycle.³⁰

29 Kimberly Clausing and Michael Durst, "A Price-Based Royalty Tax?" Working Paper 41 (International Centre for Tax and Development, 2015).

30 This result for mining compares is compared with the oil sector, where the authors find that a 1 percent rise in oil prices is associated with 0.76 percent rise in profits. Therefore, price-based royalties may be less suitable in the petroleum industry than in mining. A study of the oil sector found a similar result: costs rise and fall with prices. See Naumov, Alexander and Gerhard Toews, "Revisiting the Relationship between Oil Prices and Costs in the Upstream Industry," VOXEU, 22 February 2016, <http://www.voxeu.org/article/oil-prices-and-costs-upstream-industry>.

While the evidence is not clear, it is likely that an increase in the copper price brings with it at least some increase in costs. Given that the rate of price-based royalties automatically increases when price increases, there is the possibility that these royalties can be regressive. In this manner, revenue-based taxes—including price-based royalties—are a second-best solution. The Zambian authorities essentially face a trade-off along a continuum with two extremes, as illustrated in Figure 14: a tax regime that is progressive, but creates a risk of tax abuse; and a regime that is regressive, risking revenue loss from closures, high grading and loss of investment for Zambia, yet lowers the risk of tax planning. A variable rate royalty allows the authorities to have a regime that sits somewhere between these two extremes, but it is not yet clear how well it balances the risks.

	Predominantly profit-based tax regime	Predominantly revenue-based tax regime
Risk of revenue loss from tax planning	Higher	Lower
Risk of closure, high grading and loss of investment	Lower	Higher

Figure 14. Tax policy trade-off

CONCLUSION

Frequent changes in tax policy in Zambia should be avoided to attract further investment in the mining sector, to ensure rent it is captured when it is generated and to reduce opportunities for policy mistakes. The new regime, based on a new price-based royalty, provides some flexibility, allowing automatic changes in the tax burden in response to changing prices. It also helps alleviate the risk of tax abuses by companies by relying more on a revenue-based tax.

However, removing the variable profits tax and introducing a price-based royalty without higher price thresholds create a tax regime that will not deliver the revenues Zambians require in the future. This will create pressure for further destabilizing changes and continue to trap Zambia in its cycle of reforms. It would be better to anticipate these pressures now and design a tax regime that is robust to the future.

The government faces a two trade-offs when designing the mining tax regime. One is the desire for a progressive regime that captures rent and increases the overall stability of tax policy against the disinclination to expose the treasury to the risk of low mining revenue if prices fall. The other is the desire for a progressive tax regime on the one hand, and a regime that is simple enough to collect revenues and combat tax avoidance on the other.

There are no clear answers. However, Zambia civil society has called upon the government engage in a consultative and participatory process in developing tax regimes. A more open approach to policy-making based on an analytical approach would help bring greater expertise to bear on the choices the government must make. It would also help build trust in a policy that should remain stable in the future.

APPENDIX. MODELING EXPLANATION

Modeling assumptions and results

The discounted cash flow model, assumptions and data used for this paper are available on the NRG website. Below is a summary of the assumptions and further results.

Project profiles

I used two project profiles: “Low-cost mine” and “High-cost mine.” These are based on the profiles used by the IMF in its recent analysis of the Zambian mining tax regime.¹ These, in turn, are based on actual mining projects in Zambia and loosely relate to a low-cost open-pit mine and a high-cost underground mine.

I assume a copper price of USD 7,000 per tonne, as assumed in IMF, 2015. This is justified by the World Bank’s 2025 forecast for copper prices.²

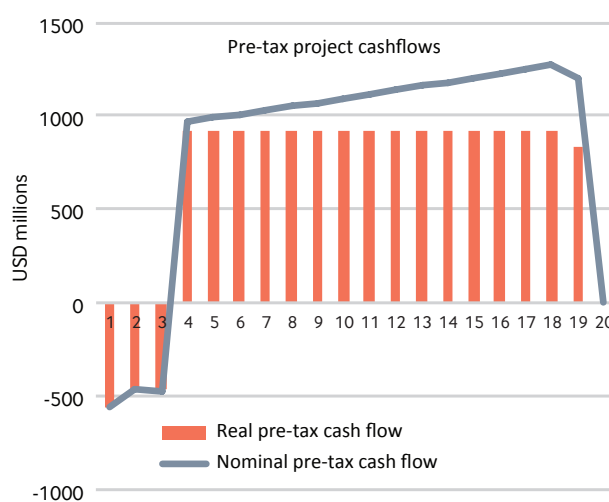
Table A1. Summary of mining tax regimes imposed in Zambia since 2001

Source: David Manley. *Zambia votes president: What will the winner do about copper tax?* Natural Resource Governance Institute, 2015; International Monetary Fund. Zambia: Selected Issues. IMF Country Report No. 15/153, 2015, page 5.

Notes: Not modeled, assuming companies found exemptions or processed copper domestically.

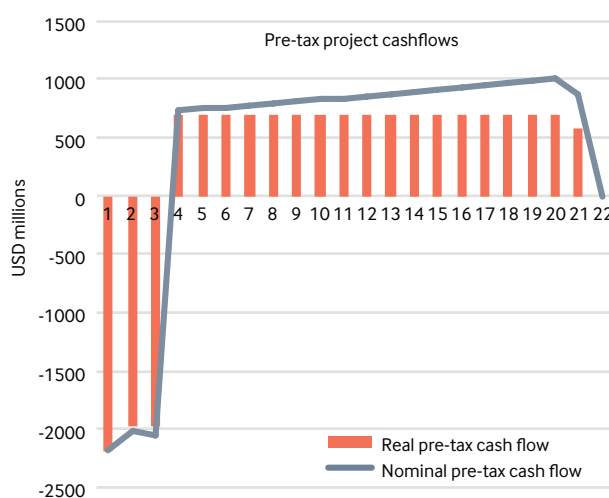
Project 1. Low-cost mine

Summary assumptions	units	
Produced reserves	tonnes	4339000
Production starts	year	4
Exploration costs	\$m	100
Development costs	\$m	1373
Production to CAPEX	tonnes/\$m	3,160
Mineral Price	\$/tonne	5,000
Mineral Price	\$/lb	2.27
Operating cost per unit	\$/tonne	1628
Operating cost per unit	\$/lb	0.74
Refining and treatment charge	\$/lb	0.18
Total C1 cash costs	\$/lb	1.06
Discount rate (government)	%	10%
Discount rate (investors)	%	12.5%
Inflation	%	2%
Real interest rate	%	13%
Leverage (equity/total assets)	%	50%



Project 2. High-cost mine

Summary assumptions	units	
Produced reserves	tonnes	6076000
Production starts	year	4
Exploration costs	\$m	200
Development costs	\$m	5944
Production to CAPEX	tonnes/\$m	1,022
Mineral Price	\$/tonne	5,000
Mineral Price	\$/lb	2.27
Operating cost per unit	\$/tonne	2965
Operating cost per unit	\$/lb	1.34
Refining and treatment charge	\$/lb	0.18
Total C1 cash costs	\$/lb	1.66
Discount rate (government)	%	10%
Discount rate (investors)	%	12.5%
Inflation	%	2%
Real interest rate	%	13%
Leverage (equity/total assets)	%	50%



1 International Monetary Fund, *Zambia Selected Issues*. IMF Country Report No. 15 (2015), 153.

2 World Bank, *Commodity Markets Outlook: Resource Development in an Era of Cheap Commodities*, April 2016.

Fiscal regime assumptions

Year	2001	2007	2008	2009	2012	2013	2015 (proposed)	2015 (enacted)	2016 (proposed)
Model ID	Regime 2001	(not modeled)	Regime 2008	Regime 2009	Regime 2012	(not modeled)	(not modeled)	Regime 2015	Regime 2016
Mineral royalty	0.6%	3%	3%	3%	6%	6%	8% (underground mine) 20% open-pit mine)	9%	Sliding scale from 4 to 6%
Corporate income tax	25%	30%	30%	30%	30%	30%	0% on concentrate, (30% on processing)	30% (35% on processing)	30%
Windfall tax	No	No	Yes	No	No	No	No	No	No (but see price-based royalty)
Variable profit tax	No	No	Yes	Yes	Yes	Yes	No	Yes	No
Capital allowance	100%	100%	25%	100%	100%	25%	25%	25%	25%
Loss carry forward	10	10	10	10	10	10	10	Limit of deductions carried forward to 50% of profits	Limit of deductions carried forward to 50% of profits
Export duty on concentrate*	0%	0%	15%	15%	10%	10%	10%	10%	0%

Table A1. Summary of the mining tax regimes imposed in Zambia since 2001

Source: David Manley. *Zambia votes president: What will the winner do about copper tax?* Natural Resource Governance Institute, 2015; International Monetary Fund. *Zambia: Selected Issues*. IMF Country Report No. 15/153, 2015, page 5.

Notes: Not modeled, assuming companies found exemptions or processed copper domestically.

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