The Probable Impact on **Zimbabwe Mining Fiscal Revenue and Industry Competitiveness** of Various Price, Production & Fiscal Scenarios:

Incorporating a Quantitative **Case Study of the Gold Sector**

Zimbabwe Economic Policy Analysis and Research Unit

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Incorporating a Quantitative Case Study of the Gold Sector

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List of Acronyms

APT	Additional Profit Tax
CBZ	Commercial Bank of Zimbabwe
CGT	Capital Gains Tax
CIT	Corporate Income Tax
CR	Concentration Ratio
CSR	Corporate Social Responsibility
EMA	Environmental Management Agency
FI	Fraser Institute
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HRD	Human Resources Development
IMR	Institute of Mining Research
MMCZ	Minerals Marketing Corporation of Zimbabwe
MMMD	Ministry of Mines and Mining Development
NPV	Net Present Value
OECD	Organization for Economic Cooperation and Development
PAYE	Pay As You Earn
R&D	Research and Development
ROI	Rate of Investment
ROM	Run of Mine
RRT	Resource Rent Tax
SML	Special Mining Lease
VAT	Value Added Tax
ZELA	Zimbabwe Environmental Law Association
ZIMDEF	Zimbabwe Manpower Development Fund
ZIMRA	Zimbabwe Revenue Authority
ZMDC	Zimbabwe Mining Development Corporation

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Foreword

Zimbabwe has a diverse and rich mineral resource base whose exploitation should be a key source of revenue for Government. In light of the binding fiscal constraints, government expectations from the mining sector with regards to fiscal contribution are much higher than the current performance. Government is cognisant of the need to balance between the revenue consideration and addressing the viability concerns of the mining industry especially when commodity prices are depressed.

Cognizant of this, the Ministry of Mines and Mining Development with financial support from the Africa Development Bank collaborated with ZEPARU to undertake a study on 'The Probable Impact on Zimbabwe Mining Fiscal Revenue and Industry Competitiveness of Various Price, Production and Fiscal Scenarios: Incorporating a Quantitative Case Study of the Gold'. The study attempted to estimate the implications of changes in prices on fiscal revenue on one hand, and those of changes in tax on mining industry viability on the other hand. The study generated useful insights and recommendations which we will consider in our deliberations on the mining fiscal regime, in particular, and mining sector policy management, in general.

The recommendations from this study are far reaching in that they highlight areas that deserve Government attention in order to make the fiscal tax regime more efficient for the mining sector. Considering taxation best practice, the study finds that the royalty regime though high for other minerals (for example diamonds), seems to balance out with the numerous generous incentives because the latter have a negative impact on short-term government revenue flows. The study's findings and recommendations will assist us in reviewing our fiscal regime and mining policy to ensure that the fiscal regime does not stifle growth of the mining sector without unduly undermining revenue contribution to government.

In conclusion I want to record the Ministry's gratitude to the African Development Bank that provided funding that made this study possible and to technical assistance provided by the ZEPARU research team that carried out this study. I also extend our heartfelt gratitude to stakeholders in the minerals sector who participated and provided valuable information during the course of this study. In this regard, I commend this very important study to all the stakeholders and I remain confident that you will assist in the implementation of the recommendations in this study.

Thank you and God bless you.

Hon. W. Chidakwa
Minister of Mines and Mining Development

Executive Summary

Arguably, Zimbabwe has a diverse and rich mineral resource base, which has not even been significantly explored. The mining sector has emerged to become the key economic sector in the country in terms of contribution to GDP, exports, fiscal revenue, FDI and employment. However government expectations from the sector, especially as regards fiscal contribution, are much higher than the current performance. On the other hand, the mining industry has indicated that the current fiscal regime is not conducive, especially given depressed commodity prices. Thus, the delicate task facing government is to strike a balance between the two imperatives. It is clear that fiscal revenue from the mining sector is dependent on the viability of the sector, so that the two imperatives should not necessarily be viewed as competing.

Besides undertaking a qualitative evaluation of the current mining fiscal regime, this study develops a model that could estimate the effect of changes in prices, production and fiscal regime on mining fiscal revenue, and also the impact of the fiscal regime on industry viability hence investment, production and resource sterilization. A case study of the gold sector is used in the development of the model as no data could be obtained for the other minerals.

The qualitative analysis shows that the Zimbabwean mining fiscal regime is competitive compared to other mining jurisdictions in Africa, Southern America and OECD countries in terms of corporate tax, withholding tax, VAT and the various generous incentives given to the sector. However, the regime is less competitive when it comes to royalties (which are too high for a certain few minerals, *in rem*, non-deductible for income tax and unstable) and the multiplicity of tax heads, regulatory instruments and collecting agencies. The regime has also not performed well in terms of meeting government objectives of revenue generation, redistribution and repricing, particularly looking at the difficulty of doing business which has remained a sticking point in investment promotion.

Considering taxation best practice the study finds that the royalty regime is simple to implement, limits tax evasion, is highly revenue-productive in the short-term and less revenue-productive in the long-term as it sterilizes resources. However, in terms of the revenue productivity, the royalty regime seems to balance out with the numerous generous incentives because the latter have a negative impact on short-term government revenue flows. Thus, the study concludes that there is no need for significant changes in the royalty regime and the incentive structure, save that the royalty needs to be more stable and deductible for income tax purposes. In the case of corporate

tax, there is a trade-off of revenue productivity (due to depressed prices) for efficiency and equity (because it is profit-based). Withholding tax is an efficient head, but when applied to payments for external technical services, would make sense only if accompanied by development of local capacity.

From a qualitative point of view the study makes several recommendations on an optimal fiscal regime. There is need to make royalties deductible for income tax purposes to make the regime more efficient, and also to enhance the formalization of the artisanal and small-scale mining sector so that more royalties can be collected. For SMLs there is need to do away with the APT and consolidate the general mining CIT with the special CIT, which will improve simplicity and economy of collection. While there is some attraction to apply the RRT, it should be implemented at a moderate rate. To reduce the burden of compliance and administration, there is need to simplify the fiscal regime to a few heads, regulations and collecting agents. This is especially necessary for the artisanal and small-scale miners, who, in addition, need education on simple book-keeping and basic technical issues of mining and processing.

From the quantitative analysis the study finds that a fiscal scenario which is characterized by reduced rates on major tax heads (royalties, CIT, withholding taxes and resource rent tax) results in increased mine viability at all grades and mining rates, hence in low-grading, resulting in de-sterilization of resources. In more extreme cases this is accompanied by increased mining rates. Thus, ore grades exploited are more sensitive to changes in fiscal rates than mining rates; hence mine lives tend to increase under reduced fiscal rates. This brings with it high NPVs, but reduced annual government inflows. The highest annual fiscal revenue inflows are experienced when the highest fiscal rates are charged, in which case mine viability will be at its lowest and mines high-grade and slightly moderate their mining rates. This leads to lower mine life expectancies hence the high government inflows are experienced in the short-term as mines soon close. Note that investment values normally follow NPVs. It is noted that the proposed fiscal scenario and the stipulations on HRD and R&D is estimated to increase annual government revenue by 83% (about $128m), but would reduce mine viability by 66% and sterilize resources. However, mining as a business venture would remain profitable.

This study proposes a slightly different (but similar) fiscal regime to the base scenario recommended in the 2012 mining sector policy study. The envisaged optimal mining fiscal regime would require the following changes to the current fiscal regime and related stipulations governing the gold sector: (i) a slight (10%) increase of royalty from 5% to 5.5%; (ii) maintain the corporate income tax rate at 25%; (iii) adopt the HRD and R&D proposed in the 2012 study as a percentage of payroll; (iv) peg withholding taxes at 17% and 19.5% for non-tax haven and tax haven destinations respectively; (v) apply a resource rent tax of 25% of resource rent (assuming a normal profit of 10% of total costs); and (vi) increase effort by government in conjunction with mining industry to reduce labour cost from the current 36% of total costs to 25%. This proposed regime is largely consistent with several qualitative results and conclusions already highlighted.

1. Introduction and Background

Zimbabwe has a long history of mining which spans over a thousand years (Roussos, 1988). The country is endowed with a diverse mineral resource base, with more than sixty different types of minerals discovered, forty of which have historically been exploited to various extents (Mugandani and Masiya, 2011). The mineral endowments span across most of the mineral classifications, with Table 1 showing main minerals exploited under each category (classification).

Table 1: Classification of Main Minerals in Zimbabwe

Precious Metals	Precious Stones	Base Metals	Industrial Minerals	Hydrocarbons	Dimensional Stones
Gold	Diamonds	Copper	Asbestos	Coal	Black Granite
Silver	Emeralds	Nickel	Graphite		
Platinum		Tantalite	Phosphate		
Palladium		Lithium	Limestone		
Rhodium		Iron Ore	Feldspar		
		Chromium	Magnesite		

There are a variety of other minerals that have been exploited but not listed in Table 1, like tin, antimony and a variety of semi-precious stones including tourmaline, aquamarine, chrysoberyl, topaz, alexandrite, et cetera (Mugandani and Masiya, 2011). Zimbabwe also has uranium deposits in the Zambezi Valley, estimated at 450,000 tons according to the drills made so far - there are several anomalies elsewhere. There are potential oil and natural gas reserves in the Zambezi Valley – Manapools, Cabora Bassa Basin and Lupane (Sunday Mail, 28 September 2014).

Table 2 shows some of the major minerals in Zimbabwe, some estimated reserves and estimated average national grades. On the basis of the information in Table 2 it may be concluded that Zimbabwe's mineral resource base is not only diverse, but also rich, especially in specific minerals such as platinum, chromium, diamonds, gold (in terms of geological prospectivity), black granite, asbestos, coal and tantalite. Little exploration outside rediscovering 6,000 ancient workings has been done (Mugumbate, 2010). Mining of many minerals such as gold and chromite has remained small-scale, with miners having neither capacity nor desire to undertake major exploration even around their deposits – which are actually believed to be expansive (Mugumbate, 2010). Therefore,

tremendous exploration scope exists, for discovery of new and old minerals (Mlambo, 2012a), a fact that should reinforce the argument of richness. However, this opinion is not entirely shared by stakeholders and authors in the country, for example Hawkins (2009).

Mining has grown to be the key economic sector in the country as most other sectors have been affected by the more-than-a decade long economic recession. Currently, it contributes 9% to the country's Gross Domestic Product (GDP), more than 55% of exports, 11% of fiscal revenue, 50% of investment, 35,000 jobs directly created in the primary mining sector, and 70,000 jobs indirectly created in the upstream and downstream industries (Chamber of Mines of Zimbabwe, 2014). With a dependency ratio of about 8.3 to 1, more than 871,000 people are estimated to be directly dependent on mining for their livelihood.

Table 2: Zimbabwe's Estimated Potential Reserves (Ore)

Mineral	**Estimated potential reserves (Ore)**	**Estimated average grade**
Gold	84 million tons	3.17 g/t
PGE[1]	4.4 billion tons. Second largest resource in the world after South Africa.	3.6g/t, (4E)[2]
Diamonds	38 million tons excluding Marange Fields	37.6 carats/100t
Emeralds	Enormous potential in Mberengwa District	High quality and beautiful, though small sizes
Chromium	10 bn tons on Great Dyke; 608m tons (elsewhere). Largest reserve of metallurgical quality chromite in the world.	47-60% Chromic Oxide
Nickel	114 million tons	0.87%
Tantalite	Suggestions are that Zimbabwe has large potential and the country ranks among few countries with large resources.	
Lithium	6m tons. Zimbabwe is 4th largest producer after USA, Russia and Chile.	4.2% Lithium
Iron Ore	>30bn tons	53% Fe (against a typical good quality range of 70-85%
Copper	29.4 million tons	1.1% copper
Coal	11 billion tons, 2.5 tons opencastable	13.50% ash content
Mineral	**Estimated potential reserves (Ore)**	**Estimated average grade**

Coal Bed Methane Gas	500 billion cubic metres, conservative estimate	95% purity
Limestone	Cement manufacture and agriculture lime quality available; scarce is quality for ferrochrome industry.	>80% calcium carbonate common.
Phosphate	97m tons	13% Phos. Pentoxide
Asbestos	>42m tons (for only 2 mines). Zimbabwe has the bulkiest known world's resources of high quality.	Good quality
Graphite	1.2m tons	Carbon content of 22.80%
Feldspar	Large deposits	
Magnesite	Large reserves	
Black Granite	Ubiquitous in North-East of the country.	Of rare quality and great décor which is well noted internationally.

Sources: IMR database, Mlambo (2010), MMMD[1] (2011); Mugandani & Masiya (2011); Mlambo,(2012b); LUPGAS[2](2014); Mungoshi (2014); Mlambo & Mungoni (2011).

However, given the diversity and the richness of the mineral sector, Government's overt expectations regarding the sector's contribution to development, and in particular, to fiscal revenue are far much higher than the current levels. Government has used every relevant forum to indicate strongly that it is not getting a fair share of the wealth flowing from its minerals sector. On the other hand, concerns abound among mining companies regarding the effect of the current structure of the fiscal regime on the development of the sector in terms of exploration, production and investment levels, especially given the volatile nature of the commodity prices. The current softening of most international commodity prices has presented viability challenges in the mining sector. The mining industry players, especially the gold producers, have repeatedly lobbied Government indicating that their viability is being compromised by the current fiscal regime structure.

[1]Ministry of Mines and Mining Development
[2]Lupane Gas Development Company

2. Study Rationale

The Government is faced with a dilemma to balance between the revenue consideration given the binding fiscal constraints and addressing the viability concerns of the mining industry. *Revenue productivity* (also termed the canon of fiscal adequacy) is concerned with the extent to which the tax system is able to yield enough revenue needed by government to implement its programs (Tina, 2009). Macku *et al* (2010) argues that a good tax system must ensure a relatively stable flow of fiscal revenues while attaining a reasonable share of economic rent over the life of the mine. However, it is clear that revenue productivity of the tax system is also dependent on the health of the mining industry (its ability to be viable) under the tax regime, cost structures and world price trends, among other factors.

It can be argued that *too high taxes kill the goose that lays the golden egg*[3], while on the other hand, too low taxes would mean that the state's main benefit from the mining sector would be non-tax (for example, infrastructure development) (Otto *et al,* 2006). Thus, industry's further argument is that raising tax rates apparently seem successful in raising revenue from the mining sector in the short-run (when mines cannot close suddenly because of fixed costs), but its negative incentive effect on exploration and mine development in the long-term reduces tax revenues. The delicate task is to come up with some optimal tax structure. Determination of this structure and how it should be varied from time to time requires detailed mathematical modeling of fiscal revenue forecasts, which would make it possible to estimate two types of effects: (i) the effect of changes in prices and production on fiscal revenue; and (ii) the cumulative impact of the fiscal structure on investment in exploration, mine development, resource sterilization, production and beneficiation (which are dependent on profitability). Currently, there is limited information on these two effects, thus making it difficult to either forecast fiscal revenue from the mining sector (something that would be useful for Government budgeting) or to estimate the implications of changes in tax on the mining industry. It is in this regard that this study attempts to close this information gap.

The output from this study can be useful in informing policy debate on mining fiscal regime and mining sector policy management in general. The results of this study are expected to be of benefit to all mining stakeholders in the country, in particular the Ministry of Mines and Mining Development, the Ministry of Finance and Economic Development and the miners themselves. The authors

[3]Bastable (1903, p.5) uses stronger terms: "It is a far greater evil to hinder the normal growth of industry and commerce, and therefore to check the growth of the fund from which future taxation is to come"

acknowledge other efforts being made to come up with some effective way of forecasting fiscal revenue from the Zimbabwe mining sector. This study, especially the quantitative model, could be used to validate these other efforts, especially the report on the World Bank Fiscal Model for Zimbabwe when it comes out. The World Bank project and the current study share the common feature that they are both forms of microsimulation models (see section 3).

The specific objectives of the study are:

- To undertake a situational analysis of the current mining fiscal regime in Zimbabwe;
- Evaluation of the current mining fiscal regime to see the extent to which it serves the interests of government and the mining industry (investor);
- Estimate additional revenues raised from the proposed royalties and taxes;
- Undertake a qualitative analysis of the impact of the different fiscal regimes on production levels and investment; and
- To develop a mine fiscal model for prediction of mine fiscal revenue (on the basis of expected prices, production levels and fiscal scenarios) and for control (on the basis of Treasury revenue targets and the country's mining investment and production targets).

3. Literature Review

3.1 The Fiscal Regime Applicable to the Zimbabwe Mining Sector

The mere fact that mineral resources are finite provides the rationale behind government capturing extra rents whilst the minerals are extant. Several government agencies, including local authorities are involved in the collection of mineral revenue and these include Zimbabwe Revenue Authority (ZIMRA), Environmental Management Agency (EMA), Ministry of Mines and Mining Development (MMMD), Zimbabwe Mining Development Corporation (ZMDC) and Minerals Marketing Corporation of Zimbabwe (MMCZ). This has raised concern that the various uncoordinated collections not only compromise viability of the mining sector, but also present transparency and accountability challenges over mineral revenues accruing to the country. In an effort to redress these challenges government is in the process of reviewing the mining fiscal regime to ensure that the country maximizes the benefits from its mineral resources, while at the same time encouraging investment in the sector. Currently mining companies are subject to the following taxation regime.

3.1.1 Direct Tax Instruments

Corporate Income Taxes (CIT): The country applies a standard corporate income tax rate of 25%. Taxable income of a holder of a Special Mining Lease (SML) is taxed at a special rate of 15%. Investments of over US$100 million qualify for SMLs and currently the country has only two SMLs: Zimplats and Unki platinum mining companies. There is currently no restriction on carryover of tax losses; these can be carried forward for an indefinite period. All capital expenditure incurred exclusively for mining operations is deductible at a rate of 100%.

Additional Profit Tax (APT) - only for SMLs: APTs are negotiable. Their computation is highly complicated (ZELA, 2012). Generally APT is regarded as the least distortionary form of tax as it does not affect investment decision for average or marginal resource but is applicable above a threshold return set at the expected return.

Withholding Taxes: Withholding taxes are payable on dividends remitted outside the country. The withholding tax is levied at 15% for both resident and non-resident shareholders. Currently rates are considered to be high for non-resident shareholders and needs to be reviewed.

Capital Gains Tax: Capital Gains Tax (CGT) is a tax levied on the capital gain arising from the disposal of a specified asset. Specified asset means immovable property (e.g. land and buildings) and any marketable security.

Pay As You Earn (PAYE): PAYE is a method of paying income tax on remuneration whereby the employer deducts tax from salaries or pension earnings before paying the employee the net salary or pension. PAYE is one of the largest contributors in terms of revenue heads.

AIDS Levy: The AIDS levy pegged at 3% of individual or company assessed income tax was introduced on January 1, 2000 in order to raise funds for HIV/AIDS related support programmes. Prior to 2015, the levy did not apply to tax payable by a company or trust engaged in the mining business. The government has since extended the AIDS Levy to mining companies starting 1 January, 2015.

3.2 Indirect Taxes

Royalties: Royalties are the oldest form of mineral taxation and are applicable in Zimbabwe currently. Royalty payable is determined by multiplying the stipulated percentage by the revenue generated by each metal. Mineral royalties in Zimbabwe as of March 2016 were as follows:

Table 3: Royalties

Mineral	**Rate**
Diamonds	15%
Other precious stones	10%
Platinum	10%
Gold	5%, and a reduced rate of 3% on incremental output of gold using the 2015 production as a base year for large scale producers, and 1% for small scale miners
Other precious metals *(Palladium, Rhodium, Ruthenium, Iridium and Silver)*	4%
Base metals (Nickel, Copper and Cobalt)	2%
Coal bed methane	2%
Coal	1%

Source: ZIMRA

There have been some fine tuning of royalties in the Gold sector in recent years. For example, following a reduction in royalties for both primary and small scale producers of gold from 7% to 5% and 7% to 3%, respectively, with effect from October 2014 in response to declining gold prices, the royalty rate for small scale producers was further reviewed downwards from 3% to 1% in September 2015 to curb some leakages. A proposal to introduce a reduced royalty rate of 3% on incremental output of gold using the 2015 production as a base year, with effect from 1st January, 2016 is a positive development. Jourdan *et al*., 2012, recommended a royalty rate within the 1-2% to discourage sterilisation and sub-optimal extraction.

Value Added Tax (VAT): The VAT is at 15%. VAT on mining inputs qualifies for deferment for zero rating for exports. VAT has been the largest contributor in terms of revenue heads, for the period January to October 2014 when it constituted 27% of government revenue earned.

Mineral Export Taxes: Export tax is an effective instrument to facilitate mineral value addition where there is a clear case for beneficiation. However, an export tax could be distortionary if set too high (>5%) as it effectively adds to working costs. Zimbabwe's proposal to introduce a 15% export tax on raw platinum effective January 2015 to encourage local beneficiation and to raise revenue for the government through the 2015 National Budget Statement did not materialize since platinum firms promised to build a refinery by 31 December 2016.

Customs Duties: Companies are usually granted tax concessions on the importation of capital equipment and inward investment. All capital expenditure on exploration and development incurred wholly and exclusively for mining operations is allowed in full.

Marketing Commission Fees: MMCZ charges marketing levy of 0.875% on mineral sales other than gold.

3.3 Non Tax Instruments

Prospecting Licenses

In March 2014 the government reduced the mining prospecting license fees. The platinum special prospecting license was revised downwards from US$2.5million to US$750,000. Ordinary platinum prospecting license fee was slashed from US$500 000 to US$500.

Environmental Licenses/ Permits

Mining companies need to obtain environmental permits which are renewed on an annual basis. The environmental permits pertain to pollution prevention and control issued under the various regulations in Zimbabwe. Permits issued cover radiation sources, air emissions, effluent discharge points, solid waste sites and hazardous substances storage sites. Certificates on Environmental Impact Assessment (EIA) and Environmental Management Plans (EMP) are issued by the Environmental Management Agency (EMA).

Labour Levy/ MANDATA Levy: ZIMDEF levy is currently 1% of payroll. The 1% training levy is calculated from the gross wage bill collected from employers in terms of section 53 of the Manpower Planning and Development Act (Chapter 28:02), through the Statutory instruments (74 and 392 of 1999).

Standard Development levy: The Standard Development Fund under the Ministry of Industry was established through the Act of Parliament No. 3 of 1987 which empowers the Minister to impose a levy of 0.5% of the total remuneration payable by the employer to his employees. The purpose of the fund is to collect levy from employers for the development and promotion of standards and quality control of services and commodities. The payments are paid four times a year.

Radiation Protection Fees: Under the Radiation Protection Act (Chapter 15:15) section 9(c) and 22(g) of the Act, Radiation Protection Authority of Zimbabwe is empowered to charge fees for the licensing of radiation generating apparatus. Applicants are required to pay applicable authorization

fees in accordance with Statutory Instrument 134 of 2012. Medium scale operating mining and mineral processing facilities fees are US$15,000 whilst for large scale facilities the fee charged is US$40,000 per annum.

Engineering Council of Zimbabwe Fees: Every engineer or firm registered under the Engineering Council Act is required to pay an annual licensing fee to the Council of such amount as the Council may from time to time prescribe and such a fee shall be due on 1st January of each calendar year. Only registered persons are permitted under the Engineering Council Act, (Chapter 27:22) to carry out engineering work in Zimbabwe.

3.2. Objectives of Government Mining Fiscal Regime

According to Christian Aid and SOMO (2011), the objectives of any country's taxation system are revenue generation, redistribution, representation and repricing.

a. *By revenue generation* they refer to securing revenue to finance government programs.

b. *Redistribution:* This entails the ability of a government to channel resources from the richest towards the poorest and most vulnerable.

c. *Representation:* This asserts the use of taxation as an instrument in building accountability of governments to citizens. According to them, empirical evidence shows a close correlation between taxation and democracy.

d. *Repricing:* Entails use of taxation as a tool to influence the behaviour of their individual and corporate citizens. Thus governments may incentivize behaviour which is considered to be beneficial to society, whilst making it costly for citizens to engage in socially undesirable behaviour and this can be illustrated by increasing taxation on mining operations to limit the damages to the environment (Cobham, n.d.).

Thus in evaluating the Zimbabwe mining fiscal regime the study will follow the four principles of Revenue, Redistribution, Representation and Repricing.

3.3. Principles of Taxation Best Practice

Adam Smith, propounded four principles (canons) of taxation, namely equality (or equity), certainty (or stability), convenience and economy (Tina, 2009; Bastable, 1903). His main concerns in proposing the four canons were (Tina, 2009): (1) to increase the productive capacity of the economy, hence achieve higher rates of economic growth; and (2) reduce collection costs (convenience to payer and tax authority). Six more principles have been added by other authors (Tina, 2009). These include revenue productivity, diversity, simplicity, flexibility, social objectives, and efficiency. These canons are applicable to the mining sector, though the specificity of the sector demands that some of them be viewed in that specific context and that one or two more be added.

The canon of *equality* states that tax payers should pay in accordance with their ability as determined by the revenues they enjoy under the state's protection. *Certainty* requires that tax liability, the timing

and manner of payment be known by the payee in advance. *Convenience* requires that payment modes and timings (tax administration) should be convenient to the payer as far as possible, and not be made unnecessarily difficult or disruptive of business. *Economy* emphasizes the need to minimize the cost of collecting taxes. This principle is closely related to that of *simplicity*, which requires that the tax system should be simple enough so that it is easy to understand and administer.

Revenue productivity (also termed the canon of fiscal adequacy) is concerned with the extent to which the tax system is able to yield enough revenue needed by government to implement its programs. Macku *et al* (2010) argues that a good tax system must ensure a relatively stable flow of fiscal revenues while attaining a reasonable share of economic rent over the life of the mine. Revenue productivity is related to the question of optimal level of taxation. Otto *et al* (2006) illustrates that the net present value of government revenue increases steeply with initial increases in tax rates, reaches a maximum, then falls as the tax rate continues to increase. That is, *too high taxes kill the goose that lays the golden egg*[4], while on the other hand, too low taxes would mean that the state's main benefit from the mining sector would be of a non-tax nature (for example, infrastructure development and employment). Thus, their further argument is that raising tax rates apparently seem successful in raising revenue from the mining sector in the short-run (when mines cannot close suddenly because of fixed costs), but its negative incentive effect on exploration and mine development in the long-term reduces tax revenues.

The canon of revenue productivity is also related to that *of diversity*, which requires that the tax system has diverse methods of collecting taxes, so that revenue collected is not significantly affected by changes in one form. Otto *et al* (2006), in referring to the mining sector, also notes that a mix of taxes has the advantage of stabilizing fiscal revenue through the phases of a mine. For example, import duties on imported capital goods yield revenue during development, unit or value-based royalties yield revenue during production, profit-based taxes yield revenue after a profit has been realized and additional profit tax only after the profit hurdle is achieved. Also some types of taxes are easy to administer and limit tax evasion, for example, royalty based on amount produced or sold only. However, too much emphasis on diversity counters the principles of economy and simplicity. *Flexibility* requires that it be easy for the authorities to revise the tax structure in light of changing economic and treasury requirements. *Social objective* requires that the tax system addresses the social objectives of government.

The canon of *efficiency* requires that taxes raise revenue without negatively affecting business incentive (see Tutor2u, *n.d.*). This feature happens to be the key consideration for the mining industry, and touches on optimal mix of taxes (see in Otto *et al*, 2006). Otto *et al* (2006) argue that unit taxes and market value-based taxes (*in rem* taxes, in general) distort production decisions of mines as they enter directly into the costs of production, hence cause inefficiency (they render marginal and para-marginal reserves sub-marginal or sub-economic[5]). They can result in taxation of loss-making companies; hence shift more market risks to the mining companies.

[4]Bastable (1903, p.5) uses stronger terms: "It is a far greater evil to hinder the normal growth of industry and commerce, and therefore to check the growth of the fund from which future taxation is to come"
[5]See in Gentry & O'Neil (1984)

Normally, lump-sum taxes are most efficient because, once paid the marginal tax rate becomes zero (Tutor2u, *n.d.*), hence there is marginal incentive. Indirect taxes (for example, import duties) can cause deadweight losses in consumer surplus, hence can be inefficient. Otto *et al* (2006) argue that profit-based tax do not affect mineable reserves (does not affect cut-off grade) as the marginal ore remains profitable (because the tax is exacted as a fraction of profit that has already been made, unless it is pegged at more than 100%).

The main concerns of the latter six canons are with wider objectives of economic policy. Ideally, looking at the mining sector, a good tax system would, besides having the above features, address the implications of the unique features of mining. For example, it would need to: (1) alleviate the depletion of miners' livelihoods due to the non-renewability of minerals; (2) alleviate high capital costs and import bills due to the capital-intensive nature of mining, and concerns related to irreversibility of mining investment; (3) address the effects of long pre-production costs (exploration and mine-development) and the long payback periods on earlier cash-flow situations of mines; (4) alleviate perceived risks in the sector (market, technical, and political); (5) promote mining linkages; (6) address large closure costs; (7) be sensitive to price and revenue fluctuations in the international market; (8) have a long-term rather than a short-term view of revenue productivity; (9) avert the possibility of a resource curse; (10) address the question of sustainability of mining sector and the wider economy (inter-generational and intra-generational equity in use of mineral resources); *et cetera*.

3.4. Review of Tax Revenue Forecasting Models

Gamboa (2002) asserts that the reason that has been proffered for poor revenue performance of the fiscal sector has mainly been poor collection performance by the collecting government agencies due to corruption. While this remains a plausible attribution, there is a feeling that revenue targets may not have been realistic, which traces to unrealistic tax revenue forecasts. Realistic revenue targets are important in enhancing the budgetary process at the macroeconomic level, while at the micro-economic level, besides aiding tax planning, they serve as effective performance standards against which actual collection performance can be measured. Realistic revenue forecasts are a result of the application of realistic revenue forecasting techniques; techniques which also aid not only in revenue forecast, but also in estimation of the impact of tax reforms on other parameters such as efficiency, equity and general viability of the taxpayer, if it is a business entity.

The most preferred method of forecasting is the *tax elasticity approach* (also termed conditional approach) which estimates the elasticity using regression techniques, which sometimes apply the double-log functional forms, isolating the elasticity as the regression coefficient (Gamboa, 2002). Generally the main explanatory variables used are the tax base and the tax rate/structure. However, the shortcoming with this approach is that when the tax reforms involve various specific tax elements it is difficult to analyse the impact on revenue as well as cumulative impact on the sector being analysed in terms of business competitiveness. For example, in the particular case of mineral subsector analysis, it becomes difficult to use the model to analyse resource sterilization, impact on profitability and so forth.

Another method, which also uses regression, is the *extrapolation method* (Gamboa, 2002). This method simply regresses historical collections against time to get the trend (or average growth rate) and just extrapolate the revenue figures (that is, forecast) on the basis of the trend (or average growth rate). This approach is more simplistic than the elasticity approach, and it is virtually impossible to do anything with it other than just forecast revenue on the basis of time. This approach also does not recognize unforeseen circumstances which may not have happened in the history of the paying entity which may actually even reverse the trend. The model cannot in any way be used for control purposes on the basis of, say, treasury requirements or target production, investment, et cetera.

Sometimes the *macroeconomic regression models* are also used. In this case collections on a particular tax head is regressed against some macroeconomic variables such as GDP. To make this approach more realistic one would need to include several macroeconomic variables which possibly would lead to the problem of multicollinearity (as most variables that determine tax revenue are too closely related to each other, for example production, GDP and prices) or otherwise specification errors. Most of the methods that are used to correct the problem of multicollinearity would be difficult to apply in this case. Dropping some variables, for example, would definitely lead to specification errors as most of these variables (both technical and economic) are key in determining the amount of tax revenue collected. Most regression models actually drop many of these variables, which is probably why most of these models end up with one variable or two, mainly GDP. It would also require a lot of time and more resource to obtain *a priori* information on the relationships between the various variables that could be used to reduce their number, and also, to conduct a more comprehensive survey that could yield cross-sectional and time-series data that would permit data pooling.

One approach that conceivably could be applied is the dummy variable approach, whereby dummies are used to indicate the presence or absence of, say, incentives. However, the difficulty here is that most of the variables concerned are of a quantitative nature, so that the issue is not only about whether or not, for example, an export tax is introduced, but also what rate is the export tax. This essentially means the best way would be to enter the variable as a quantitative one, which reduces to the problem of multicollinearity. However, dummy variables could be introduced for purely non-quantitative policy variables such as some aspects of indigenization.

Minh Le (n.d.) indicates that the data requirements for macroeconomic modelling would be tax collection, GDP and GDP deflator, which makes the model too simplistic and less useful. Like the other regression approaches, the analyst loses a lot of specific information that limits the scope of impact analysis as well as tax structure recommendations. For example it would be impossible to analyse the impact of specific tax incentives or specific terms of agreement between Government and the taxpayer on issues of, for example withholding taxes or stipulations on Human Resources Development (HRD) or Research and Development (R&D).

The other approach used is the *microsimulation model*. Bai & Zeitlhofer (n.d., p.369) state that microsimulation "…involves simulating changes in a company's tax liability by forecasting their profits (or losses) and taxation reconciliation agreements…" and then aggregate across the population of paying entities to get the overall forecast. They argue that, while macro-based models are simple and, with reliable variables, yield good results within a stable environment, the environment is normally volatile for a company (cost structure changes, price changes, *et cetera*, especially in the mining sector). Microsimulation simulates the volatilities at company level and aggregates the results into profiled groups (for example, an industry). This model basically goes through three stages. The first stage is the forecasting of the level of profit or loss of the company before application of tax adjustments. The second stage is then the adjustment of the above for special tax treatments such as loss carryovers or recoupment, R&D allowances, accelerated depreciation and so forth, all of which adjust the basis for tax liability. This stage ends with the imposition of the tax regime to determine the tax liability for the company. The third stage phases the estimated tax collections into monthly collections or quarterly collections. "Any microsimulation model is reliant on unit record data. All companies in Australia are required to lodge annual tax returns that provide a range of income, expense and statistical data items" (Bai and Zeitlhofer, n.d., p.374).

A World Bank study uses a variant of a microsimulation model. In this ongoing study on the Zimbabwe Mine Fiscal Model, the Bank seeks to develop a model that is applicable to large and small mines in some selected commodities. The model is being developed using excel and includes the fiscal aggregation system which would be capable of taking data from individual mines and aggregate it by tax head. Information required for the building of the model ranges from various taxes and fees charged by government (both central and local), special tax treatments, government equity in mines (reflecting the indigenization policy), and number and nature of existing and prospective mines. Taxes and fees include royalties on main products and the various by-products, AIDS levy, additional profits tax, local authorities levies, marketing authority levies, environmental charges, VAT, depletion fee, withholding tax on dividends, conveyance fees on asset transfer, registration fees, application fees, ground rentals, inspection fees, export permit fees, management fees (for domestic and foreign companies), skill levy, *et cetera*. Other information include breakdown of pre-operative costs and commencement costs, capital expenditure requirements particulars, finance methods and debt repayment terms and so forth.

The World Bank Model has been meant to develop from using data estimates (hypothetical data) to use of actual mine data. The model is meant to project revenue over ten years. It looks at a few minerals – nickel, gold, coal, platinum and 'other mineral'. However, the model may be difficult to complete and use due to the fact that it is too detailed (demands too much data from mines) leaves out key technical parameters important in management decisions (for example, available optional cut-offs, possible run of mines, ore recovery rates, plant recovery rates, *et cetera*) and is not likely to be comprehended by the intended users of the model (Government). Much has also been written about complicated models (that try to encompass many components), indicating that they usually yield results that are inconsistent with observed economic outcomes.

> "For example, von Nuemann (1995) (cited in Israel, 2002, p.241) notes that mathematical modelling of economic equilibria in the 1970s and 1980s, especially on stability and uniqueness of equilibrium, produced 'negative or odd results', though that did not stop the modelling momentum towards complexity. Keuzenkamp & McAleer (1995) argue that simple models, unlike complex ones, are better placed to 'inspire' knowledge in empirical analysis, and that complex models should be used if simpler ones have empirically failed to be useful. Thus, models should get incrementally complex with data availability and/or necessity. In the scientific approach mathematical models are evaluated in relation to their empirical predictive performance, and not how faithful they are to structure (von Nuemann, 1995, cited in Israel, 2002)" (Mlambo, 2012a, p.1).

Generally, most effort in the literature on revenue forecasting has focussed on eventually producing nation or economy-wide forecasts, not sectoral forecasts. The one approach that is closer to sectoral forecasts is the microsimulation technique by virtue of it requiring data from data record units. At the least there are no models that seek to make use of sector-specific technical and financial parameters to forecast mining tax revenue. Thus, the current approach is specifically designed to capture important decision parameters at the mine level and how they influence the tax revenue collectible from the mine through influencing optimal extraction levels and rates, hence revenues, costs and gross surpluses.

4. Methodology

The study undertakes a situational analysis of the mineral fiscal regime in Zimbabwe. This is benchmarked with other country experiences. Qualitative analysis of the impact of the mining fiscal regime has been done, with a view to increase the sector's overall contribution to fiscal revenues and economic growth. The qualitative analysis is complemented by quantitative analysis, which is a modification of the microsimulation approach. The quantitative analysis seeks to establish (i) amount of additional revenues raised from the proposed royalties and tax regimes; and (ii) the overall fiscal impact of these royalties and tax rates on production levels and FDI flows into the mining sector. These are demonstrated through a case of the gold sector. Specifically the quantitative analysis focuses on the recommendations of the ZEPARU (2012) study:

- Standardise CIT at 25% (national rate) for all mining ventures;
- Lower royalties to 1-2% for all minerals;
- Imposition of a Mineral Export Tax of 1-5% on all unprocessed mineral exports where the next value addition step has been independently shown to be economically viable (e.g., real IRR >10%);
- Establishment of a ring-fenced Fiscal Stabilization Fund using 30% of the proceeds of the Resource Rent Tax (RRT) (locked offshore fund);
- Making local expenditure on HRD/R&D of ≥5% of pay-roll a condition in all Mining Leases;
- Reduction of withholding Tax on expatriated dividends to 15%, but increase to 30% for investors domiciled in tax havens;
- Increase (RRT) to 50% above a return on investment (ROI) of the treasury long-bond rate plus 7%; until a market for long-bonds is established, the threshold ROI can be set at 20%; and
- Imposition of a Capital Gains Tax (CGT) of 50% on all Exploration License transfers (sale before mining commences) to discourage speculators.

This research also covers proposals on the fine-tuning of the recommended instruments and the building of the requisite state capacity to effectively administer the new mineral fiscal regime. The study employs both qualitative and quantitative approaches.

4.1 Qualitative approach

The study partially relies on qualitative assessment to understand and evaluate the current fiscal regime as well as its optimality or lack of it. Thus, for the situational analysis, a desktop literature review was undertaken. Specific approaches on evaluation of the current mining fiscal regime include:

(i) Country benchmarking, which is a desktop review of regional and international country rates which are compared with those applicable in Zimbabwe.
(ii) Juxtaposition of the current fiscal regime against taxation best practice.
(iii) Juxtaposition of the current fiscal regime against government taxation objectives.
(iv) Qualitative design of an optimal mining fiscal structure.
(v) Identification of gaps (loopholes) in and recommendations for tax collection and tax revenue administration in order to enhance the capacity of tax authorities to maximize tax collection (counter illicit flows/evasion) in light of new fiscal proposals.

4.2 Quantitative approach: Microsimulation Applied to the Gold Sector

4.2.1 Calibrating the model

To understand the effects of price and production on fiscal revenue from a mine, and the effect of a fiscal regime on mine production and investment, the study enters the decision model of the mine manager (See in Rudawsky, 1986). For the gold sector, which is reported in this study, a typical mine design optimization is done, which is then scaled up to the gold sector level using the following output ratio based on the sector's output for 2015. That is, the obtained mine level revenues are multiplied by the ratio:

$$r = \frac{O_w}{O_m} \qquad (1)$$

Where O_m is the output of the typical (average) gold mine in 2015 and O_w is the output of the whole sector for the same year. O_m is obtained by a simulation using the current fiscal regime and price for 2015 (which is equal to US$1,160), which gives a typical mine output level of 1.031515888 tons against an industry output of 20.023000000 tons. Thus, the ratio is equal to 19.41, which is assumed to be constant under all scenarios. An optimal design is a combination of selected cut-off grade and run of mine (ROM) which maximizes the mine's net present value (NPV).

For the optimization to be done a range of data are required on the technical and financial parameters of the typical mine. The technical parameters include cut off grades and average ore grades, cumulative reserves for each cut-off grade, recovery rates in mining and concentration, annual run of mine (rate of ore mining) and grade of marketed concentrate. The data submitted by mines on the above were averaged to get the typical mine data. The financial parameters include

cost of mining ore given against ROM for the past five years (2011-2015), average concentration costs, current price of gold per oz, capital investment and salvage values as percentages of initial investment. These original data from the mines are highlighted (by yellow) in Appendix 2. The processing of the technical parameters to get the typical mine parameters is explained in Appendix 3 notes.

Total cost of mining ore is obtained from a cubic econometric regression of historic costs over output as indicated in equation 2.[6] The data for regression is pooled data from seven gold mines over the 5 year period. This data is presented in Appendix 4. After equation 2 is estimated respective cost for each level (cut-off grade) is then computed to give Appendix 5.

$$TCM = b_0 + b_1 q + b_2 q^2 + b_3 q^3 + u_i \qquad (2)$$

where q = ROM (tons). In the above equation:

$$b_0, b_1 \; and \; b_3 > 0$$
$$b_2 < 0$$
$$b_2^2 < 3 b_1 b_3$$

Note that mining costs submitted by mines relate to direct production costs onsite (including wages, consumables/materials, onsite regulatory expenses and onsite administration costs) and transport costs, but exclude depreciation and tax expenses which are considered separately later in the model. With the above information, the study develops, for each cut-off grade considered, a series of total costs of mining, average costs of mining, feed costs per ton of concentrate, concentration costs, and eventually average total costs of producing a concentrate (including the necessary mining costs and plant recovery costs) corresponding to each ROM. These computations give Appendix 6. Price is exogenous. Using prices, concentrate outputs (ROM/CR) and average cost per concentrate the study computes unit profits and total profits (annual or life-time) of the typical mine for the various cut-off grades and ROMs combinations. This is given in Appendix 7. For simplicity all capital is assumed to be life-long investment, and that the production function displays constant returns to scale (as measured by the run of mine). The assumption of constant returns to scale means that the capital to ROM ratio remains constant across the various mine capacities. Capital levels vary by ROM and not by cut-off grade. The salvage value as a percentage of the capital investment is the average of the salvage percentages obtained from the mines surveyed. The straight line method of depreciation is used. This information is presented in Appendix 8.

[6]Gujarati (1988)

The proposed fiscal regime and other related regulatory stipulations are superimposed on the mine – royalties, corporate tax, export taxes, any required HRD expenditures, resource rent taxes, *etcetera*. The base (which is the proposed) fiscal regime is shown in Appendix 9. With appropriate discount rate (estimated to approximate the cost of capital), at this stage cash flows are developed and the NPVs are calculated. These are calculated for each possible combination of cut-off grade and ROM over mine life, which combinations, for 3 cut-off grades and 4 ROMs number 12. At this stage a business decision is made on the optimal design (the cut-off grade and ROM that maximizes NPV, which is the same as cumulative NPV since the analysis includes annual NPV computations). The respective fiscal revenue is then noted.

4.2.2 Simulations (scenario modelling)

The following scenarios are analyzed in the above model: (i) Effect of exogenous price changes (rises or falls) on cut-off grade and ROM levels (optimal decision) as well as concentrate output; (ii) Fiscal revenue for an assumed fiscal regime; and (iii) cumulative effect of changing the fiscal regime on profitability (hence investment implications), cut-off grade (hence the amount of resultant resource sterilization), and production levels. It is assumed that a change in price or fiscal scenario will make mine management re-evaluate the viability of the mine, which could result in scaling up or down of the ROM within certain narrow ranges (determined by the original typical investment level) or a temporary shutdown of operations.

4.3 Scope and Data Issues

The sampling frame used was the list of gold mines in the confidential report for CBZ Bank on Value Chain Analysis done earlier in the year (2016) (Mupamhadzi, 2016). The current study focuses only on the gold sector for the reason that all the mines approached in the other mineral subsectors did not respond. Thus, the quantitative aspect of the analysis in this report is actually a case study of the gold sector. The mines sampled are classified by the Chamber of Mines as large-scale, though it is a known fact that they are all small-scale by international standards.[7] The method of simple random sampling was used to pick 9 mines out of 27.

A questionnaire on technical and financial parameters pertinent to construction of the forecast model was designed and sent to the selected mines. The questionnaire is included in Appendix 1. The questionnaire was meant to guide subsequent face to face interviews with mine technical officials. However, the mines elected to fill in the questionnaire and send it by email. Eight of the nine mines successfully submitted the completed questionnaire. Of the eight completed questionnaires, one was not considered as it had peculiar data which could not be standardised with the others.

[7]For example, the tenth largest gold mine in the world is Bordington Mine in Australia, owned by Newmont (Basov, 2015). This mine produced 19.73 tons of gold in 2014, which was greater than the total production from the whole gold sector in Zimbabwe at about 15.39 tons. The largest gold mine in the world is Muruntau in Uzbekstan, owned by Navoi, which produced 73.71 tons of gold in 2014.

The quantitative model only picks a few major tax heads exacted by the central government, and does not include the levies exacted by the local government. The fiscal revenue projected in this study refers only to the central government for the particular set of tax heads considered and no attempts are made to extrapolate this to the whole mining sector or all levels of government. This is done for simplicity as argued under literature review.

It is acknowledged that mining has multiplier effects on the economy through upstream and downstream activities. These multiplier effects impact on the fiscal revenue government ultimately obtains directly and indirectly from the mining sector activities. This study, however, does not seek to delve into this area, which on its own is rigorous and significant enough to warrant a separate study. The purpose of the paper is not to demonstrate the broad economic significance of the mining sector, but *inter alia*, its direct impact on fiscal revenue as well as the cumulative impact of the fiscal regime on industry competitiveness.

5. Qualitative Results on Mining Sector in General

5.1 Country benchmarking: International Comparison of Mining Taxation Regimes (Main Tax Heads)

This section looks at a comparison of Zimbabwe's mining fiscal regime against four African countries (Burkina Faso, Mali, Ghana and South Africa), one South American country (Chile) and two OECD countries (Australia and Canada). The rationale for selection of these countries is based on the fact that they are generally considered as mining countries. Normally, mining companies are subjected to various forms of taxes which include corporate income tax, royalties, withholding tax, skills development levy, VAT and customs duty. Other taxes include payroll tax, real property tax, social security and stamp duty. The mining tax regimes across countries attempt to determine the 'right price' for extracted resources, striking a balance between a sustainable return for the government and a 'reasonable' profit for the mining company (KPMG, 2014). However, the global developments in mining taxation drawing from case studies of minerals taxation in selected mining countries, reveals that the rates, type of tax and collection methods can vary significantly between countries and commodities.

Corporate Income Tax

A comparison between Zimbabwe's mining corporate income tax with other mining jurisdictions reveals that most countries apply a standard national rate in the range of 15% to 35% which is in line with Zimbabwe's corporate tax rate of 25%, although Zimbabwe also offers a reduced rate of 15% to holders of special mining leases, which are mining firms with investment in excess of US$100 million. Ghana has the highest corporate income tax at 35%, followed by Australia (30%), South Africa (28%), Burkina Faso (27.5%), Chile (24%) and Canada (15%) (Table 4).

Despite Canada appearing to have a low corporate income tax, provincial general corporate income tax and branch profits tax are also levied at mining companies at 11-16% and 25%, respectively. In South Africa corporate income tax is levied at 28% for both resident and non-resident companies, with gold mining companies taxed according to a special formula (Deloitte, 2016). Previously,

there were two formulae for determining corporate income tax for gold-mining companies, one for gold-mining companies that were subject to STC and the other for such companies that had elected to be exempt from STC. However, with the implementation of the dividends tax, STC was repealed and all gold mining companies must now use the standard formula to calculate the tax rate (PricewaterhouseCoopers, December 2015).

Ghana differentiates the standard 25% rate of corporate income tax with that of mining companies which is pegged at 35%. An additional 8% tax is imposed on repatriated profits of branches of non-residents operating in Ghana. In Chile, additional withholding income tax for non-resident entities must be paid upon distribution of profits. A 35% additional withholding income tax applies to remittance of profits attributable to branch, with 24% first category income tax paid at branch level creditable.

Table 4: A comparison of Zimbabwe's Corporate Tax Rate with Selected Mining Jurisdictions

Jurisdiction	**Corporate income tax**
Australia	30%
Burkina Faso	27.5%
Canada	15%
Chile	24%
Ghana	35%
Mali	25%
South Africa	28%
Zimbabwe	25%

Source: Deloitte, March 2016; Trench et al (2015).

For Australia, Canada, Ghana, South Africa and Zimbabwe, the corporate income tax remained stagnant since 2012, except for a slight increase for Canada from the previous recorded 25%-31% between 2012 and 2015 to 26% to 31% in 2016. Conversely, the rates for Chile have been increasing from 18.5% in 2012 to 20% in 2013 and 21% in 2014. The rates continued to increase from 22.5% in 2015 to 24% in 2016. The rate is to be incrementally increased until it reaches 25% or 27% by 2018 (Deloitte, 2016). Zimbabwe's corporate income tax is within regional and international norms, hence it could continue to operate at the same tax rate.

Royalties/Minerals Resource Rent Tax (MRRT)

Royalties and mineral resource rent tax represent the price the industry pays to governments and communities for the natural resources extracted. The country's royalties are generally among the highest in the region. For example, for gold royalty rates for some regional countries are as follows:[8] Angola 5%, Zambia 5%, Burkina Faso 3-5%, Tanzania 4%, Botswana 3%, Senegal 3%, South Africa 3% unrefined and 1.5% refined, and Democratic Republic of Congo 2%. However, mineral by mineral, besides diamond, other precious stones, and platinum which are charged at 15%, 10% and 10% respectively, royalties for other minerals are generally competitive globally. For example,

[8]Various Country information/Clarus Securities Inc.

for copper Zimbabwe is at 2% while Canada is at 16%, Chile 14%, Indonesia 4%, India 4.2%, DRC 4% and Argentina 3%. For coal Zimbabwe is at 1%, Canada 16%, Chile 14%, China 4%, Argentina 3%, DRC 3%, Ghana 5% and Indonesia 7%.9 Even the gold rates in Zimbabwe are globally competitive.

Jourdan *et al* (2012) and Burns (2015) advocate for resource rent tax as opposed to royalties, arguing that royalties add to working costs and consequently increase the cut-off grade of a mineral deposit, and hence could sterilise marginal deposits/reserves if set too high (>5%). Jourdan *et al* (2012) also argue that only few countries apply resource rent tax due to: (i) the perception that it would make them less attractive to foreign direct investment; and (ii) perceived administrative complexity of the tax system, despite the resource rent tax being one of the least distortionary among various tax instruments. They further argue that a high resource rent tax does not impact on investment decision of marginal deposits as opposed to royalties.

Australia has a Petroleum Resource Rent Tax levied on all Australian onshore and offshore oil and gas projects at a rate of 40% of the taxable profits derived from the recovery of all petroleum in the project. This tax applies in addition to normal income tax. The petroleum resource rent tax payments are, however, deductible for income tax purposes. However, the minerals resource rent tax (MRRT) levied on profits related to the extraction of coal and iron ore from 1 July 2012 was abolished from 1 October 2014.

Australia also impose ad valorem state royalties of up to 12.5% which vary by state, deductible as an expense for income and creditable against petroleum resource rent tax.[10] The royalty also depends on whether the mineral is refined or unrefined (KPMG, 2014). Jourdan *et al* (2012) also observed that some states decrease royalties with increasing value addition to encourage local beneficiation of minerals. Canada and Zimbabwe charge high royalty rates of 10% and 1-15% respectively.[11] The royalty rates in South Africa range from 1% to 5% depending on the type of mineral. Similarly, Ghana's mineral royalty changed from a range of 3-6% to a fixed rate of 5% currently in place (KPMG, 2014). However, from January 2017, reduced royalties will be levied on a sliding scale instead of the flat 5% of revenue currently in force. The royalty rates will range from 3% to 5% depending on the value of the mineral on the market.[12] Zimbabwe is in the process of reviewing the mining fiscal regime to ensure that the country maximises the benefits from its mineral resources. In this review there is need to consider indexing royalty rates to international prices, so that when the prices are going down industry is not disadvantaged and when they are going up government is not disadvantaged.

Tax incentives

Government of Zimbabwe states that "Government incentives to the mining industry are flexible and will constantly be reviewed in order to respond to market conditions and viability concerns of

[9]ZIMRA

[10]http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Energy-and-Resources/gx-er-oilandgas-australia.pdf

[11]http://www.ird.gov.hk/eng/tax/dta_rates.htm

[12]http://www.miningweekly.com/article/ghana-affords-gold-fields-tax-royalty-relief-in-country-bereft-of-weaker-currency-respite-2016-03-29

the mining industry". The Government provides tax incentives as measures to attract both local investment and FDI to particular sectors or geographical areas of the country (ZIMRA, 2013). Tax incentives ultimately seek to achieve the following: employment creation, skills transfer, export promotion, income generation, industrial development, small business development, and revenue inflows. Generally they represent an advantage to investors and yet a cost to government. Tax incentives are administered by ZIMRA, while a number of non-tax incentives are administered by other organizations such as the Ministry of Industry and International Trade, Industrial Development Corporation (IDC) and Zimbabwe Investment Authority (ZIA). Revenue incentives do not discriminate between local and foreign investors.

Tax incentives vary by sector, economic activity, organizational form, and geography of investment (ZIMRA, 2013). Examples of incentives are tax holidays, tax rate reduction, and accelerated depreciation. Several incentives are available to the mining sector. These include:

- Full claiming of Capital Redemption Allowance on mining capital expenditure (Special Mining leases claim the allowances over four years).
- Unrestricted carryover of tax losses.
- Income tax on special mining leases is at a special rate of 15% (compared to 25% for others).
- Use of rebates on imported capital equipment that suppresses customs duty and VAT.
- Use of Double Taxation Agreements (DTAs) that provides for lower rates of withholding taxes on payments to foreign services providers.
- 90 days deferment of collection of VAT on importation of capital goods.

Interest on debt is allowed up to the debt-equity ratio of 3:1, and any extra payment are regarded as dividend and taxed as such. Loan dealings between affiliated companies are at Arm's Length Interest Rates and any excess interest above the market rate is not deductible but taxed as dividend.

Withholding tax

Just like for Zimbabwe dividends paid to individuals, trusts and foreign persons are subject to a 15% withholding tax in South Africa. In Chile dividends distributed to individuals resident in Chile are subject to progressive tax which ranges from 0% to 40%, whereas profits repatriated to a parent company abroad are subject to additional withholding income tax of 35%. The same also happens in Canada where dividends from non-connected corporations are subjected to additional tax although deductions are available for dividends from foreign affiliates. In Australia, dividends paid out of profits on which corporate taxes have been paid entitle shareholders to a tax offset for the corporate tax paid.

Capital gains tax

This tax is payable in Zimbabwe on the disposal of immovable property or shares that are listed (with the Zimbabwean Stock Exchange) or unlisted companies. The rates are 1% of proceeds of listed securities, 20% of capital gain on property and 20% of capital gain on unlisted securities. No capital duty is paid in Australia and South Africa. Notwithstanding, in Chile business entities pay an annual municipal licence fee which ranges from 0.25% to 0.5% on tax equity, up to a maximum of approximately US$500,000.

Skills Development Levy (payroll tax)

Mining companies are liable to a compulsory levy to fund education and training. A 1% skills development levy is imposed on employers which meet the requisite payroll costs of ZAR500,000 in South Africa. This is almost the same system that applies in Zimbabwe since, subject to some exceptions, employers are required to pay a 1% monthly training levy (on the gross wage bill) to the Zimbabwe Manpower Development Authority. In Canada different states impose a slightly higher payroll tax compared to South Africa and Zimbabwe, ranging from 1.95% to 4.3% of annual gross wages, salary and other remuneration paid by the employer. This is the same model that is being used in Australia where the tax on payroll is levied on employers by the states, with the amount based on salaries, wages and benefits paid to employees.

VAT

VAT is levied on the supply of goods and services, and on imported services. In general terms, this tax is levied over the price of goods and services. In South Africa a standard rate of 14% is levied on taxable transactions with certain transactions zero-rated or exempt. This is the same system in Zimbabwe where the standard rate is pegged at 15%. In Ghana, other than exempt goods and services, a VAT of 15% is payable coupled with a flat VAT rate of 5% on the supply of immovable property by an estate developer. A special petroleum tax of 17.5% has also been imposed on specified petroleum products by licensed oil marketing companies. Exports of goods and services are zero-rated. In Canada, five provinces charge a harmonised tax rate which ranges between 13 and 15%. The harmonised sales tax includes the 5% federal goods and services tax and a provincial sales tax component which range from 8% to 10%. In Australia the federal government levies goods and services tax at a rate of 10%, and distributes the revenue to state governments. Chile also charge VAT on the transfer of goods and the provision of services at a 19% rate.

Customs Duty

Imports into Australia are subject to duties under the Australian Customs Tariff. The top duty rate is 5%. This is almost in line with Chile which charges 6% customs duty, with reduced or zero customs duties rates for extended network of free trade agreements. Conversely, South African customs duties are charged at rates ranging between 3% and 20%, except for clothing and apparel, which may have rates as high as 45%. The import duties may also include anti-dumping and countervailing duties of up to 150%.[13] No customs duties are charged on trade between the Southern African Customs Union (SACU) members, South Africa, Botswana, Lesotho, Namibia, and Swaziland. Preferential treatment is also given to those countries in the same regional economic community. However, for Zimbabwe, despite different rates being charged depending on whether the product is manufactured locally or not, companies are usually granted tax concessions on the importation of capital equipment.

[13]http://taxsummaries.pwc.com/uk/taxsummaries/wwts.nsf/ID/South-Africa-Corporate-Taxes-on-corporate-income

5.2 Juxtaposition of the current fiscal regime against taxation best practice[14]

5.2.1 Royalties

The royalty regime in Zimbabwe positively meets a number of the canons of taxation. It is a way government asserts its ownership of mineral resources vested in the state. Thus, royalties ensure that any exploitation of these resources (which is a transfer of ownership) is not free hence should be done in the most productive manner possible, not indiscriminate and unmethodical. It is highly revenue productive in the short term for the following reasons: (1) it is exacted on the value produced (sold) hence its base is large; (2) it limits tax evasion and is easy (economical) to collect since it requires only a single straight-forward datum (value sold). It also yields stable revenue over the year since it is not immediately affected by cost surges, though it is affected by price fluctuations. It is easy to understand (simplicity) and certain in terms of estimating future liability in the year.

However, there are other canons that are transgressed by the regime. Firstly, it has been unstable in the past 7 years (since 2009). Instability creates significant risk for potential investors and destroys the competitiveness of the nation as an investment destination relative to other mineral rich countries in the region and internationally. In one field survey that was done by the Institute of Mining Research in conjunction with other authors, indications were that, while liability is predictable over a given year, instability makes predictability over a period longer than a year to vanish.

The royalty regime is *in rem*. While this has a significant revenue advantage, this trades off with many disadvantages of a more serious nature. This creates inefficiency in the sector as it interferes with business behaviour and is capable of changing it. *In rem* royalties are a tax not only on profit but also on costs of production, since value is equal to cost plus profit. Thus, they enter into the variable costs of production directly since the more is produced the more should be paid in royalties as a cost. They become a key production decision variable, especially at the moment they are changed. When they are raised they raise the cut-off grade and can easily sterilize (destroy) marginal and paramarginal resources[15]. This means that, simply because of the in rem royalties the country could rank as being resource poor in comparison with other countries with lower royalties or *in personam* royalty regimes. Thus, royalty setting in Zimbabwe has tended to have a short-term view to revenue productivity by sterilizing resources, discouraging exploration, mine development and production, hence limiting the present value of long-term revenue.

The royalty regime is also inequitable in that it is not based on the ability to pay, which means it taxes both loss making and profit making mines. Royalties in Zimbabwe are not deductible for income tax purposes (from 2014 national budget statement onwards), and therefore, the subsequent exaction of corporate tax means that profits are double taxed by the same authority. The burden of royalty is even heavier when one considers that they are applied before any allowable deductions, like capital consumption allowance, et cetera, and that there is no depletion allowance. Because the royalty regime is not sensitive to losses, it can easily cause unemployment during times of economic

[14]Based on co-author's (Mlambo's) contribution to the report on the ongoing World Bank Study on the fiscal model.
[15]Para-marginal resources are those resources that can be economic if the current price were to increase by a factor of 1.5.

downturn in the minerals market. It also reduces the ability of mines to meet social objectives in the form of corporate social responsibility (CSR).

It is not clear on what basis the royalty rates are pegged. One understanding of royalties that they are an ownership transfer fee, would imply that, appropriately, royalties should be based on the estimated value of the resource transferred in a given period - which is the present value of net receipts in that period. Thus, the current calculation where it is based on gross sales revenue is an overestimation. Another understanding of royalty (Farzin, 1992, as cited in Mlambo, 2012, p.471) is that, it is scarcity rent or user cost, which makes it essentially a depletion charge (charge for depleting a resource), which is an estimate of how much is depleted. Being scarcity rent, it is only a portion of total resource rent (as the latter also includes Ricardian rent and entrepreneurial rent). The second understanding is more theoretically sound, being based on the Hotelling rule of optimal resource extraction. However, both understandings confirm that the current computations in Zimbabwe are in error.

5.2.2 Corporate Income Tax (CIT)

CIT, unlike royalties, does not selectively apply to extractives over other industries. CIT is also considered to be progressive in the sense that larger, more profitable firms pay more than smaller firms. The key problem is that if firms are not making profits then governments will not get any revenues. Another key weakness of CIT is that, compared to other taxes, it is very difficult for developing countries to collect, due to the fact that mining companies can use complicated accounting systems that reduce their tax liability, for example, through exaggerating costs, use of transfer pricing, and offshore subsidiaries.

Corporate income tax is less distortionary than value-based taxes as it maintains the profitability of marginal reserves, and does not sterilize resources. At a rate of 25%, the corporate income tax exacted on the general mining sector in Zimbabwe compares well with rates in the region and internationally, which helps maintain the country's competitiveness for mining capital. The lesser rate of 15% applied to special mining leases is some incentive for large mining ventures, albeit there may be no net advantage when one considers that Special Mining Leases are subject to additional profits tax which may result in larger tax payment than the 25% CIT. In general the corporate tax regime meets the canon of efficiency.

5.2.3 PAYE

PAYE collection among small-scale miners is not effective because they do not register with ZIMRA as employers due to the demanding nature of registration and compliance procedures. Also, much of their labour is not formal, but individual, family or organized. The number of people involved in gold panning alone was estimated at 300,000 in 1996 (Mining Journal 1996 Edition of the Mining Annual Review, as cited in Chimsasa, 1996), and the number of artisanal miners involved in all minerals has increased over time. Many people who are not necessarily miners themselves, but service providers for miners, also receive their earnings from the small-scale mining activities. The current structure of income tax is not able to harness these sources of fiscal revenue thereby failing to maximize on revenue productivity.

5.2.4 Customs Duties

The regime provides significant incentive to exploration and mine development as goods imported for that purpose are exempt from duties. The exemption also eliminates deadweight losses normally associated with import duties. Deadweight loss is the loss in consumer surplus which is not accounted for as transferred to government or to domestic producers, as a result of an import tax. In this regard the regime is efficient. While exemptions negate revenue productivity in the short-term, they promote a long-term view of revenue and create growth, a necessary condition for attainment of employment goals, social objectives (CSR) and sustainable development. These exemptions have been in place for years, which promotes risk reduction. They also promote technology transfer. However, duty rebates have been more difficult to obtain in recent years.

5.2.5 Withholding Tax

A rate of withholding tax on remittances and payments for external services of 15% is good for the country in terms of revenue. It also encourages the use of local services hence promotes local linkages. It encourages local finance and development of local stock markets. However, unaccompanied by development of local supplies capacity, this tax does not make sense; it is just an extra cost which inhibits technology transfer.

5.3 Experiences with Meeting the Objectives of Government Taxation

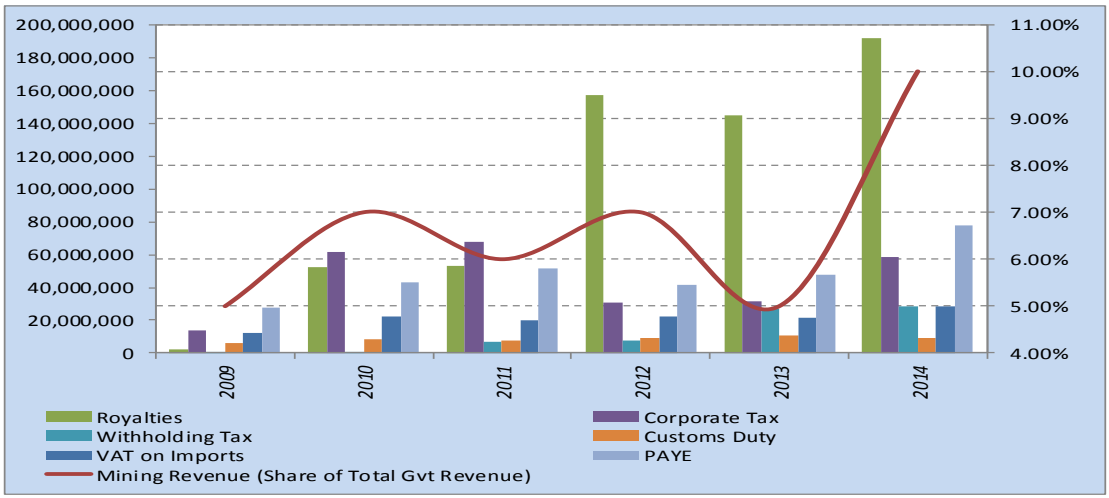
5.3.1 Revenue: Securing revenue to finance government programs

Governments seek to capture resource rents by using a number of fiscal instruments. Zimbabwe uses a combination of an economy-wide taxation system and resource-specific taxes. Taxation rates are generally set out in the legislation (the Mines and Minerals Act) thus subjecting all mining firms to the same fiscal terms. However, the government and investors have different objectives. Governments favour methods that are stable, transparent, equitable and guarantee a continuous flow of revenues to the fiscus. On the other hand companies, prefer a taxation system with the following attributes;

- stable and predictable,
- based on the ability to pay and allows early recovery of capital, but which do not distort production decisions such as cut-off grade or mine life, and
- which does not add significantly to operating costs.

Tax revenue heads for the mining sector improved since 2009 owing to reduction in royalties for some minerals, booming international commodity prices until 2013, and improved monitoring (Figure 1). Royalties seem to be the most stable revenue source. The share of mineral revenue to total tax revenue (including royalty) have also been increasing since 2013. For example in 2009 the whole mining sector paid a total US$50.61 million in taxes to government namely royalties, taxes on income and profits, VAT and customs duties and this later rose to U$335.88 million in 2014. The total amount paid constituted 5.4% of government tax revenue in 2009 compared to 9.56% in 2014.

Figure 1: Mining Sector Contribution to Government Revenue



Source: Ministry of Finance and Economic Development

5.3.2 Redistribution: Wealth Re-distribution Factor/towards an empowered society and growing economy

In the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZimASSET) economic blueprint, the government of Zimbabwe seeks to redistribute wealth through empowering the society and growing the economy. Utilising mineral taxation instrument such as royalties, the government intends to redistribute wealth from the private sector to public sector control.

According to the Chamber of Mines of Zimbabwe, approximately US$2 billion was generated as revenue by the mining sector in 2012, 17% was paid to the government in the form of taxes and other related charges and this represented 7% contribution to total fiscal revenue against the international benchmark of between 3-20%.The mining sector contribution to the fiscus is fairly comparable to the regional mining sector contribution to fiscal revenue with South Africa (12.2%), Zambia (13%), Tanzania (10%), Namibia (20%) and Swaziland (2%).

Through the Indigenisation and Economic Empowerment Act (General Regulation, 2010), the Government of Zimbabwe launched Community Share Ownership Trusts (CSOTs) in order to empower citizens residing in mining communities and to address historical imbalances. Under the community share ownership schemes, companies operating in a given area cede a 10% stake to the community and the money generated from the shareholding is then used to fund development projects such as building clinics, schools, roads and bridges (Mabhena and Moyo, 2014). However, the CSOTs and indigenization in general have been hampered by lack of clarity and consistence of policy as well as lack of transparency in their implementation.[16]

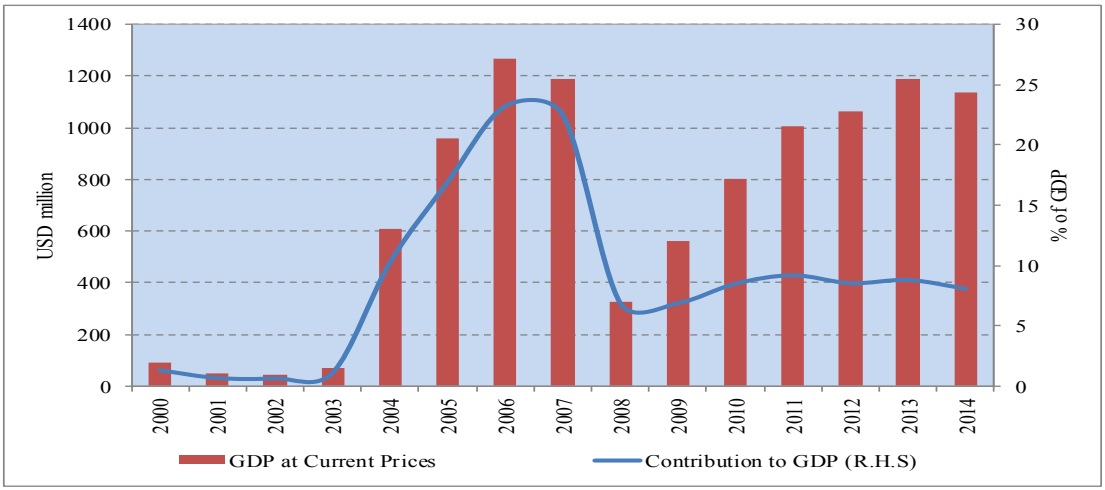
[16]The President on 11 April 2016 issued a statement that provided clarification on the indigenisation policy.

5.3.3 Representation: Promoting Investment and production in the mining sector

Royalties imposed by governments on mining operations are usually only part of the overall taxation on mineral deposits. Raising the level of taxation shifts toward the present the flow of benefits a country receives from its mineral sector over time. However, a higher tax level is likely to discourage exploration and mine development, and so reduces tax revenues to levels below what they would have been. Despite the rise in the importance of royalties in mineral revenue contribution in Zimbabwe, they are however considered as a regressive form of taxation and thus high levels of royalty rates can distort business decisions. High levels of royalties or mineral taxes would mean that reserves with low ore grades would have been calculated as uneconomic hence this would discourage production.

Following the government of Zimbabwe review of rates of mining royalties in 2012, whilst the mining sector contribution grew in absolute terms to US$1.064 billion in 2012 from US$ 1.006 billion in 2011, contribution to GDP declined by 0.7 percentage points whilst the mining sector contribution to economic growth rate slowed down from 2.1 percent in 2011 to 0.8 percent in 2012 (Figure 2).

Figure 2: Mining Sector Contribution



Source: Zimbabwe National Statistics Agency (ZIMSTAT)

Investors prefer profit based taxes like the CIT as their tax payments are deferred when they start operating until they have recovered their production costs. This is a progressive tax that targets the profit which is less than the gross income of the mining company. Most investors and entrepreneurs require the levels of royalties applied to reflect productivity and profitability as most production taxes impair revenue generation hence there is need to balance between tax payment and profitability of mining firms.

Mining fiscal regimes are largely designed to capture a fair share of the economic rent from mineral exploitation whilst also offering incentives for investment. However, the decision for investment is primarily based on after tax returns. Companies that are deciding whether to invest in a mineral project are largely influenced by the expected return after incorporating taxes and the risk associated with such investment. An important component of any assessment of risk is the perceived stability of the existing tax regime. Companies that plan to invest in mineral exploration are very wary of possible changes in the tax burden after their investment is made and no longer is mobile. Thus, there is need to strike a balance to sustain investment with governments' core objective of maximizing revenue. The tax policy is what is used in reconciling this interest. Thus, in designing a tax system that reconcile the interest of the government and the companies, three concepts have to be understood and applied. They are economic rent, discount rate and neutrality of fiscal regime.

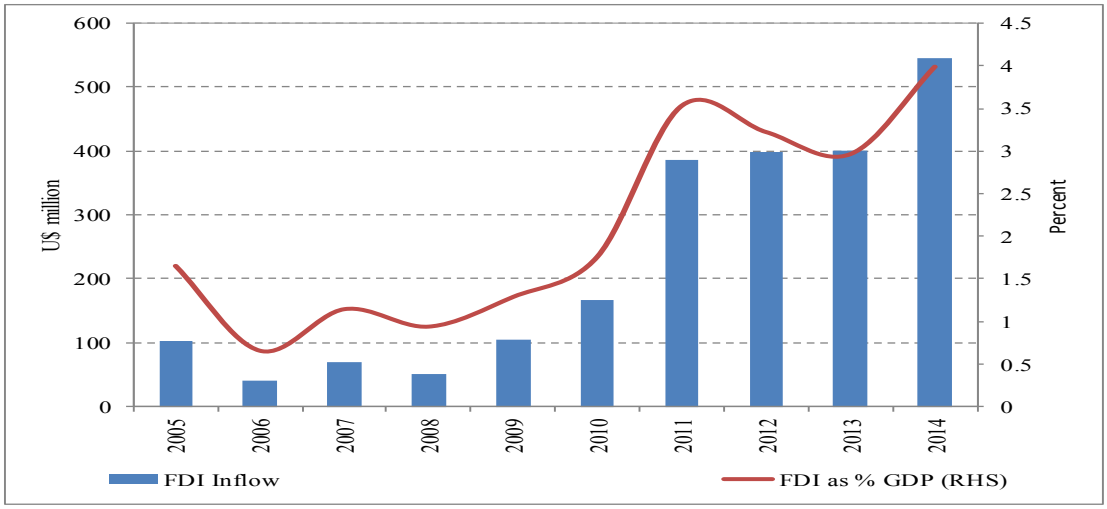
5.3.4 Repricing: Minimizing administrative burden and bureaucracy to improve the country's competitiveness and ease of doing business

Multiplicity of tax heads and collection agencies increases the administrative burden and bureaucracy by investors/entrepreneurs to invest in the country hence there is need to improve the country's competitiveness and ease of doing business. It is important to note that the domestic investment climate, particularly in the case of mineral-producing developing countries, greatly affects the ability of those countries to attract capital and technology from abroad.

Mining firms are sensitive to the taxation on their profitability and they certainly do not want frequent changes to either the base or the rate. They would also want their projects to be able to afford the taxation regime. The setting of the base and rate requires an equitable balance. When the amount collected is too low, there is public resistance because of perceived deprivation of benefits. When the royalty amount is too high, investors will seek alternatives, resulting in capital flow to competing destinations.

The mining fiscal regime in Zimbabwe is robust and coherent to some extent as the mineral royalty is not open to negotiation on a case by case, but a standardized rate is applied hence it does not place undue burden on those that administer royalty payments. However, despite the mineral royalty system being in line with international standards some elements of the tax regime has made Zimbabwe being ranked worst among the 10 least attractive jurisdictions for investment in the world according to the Fraser institute (2015). The tax regime in Zimbabwe was ranked low in terms of encouraging investment. Thus, the results of Fraser Institute Survey of Mining companies highlighted indicates that the tax regime in Zimbabwe is not investor friendly as the majority of respondents highlighted that the tax regime somehow impedes and is a deterrent to exploration investment in the mining sector. Mining is extremely capital intensive and reliant on FDI hence the impact of the fiscal regime on investor confidence cannot be underestimated.

Figure 3: Trend in investment in Zimbabwe



Source: UNCTAD/Zimbabwe Investment Authority (ZIA)

5.4 Qualitative Recommendations on Design of an Optimal Fiscal Regime and Addressing the Capacity for Revenue Collection and Administration[17]

In order to develop a long-term view of revenue productivity using royalties the paper recommends that: (1) any *in rem* based royalties be deductible for income tax purposes to avoid double taxation of profits; and (2) incorporate small-scale mines under the royalty regime by formalizing them, in order to broaden the tax base.

At a rate of 25%, the corporate income tax exacted on the general mining sector in Zimbabwe compares well with rates in the region and internationally, which helps maintain the country's competitiveness for mining capital. The lesser rate of 15% applied to special mining leases is good incentive for large mining ventures. Thus, in general the corporate tax regime meets the canon of efficiency. However, the regime makes no mention of depletion and depletion allowances. It is important to make allowance for depletion since the miner's livelihood is made vulnerable in that he/she relies on depleting resources. Additional profit tax exacted on mines holding special mining leases clearly has problems, apart from yielding income for government. While holders of special mining leases face a reduced CIT, the fact that they face additional tax implies a deadweight loss in administrative effort, hence loss in economy of tax collection. There may be need to remove the APT and just come up with one CIT rate applicable to SML holders.

Mineral resources rent tax is fraught with problems of concept and practice. Such tax would be applied in the short-run, whereas real economic rent is made in the long-run; it would kill the

[17]Based on Mupamhadzi *et al* (2014)

incentive for miners, not only to explore (to seek bonanzas), but also to innovate in order to turn marginal and paramarginal reserves into economic reserves. The argument that non-renewability create large rents has been disapproved by insignificant empirical measures of depletions (user costs), which also reduces the argument for high royalty rates. Surprisingly the resource rent tax or royalty based on resource rent have found disfavour both with governments and mining companies, though for different reasons – for the latter due to reasons given above, and for the former, revenue fluctuation.

A major issue with taxation in Zimbabwe is the multiplicity of tax heads applied to the mining sector. This has resulted in some revenue streams existing outside direct control of parliament. This fragmentation has created unnecessary burden of compliance (too many computations) on the part of miners and the burden of collection on the part of the authorities. The mines are concerned, at the end of the day with net (effective) tax and fees. Simplifying the tax system by reducing the number of tax heads would help especially as it would mean fewer registrations with ZIMRA and fewer tax returns to be completed. Thus, the major concerns about the current mining tax regime are the indiscriminate or fragmented approaches by different government departments in levying charges to mining companies, and the unpredictability of the mining tax regime. It is also cumbersome for potential investors to acquaint with the tax system, as there is no one stop destination where investors can get all information pertinent to the mining sector. Thus, there is need to have one document for the sector which explicitly outlines all the types of taxes, rates, fees, procedures, et cetera applicable to the mining sector.

Revenue productivity of the tax system is compromised by challenges related to collection. With respect to small-scale miners we note the problems of record-keeping, non-registration with ZIMRA, deliberate non-compliance, and difficulties with interpreting statutes. Revenue productivity is also compromised by low recoveries, in the short-term, and selective or destructive exploitation in the long-term. There is also suspicion from government regarding transactions between related parties or branches of same companies in Zimbabwe and in other countries. These range from transfer pricing (or profit shifting) through under-pricing of unrefined exports; re-invoicing and thin capitalization emphasizing high interest loans from overseas holding companies. There is the issue of registration and taxation of foreign contractors and expatriates which is sometimes not done because the mines are not aware of the requirements. The failure to include allowances and benefits such as (use of) vehicle, furniture and company house in calculation of PAYE has also compromised the revenue productivity of the PAYE system. These need to be included.

ZIMRA registration procedures and requirements in terms of documentation and record-keeping can be cumbersome for small-scale miners many of whom are artisanal and illiterate. For example, they must have bank accounts, complete registration forms, keep records of their operations and transactions for at least 6 years, make quarterly payments of provisional tax, and complete the quarterly and annual tax returns and submit to ZIMRA. It may not be a simple matter for small-scale miners to estimate their annual tax due for purposes of computation of the quarterly provisional tax. Thus, many small-scale and artisanal miners stay out of the formal tax system which minimizes

the revenue productivity of the tax regime as the small-scale mining sector is a significant section of the mining industry, especially gold sector. There is need to simplify requirements and procedures for the artisanal miners; and this has, to a great extent been achieved through the application of 1% royalty at the Fidelity Printers and Refiners.

6. Quantitative Results on the Case Study of the Gold Sector

6.1 Results on Econometric Estimation of the Cost Function

Estimation of the cubic cost function using LimDep V.7.0 gives the following results:

$$
\begin{array}{lllll}
c = 898.283 & + 30381.465q & - 35012.288q^2 & + 23921.454q^3 \\
\quad (1123.919) & \quad (10498.405) & \quad (24392.052) & \quad (14585.033) \\
t = \ (0.799) & \quad (2.894) & \quad (-1.435) & \quad (1.640) \\
R^2 = 0.9278 & df = 27 & & \\
\overline{R}^2 = 0.9197 & F_{3,27} = 115.58 & &
\end{array}
\qquad (3)
$$

It is clear that the first and second conditions for a valid cubic cost function below are satisfied.

$$\beta_0, \beta_1 \ and \ \beta_3 > 0$$

$$\beta_2 < 0$$

$$\beta_2^2 < 3\beta_1\beta_3$$

Likewise the last condition is also satisfied since (using rounded off estimates):

$$35012^2 < 3\,(30381)\,(23921)$$

Thus, equation (3) is a valid cubic cost function. The coefficient of q is significant since computed t value (2.894) is greater than the critical value (2.052) taken at 5% level of significance. The model as a whole is also significant. Firstly, the explanatory power of the model is 93% (meaning 93% of the variations in c are explained by changes in q). Secondly, the computed F value (115.58) is greater than the critical F value (taken at respective numerator and denominator degrees of freedom of 3 and 27). Thus, the run of mine significantly explains ore mining costs.

The estimated model (3) is used in generating cost measures in Appendix 5. Note that these costs are identical across levels and vary across run of mine. Normally increase in ore grades exploited only marginally (insignificantly) increases the mining cost per ton of ore mined for metallic minerals since the same amount of material is moved. However, it reduces the total average cost through reducing the concentration ratio (that is the amount of ore feed per ton of concentrate produced).

6.2 Results under the proposed scenario and current prices

As at 29 April 2016, the price of gold stood at $1,292.40 (Kitco website). This report shall use this as the current price. Table 5 summarizes the results on the Net Present Values and Government revenue for this scenario. Figure 4 and 5 respectively show the NPV and revenue graphed against the mining rate (ROM).

Table 5: NPV and Government Revenue under the Proposed Fiscal Regime and current Price

	LEVEL (CUT-OFF GRADE) 1			LEVEL (CUT-OFF GRADE) 2			LEVEL (CUT-OFF GRADE) 3		
	Annual Gvt Rev from mine	Annual Gvt Rev from whole sector	N.P.V.	Annual Gvt Rev from mine	Annual Gvt Rev from whole sector	Cumulat. N.P.V.	Annual Gvt Rev from mine	Annual Gvt Rev from whole sector	Cumulat. N.P.V.
ROM (T)	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m
300000	4.78	92.78	-4.88	5.20	100.94	-1.50	7.66	148.74	5.70
600000	11.98	232.62	1.11	11.73	227.71	1.97	14.55	282.39	6.26
900000	15.80	306.76	-2.12	13.78	267.52	-4.80	14.85	288.17	-3.67
1E+06	11.52	223.64	-19.46	6.64	128.84	-21.36	3.84	74.54	-17.32

Figure 4: NPVs for various combinations of ROM and Cut-off grades

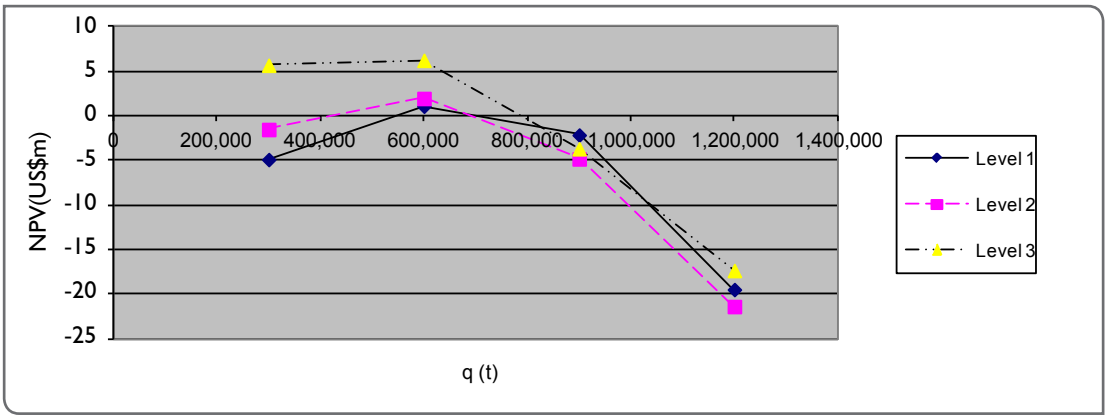
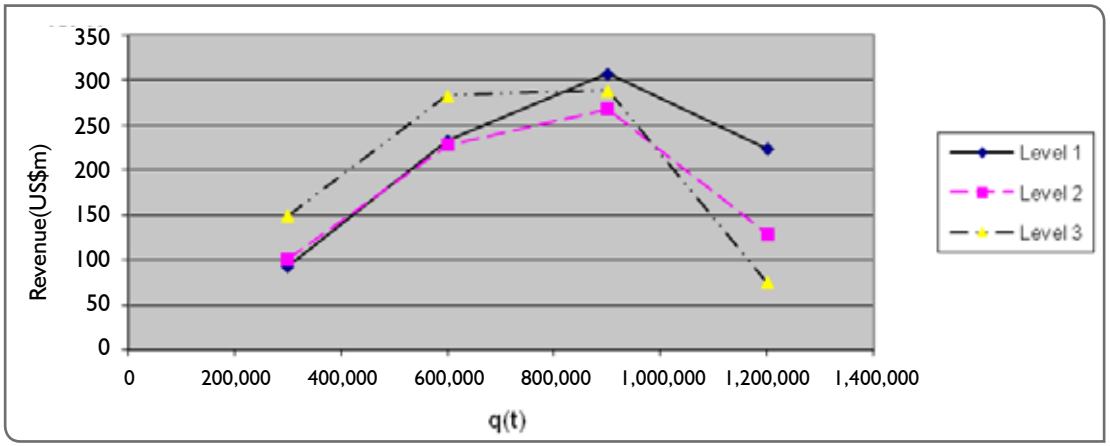


Figure 5: Annual Government Revenue for various combinations of ROM and Cut-off grades



From Table 5 and Figure 4, it is noted that for this scenario there are four combinations that are viable for the typical mine (with positive NPVs). Combination (600,000t, Level 3) gives the greatest NPV of US$6.26m. This is shown in Figure 4 where four combinations are above the horizontal zero line and level 3 (the black broken line) has got the highest peak. Levels 1 and 2 reserves are essentially sterilized by this scenario, save for mining rate of 600,000t. Thus, under this scenario the mine high-grades. Figure 4 also depicts that generally the NPV tend to fall with rapid extractions (beyond the 600,000t mark), which is probably due to decreasing overall industry profitability considering the high levels of required HRD and R&D expenditures associated with higher total costs and payrolls. The fall in NPVs eventually causes government revenue to fall (note that HRD and R&D expenditures are not dispensed to government).

Government revenue associated with the optimal combination is US$282.39m, which is not the highest possible under this scenario as shown in Table 5 and Figure 5. The figure shows that mining at the higher rate of 900,000 tons under level 1 and 3 would give the government higher annual revenues. The figure also shows that generally government revenue at all cut-off grades rises with rise in ROM up to 900,000 tons and then falls.

6.3 Results under the current fiscal scenario and current prices

The summarized version of the current fiscal regime is shown in Appendix 10. The corresponding results table and graphs are shown below (Table 6, Figures 6 and 7).

Table 6: NPV and Government Revenue under the Current Fiscal Regime and Prices

	LEVEL (CUT-OFF GRADE) 1			LEVEL (CUT-OFF GRADE) 2			LEVEL (CUT-OFF GRADE) 3		
	Annual Gvt Rev from mine	Annual Gvt Rev from whole sector	Cumulat. N.P.V.	Annual Gvt Rev from mine	Annual Gvt Rev from whole sector	Cumulat. N.P.V.	Annual Gvt Rev from mine	Annual Gvt Rev from whole sector	Cumulat. N.P.V.
ROM (t)	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m
300000	3.47	67.41	2.30	3.75	72.70	5.69	5.12	99.45	15.00
600000	7.95	154.37	18.56	8.04	156.12	15.05	9.92	192.63	17.54
900000	11.03	214.04	16.02	10.48	203.42	5.36	11.99	232.68	2.60
1200000	10.73	208.37	-13.25	9.10	176.57	-22.71	9.35	181.57	-21.19

Figure 6: NPVs for various combinations of ROM and Cut-off grades

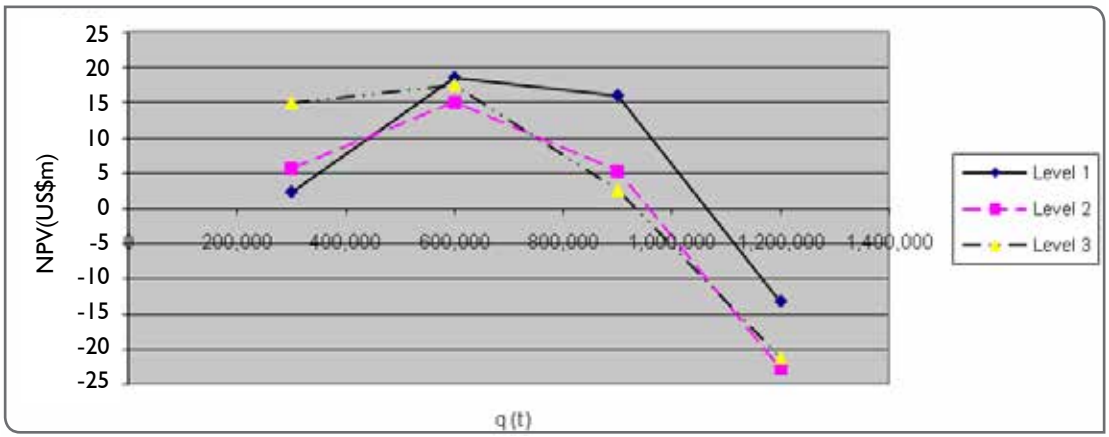
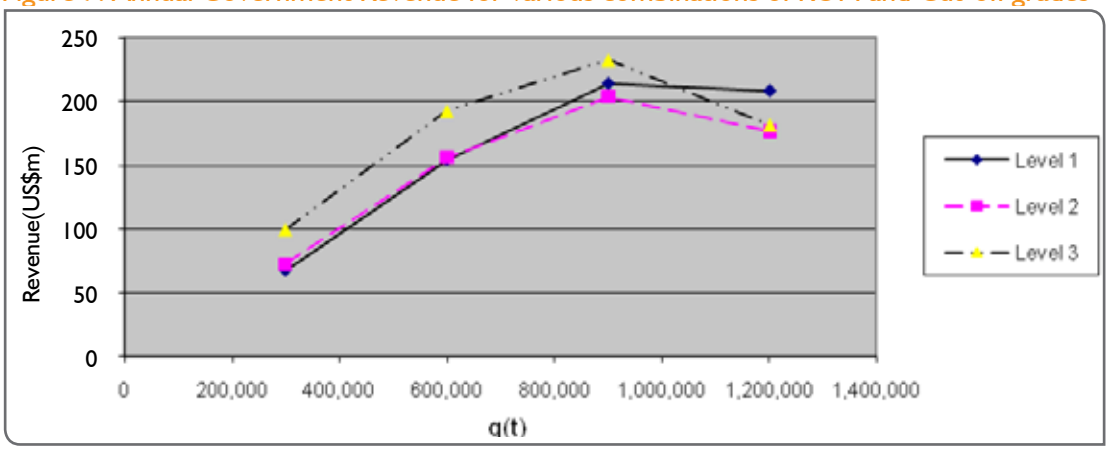


Figure 7: Annual Government Revenue for various combinations of ROM and Cut-off grades



From the above table and graphs the following are noted:

- Several combinations that were not viable are now viable (changing from negative to positive NPVs), leaving only three with negative NPVs. The optimal combination now exists at a lower cut-off (level) as compared to the proposed scenario, with NPV of US$18.56m (compared to just US$6.26m for the proposed scenario). There is essentially de-sterilization of resources, which when accompanied by an unchanged mining rate (600,000t) mean that mine life expectancies are increased, due to increased cumulative reserves.
- However, government revenue corresponding to the optimal mine choice falls to US$154.37m, despite the fact that royalty in this regime is pegged at a higher rate of 5% than in the proposed scenario (2%). This is probably explained by the fact that the current fiscal regime does not tax resource rent and there is no fiscal stabilization fund. With a few exceptions, generally government revenue falls at all levels and rates of extraction.
- While the optimal combination is still at the same capacity, this scenario change is expected to increase investment into the sector through the generally improved profitability and the increased economic cumulative reserves due to the ability to down-grade.
- Comparing annual net mine receipts (undiscounted cash flow) to annual government revenue from the sector, we find that the former is greater than the latter throughout the lifetime of the mine except in the investment year. While this might be interpreted to mean that the current fiscal regime favours the mining industry, the picture would be different if we were to introduce all forms of taxes, charges and levies at all levels of government. The probability is that the government position is favoured.

6.4 Results under the easiest fiscal regime among the four considered under current prices

A third scenario is: What would happen to profitability and government revenue if the fiscal regime were to be easier than the current regime? The easiest regime is depicted in Appendix 11. Table 7 shows the summarized results for this scenario.

Table 7: NPV and Government Revenue under easiest Fiscal Regime and current Price

	LEVEL (CUT-OFF GRADE) 1			LEVEL (CUT-OFF GRADE) 2			LEVEL (CUT-OFF GRADE) 3		
	Annual Gvt Rev from mine	Annual Gvt Rev from whole secto	Cumulat. N.P.V.	Annual Gvt Rev from mine	Annual Gvt Rev from whole secto	Cumulat. N.P.V.	Annual Gvt Rev from mine	Annual Gvt Rev from whole secto	Cumulat. N.P.V.
ROM (t)	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m
300000	1.23	23.78	20.87	1.32	25.68	22.85	1.83	35.62	31.77
600000	2.85	55.36	52.31	2.87	55.65	40.40	3.54	68.73	37.42
900000	3.92	76.05	53.55	3.67	71.20	30.22	4.15	80.64	19.96
1200000	3.64	70.66	18.44	2.94	57.15	-3.64	2.89	56.17	-8.83

Figures 8 and 9 graph NPVs and Government revenue for the various combinations under this scenario.

Figure 8: NPVs for various combinations of ROM and Cut-off grades

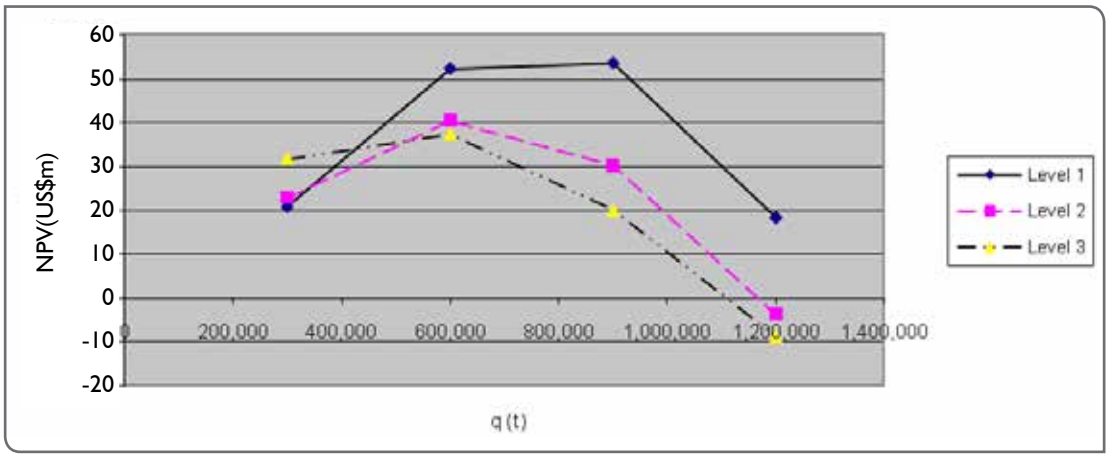
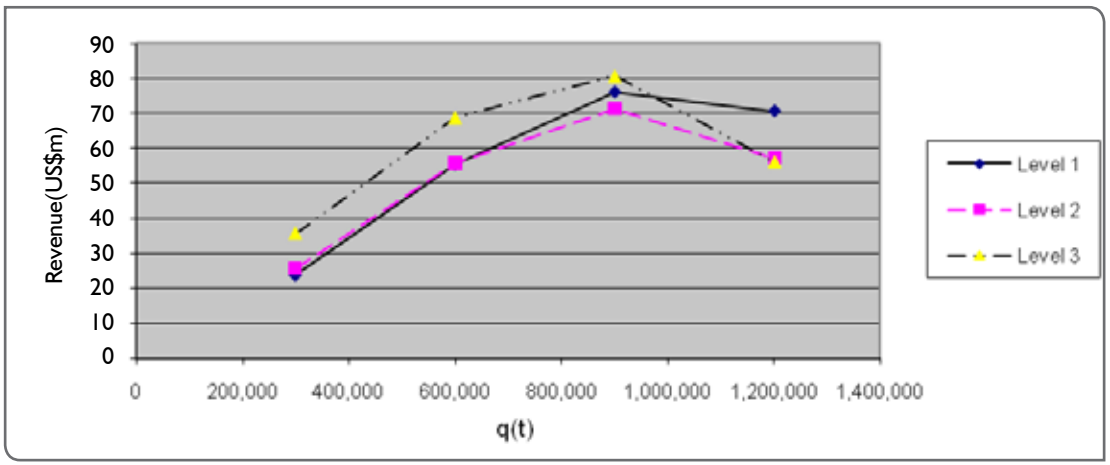


Figure 9: Annual Government Revenue for various combinations of ROM and Cut-off grades



Comparing with the base scenario (or even the current scenario which is a lot easier than the proposed base scenario) in this scenario all NPVs have gone up significantly, though still there are two combinations with negative NPVs (these are at the highest mining rate of 1,200,000 t paired with levels 2 and 3). The optimal NPV is US$53.55m obtaining at 900,000 t and level 1, giving government annual revenue of US$76.05m.

6.5 Results under a Harsher Fiscal Regime than the proposed scenario under Current Prices

A fourth scenario is: What would happen to profitability and revenue if the fiscal regime were to be harsher than the proposed? This regime is depicted in Appendix 12. This would make all combinations unviable except only three (see Table 8 and Figure 10). The typical mine will have to high-grade, with the optimal combination in level 3 and unchanged mining rate, hence reduced life expectancy compared to the current scenario. This gives an NPV of US$13.97m, which surprisingly is higher than the optimal for the base (proposed) scenario. Annual Government revenue (US$353.32m) consistent with the new optimum is higher than those under current scenario (US$154.37m) and base scenario (US$282.39m).

Table 8: NPV and Government Revenue under the a Harsher Fiscal Regime and current Price

	LEVEL (CUT-OFF GRADE) 1			LEVEL (CUT-OFF GRADE) 2			LEVEL (CUT-OFF GRADE) 3		
	Annual Gvt Rev from mine	Annual Gvt Rev from whole secto	Cumulat. N.P.V.	Annual Gvt Rev from mine	Annual Gvt Rev from whole secto	Cumulat. N.P.V.	Annual Gvt Rev from mine	Annual Gvt Rev from whole secto	Cumulat. N.P.V.
ROM (T)	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m	US$m
300000	6.02	116.90	-10.53	6.55	127.06	-2.86	9.57	185.71	12.46
600000	14.95	290.20	-7.15	14.69	285.06	1.65	18.20	353.32	13.97
900000	19.82	384.76	-13.17	17.46	338.85	-15.84	18.94	367.69	-1.22
1200000	14.98	290.84	-32.98	9.21	178.72	-29.57	6.14	119.09	-22.75

Figure 10: NPVs for various combinations of ROM and Cut-off grades

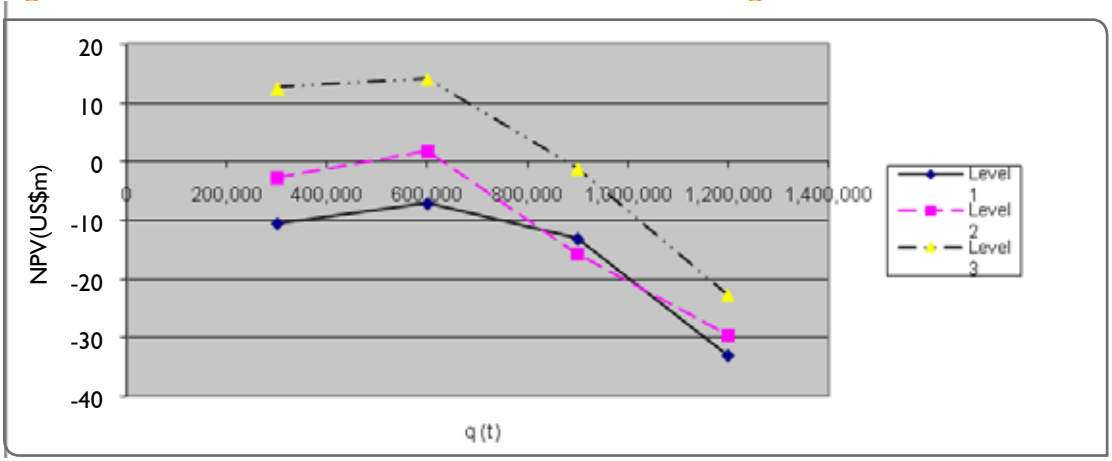
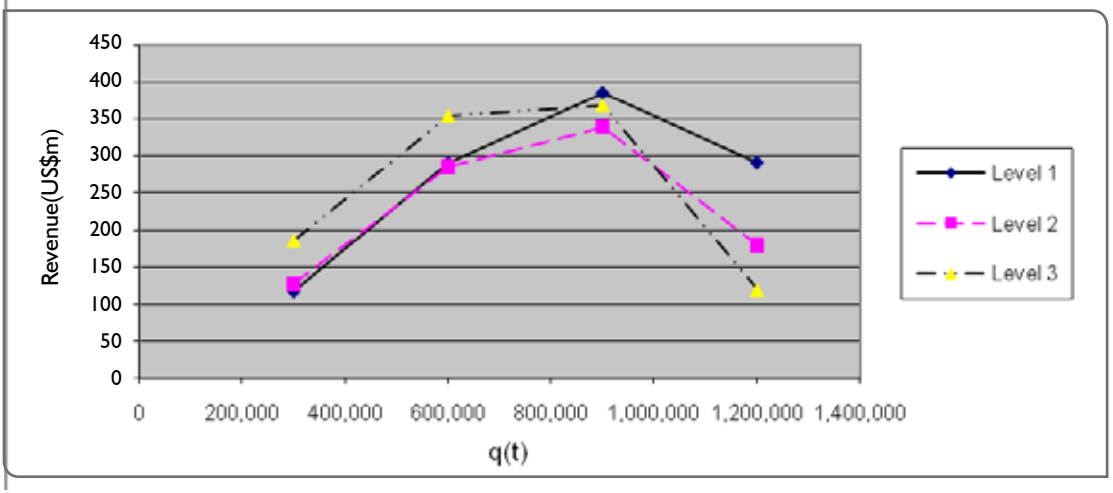


Figure 11: Annual Government Revenue for various combinations of ROM and Cut-off grades



6.6 Designing the optimal fiscal regime

The optimal fiscal regime seeks to balance industry competitiveness with the need for adequate fiscal inflows to government. Considering the four fiscal scenarios presented above under the current price, we need to consider the optimal combinations that would be decided upon by the typical mine under each scenario. These are the likely options actually chosen by the mine, and government revenue will follow from those mine decisions. Of these combinations we need to choose the best for the mine (highest NPV) and then the best for government (highest fiscal inflows) hence note their respective scenarios. The optimal fiscal regime is the one that lies half-way between the two scenarios (in other words we find the mid rates for all fiscal heads). It is noted that the highest optimal NPV of US$53.55m exists under the easiest scenario while the highest government revenue of US$353.32m obtains under the harshest fiscal scenario[18]. The half-way between the two regimes is presented in Table 9.

[18]Note however, that it may sometimes be necessary to talk of the total government revenue over the life of the mine rather than annual inflows. This is because, while government may reap high annual inflows because of a harsh fiscal regime, that may lead to closure of mine sooner or later, which would shorten the period of inflows. This may actually result in lower mine life-time fiscal payments than under an easier regime.

Table 9: Optimal Fiscal Regime and Related stipulations recommended

Item	Rate, %	Notes
CIT, %	25	That is, the current should be maintained.
Royalty, % of gross revenue	5.5	Royalty rates should slightly increase. These should be indexed to prices so that they are adjusted downwards when prices are depressed.
Mineral Export tax on unprocessed exports, % of gross revenue	0	The zero-rate is automatically maintained since all gold is marketed to Fidelity Printers and Refiners.
Fiscal Stabilization fund, % of RRT in $ terms	30	Be maintained as proposed as this is good for government and does not affect gold industry since this is at the revenue utilization level.
Exp. On HRD/R&D, % of pay-roll, which is in turn 36% of total costs	5	As proposed
Withh.tax on expat. Divid non tax haven, % of expat dividends	17	
Withh.tax on expat. Divid tax haven, % of expat dividends	19.5	
RRT, % of Resource Rent	25	So that government benefits from price booms.
Capital Gains Tax on exploration license transfers, % of the licence transaction value	30	It is good to discourage sale of licences in order to counter speculative behaviours. This would encourage mine development.
Pay roll, % of TC, assumption	23 - 36	Government together with industry need to work on reducing the cost of mining in general. Industry need to be innovative so as to increase labour productivity from the current 33 ounces per year towards South Africa's 41 ounces per year.
Normal profit, % of Total Cost (including depreciation), assumption	10	
Discount rate, %	20	RBZ needs to make effort to keep interest rates in check.

6.7 Effect of Price Changes on Government Revenue, Profitability, Production and Investment

The price of gold was increased successively by US$100 under the proposed fiscal scenario, beginning at US$1100 up to US$2000/oz. For each price level, government revenue, optimal NPV, mining rate, production level (in the form of marketable concentrate) and the extraction level (ore grade exploited) were noted. These are recorded in Table 10. Note that the concentrate output is

at grade 75.4% purity. Figures 12 to 15 depict the relationship between the price and each of the variables above.

Profitability and annual fiscal inflows from the gold sector increase monotonically with price under this scenario as shown in Figures 12 and 13. Government revenue also increases monotonically with increase in price as shown in figure 12. The price changes from US$1,100 to US$1,200, and from US$1,900 to US$2,000 result in steeper government revenue increases than the rest of the price changes because they are accompanied by increases in production capacities, which is not the case with the rest of the price changes in between (see further explanation in the next paragraph). Profitability at the lowest price of US$1,100 in this analysis is negative, which to some extent validates industry's recent argument, when the price stood at about US$1,080/oz, that the sector was making losses since unit production cost stood at about US$1,170/oz. If a price of US$1,100 were to be maintained, eventually the sector would close down, firstly the high cost mines, then lastly the low cost ones.

Table 10: Effect of Price Changes

Price, US$	Govt Reve, US$m	NPV, US$m	ROM, t	Concentrate, t	Level
1,100	90.65	-1.61	300,000	0.79	3
1,200	467.11	14.68	900,000	2.37	1
1,300	536.56	23.42	900,000	2.37	1
1,400	606	32.16	900,000	2.37	1
1,500	675.45	40.9	900,000	2.37	1
1,600	744.89	49.64	900,000	2.37	1
1,700	814.34	58.38	900,000	2.37	1
1,800	883.78	67.12	900,000	2.37	1
1,900	953.23	75.86	900,000	2.37	1
2,000	1,239.39	85.24	1,200,000	3.16	1

Figure 12: Price vs Government Revenue (GR)

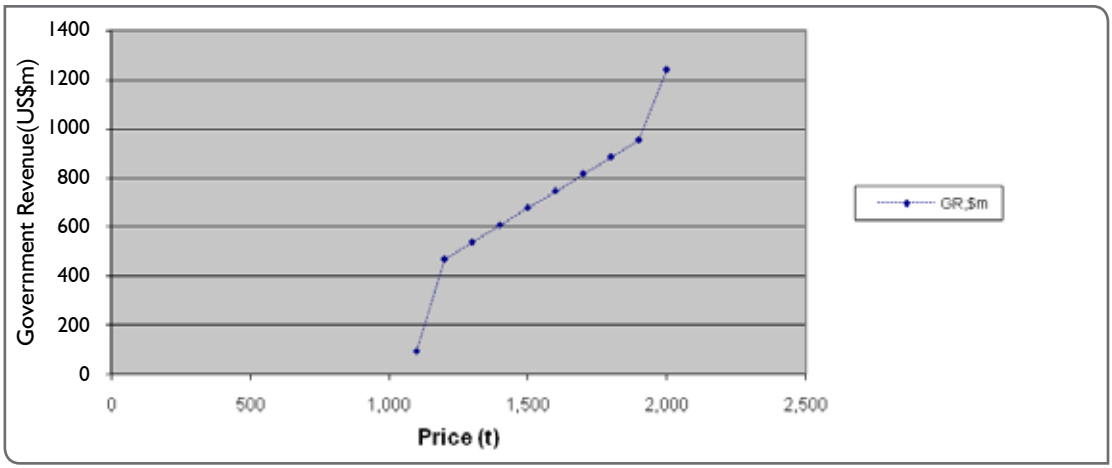


Figure 13: Price vs NPV

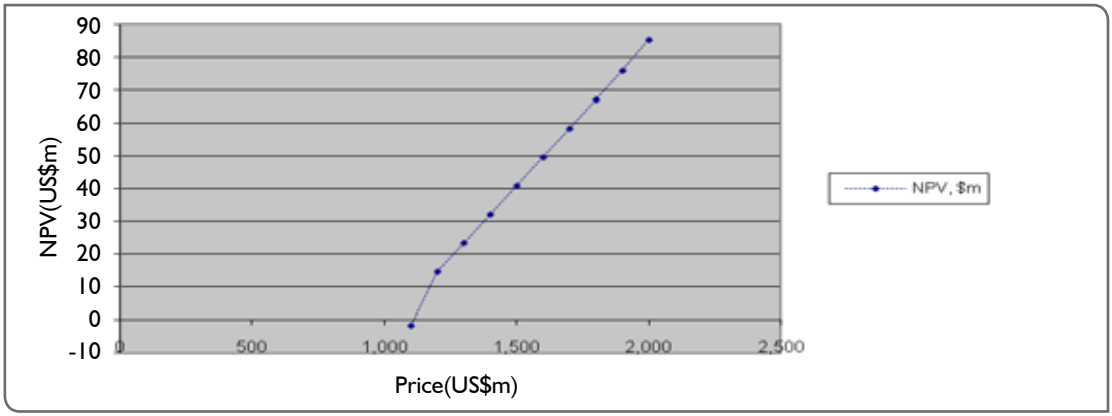


Figure 14: Price vs Mining Rate (ROM)

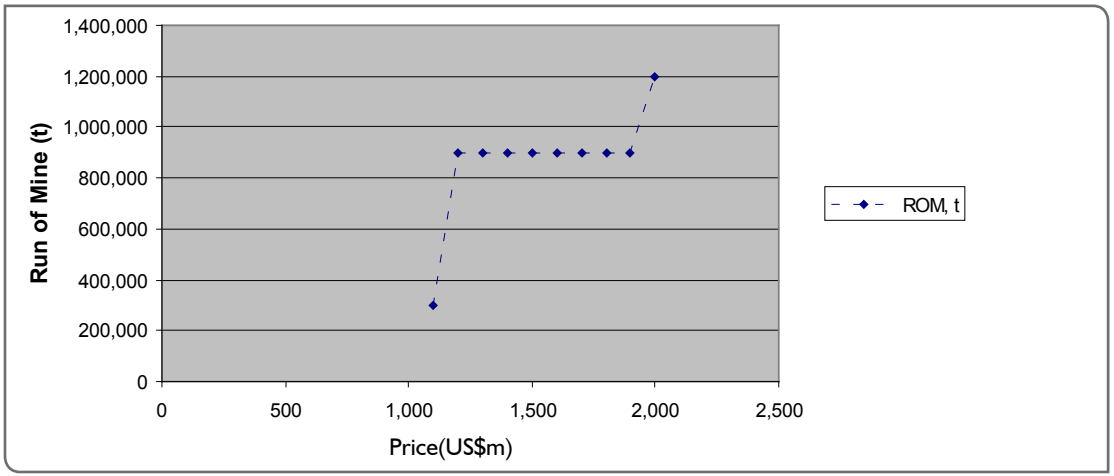
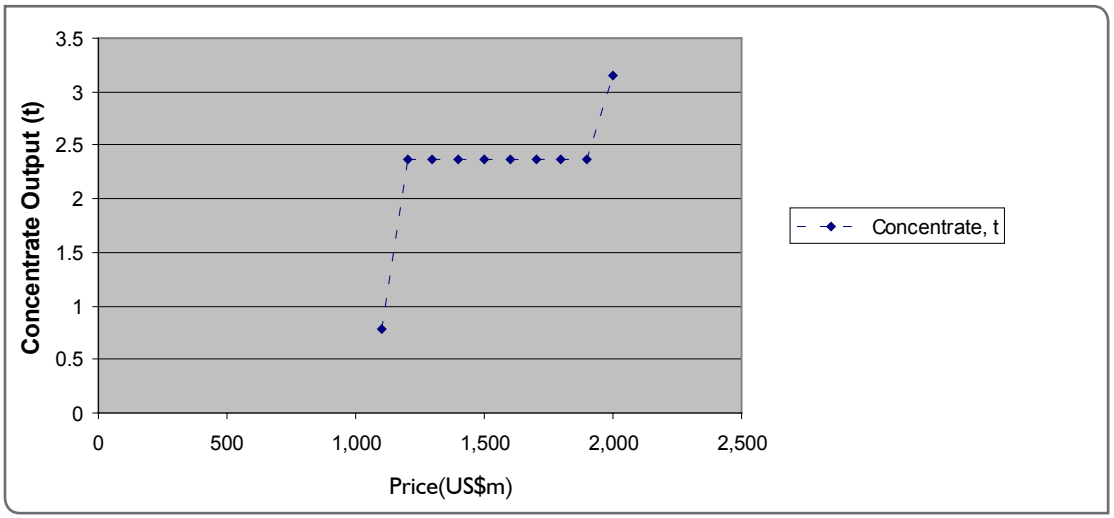


Figure 15: Price vs Concentrate Output



Of all the prices in the range, only the lowest induces high-grading to level 3, and this, at the lowest mining rate of 300,000t. Prices above US$1,200 are good enough to induce the utilization of the lowest cut-off grade in the range. The mining rate of 900,000t is maintained over a broad range of prices, and this, coupled with unchanged grades over the same range, explains why Figure 14 and 15 look identical. It would need a very high price of US$2,000 to induce a typical mine to increase mining rate beyond 900,000t. Thus, 900,000t represents the maximum capacity for a typical mine which is overstretching its actual capacity and that many gold mines in the country do not go beyond

that rate. In fact, it is a known fact that most mines in the gold sector are very small by international standards[19]. The broad range of prices might be accompanied by steady expansion programmes in order to increase capacity to 1,200,000 tpa. Thus, one would expect some investment activities over that range.

[19]For example, the tenth largest gold mine in the world is Boddington Mine in Australia, owned by Newmont (Basov, 2015). This mine produced 19.73 tons of gold in 2014, which was greater than the total production from the whole gold sector in Zimbabwe at about 15.39 tons. The largest gold mine in the world is Muruntau Mine in Uzbekstan, owned by Navoi, which produced 73.71 tons of gold in 2014.

7. CONCLUSIONS

Zimbabwe's corporate tax rate compares well with those charged in other mining jurisdictions, for example in Africa, Southern America and OECD countries. Zimbabwe has a special reduced rate for SMLs, a differentiation not found in other jurisdictions. It is therefore, concluded that the corporate tax rate in Zimbabwe is reasonably competitive compared to other FDI destinations, which has also been complemented by the fact that it has remained generally stable over time. The same can be said about withholding taxes, where some jurisdictions have maximum rates that are more than double the Zimbabwean rate of 15%, for example, Chile, Canada, Colombia, and Peru. As is the case in most mining countries such as Ghana, Tanzania, Peru, Colombia, Brazil, Chile, and South Africa, all mineral exports in Zimbabwe are VAT zero-rated (Trench et al, 2015). Given that mining companies can claim VAT input tax and are allowed to defer VAT payment on importation of capital goods, the VAT regime in Zimbabwe is apparently more generous than in other jurisdictions. The same conclusion is reached on skills development levies. There are also many incentives availed to the mining industry in Zimbabwe including the reduced corporate tax rate on SMLs, unrestricted carryover of losses, rebates on imported capital equipment, allowance of interest on debt to a certain threshold, and allowable deductions on various contributions to the economy and community including scholarship funds, Community Share Ownership Trusts, research institutions, *et cetera*.

The main sticking points on the mining fiscal regime in Zimbabwe are the royalty and the multiplicity of the regime in terms of tax heads and collection agencies and regulatory instruments. For some minerals mining royalties in Zimbabwe are high relative to other mining jurisdictions. This coupled with the fact that they are *in rem* (based on gross revenue, not profit), which makes them an effective variable cost of production, could have resulted in resource sterilization. Their *in rem* nature also means that they are exacted on both profit making and loss making mines alike, resulting in some mines (especially the low-grade and high-cost ones) closing down. This is contrasted with Canada where, though the royalties are high, they are *in personam* (profit-based); and in Australia where, though high and *in rem*, they are deductible for corporate income tax purposes.

Assessment of the fiscal regime in terms of taxation best practice is a bit tricky. It is noted that the royalty regime in Zimbabwe is simple to implement, limits tax evasion and is highly revenue productive because of its *in rem* nature. However, that very same *in rem* nature promotes a short-term view of revenue productivity because of inefficiency (its ability to affect decisions through

affecting variable costs). Its instability has also created significant risk for investors. That the regime can tax loss making firms makes it inequitable (not sensitive to the ability to pay). Non-deductibility for income tax implies double taxation of profits. Thus, royalty, assessed in isolation promotes short-term revenue productivity at the expense of efficiency and long-term revenue productivity. Considering that ideally royalty setting should be based on either a notion of ownership transfer fee or depletion charge (user cost), the current basis results in its overestimation. For CIT the converse tends to be true. There is a trade off of revenue productivity (especially when prices are depressed and costs structures high) for efficiency (due to the *in personam* nature), with the latter strengthened by the fact that it is reasonably rated. The main problem with CIT, in terms of best practice, is that it is complex to compute and subject to falsification by companies (especially of costs). The Zimbabwe mining fiscal regime has very generous incentives. These have tended to negate revenue productivity in the short-term, while promoting long-tem revenue productivity and growth of the sector. Withholding tax is an efficient head, but would make sense if accompanied by measures to develop local supply capacity of both materials and services.

Apparently, in terms of taxation best practice, the main question to consider in the Zimbabwean case is: which is more important, short-term revenue productivity (which tends to be insensitive to sterilization) or long-term revenue productivity (which is equivalent to efficiency of the fiscal regime)? It appears both short-term and long-term revenue productivities are important; hence there is need for a balance. The government has serious demands for revenue now, and industry needs to see a positive profitability horizon (so does government). One might conclude that the royalty regime seems to balance out with the fiscal incentive regime since the latter reduce short-term government revenue. Any changes on the two will have to be marginal. This leaves other profit-based taxes (in particular, withholding tax and resource rent tax), regulatory issues that promote economic development and sustainability (especially knowledge intensive initiatives – that is, HRD and R&D), and improvement in the efficiency of tax collection and administration.

The mining fiscal regime in Zimbabwe has not performed well in terms of meeting government objectives. While fiscal revenue from the sector has generally improved (both in absolute and relative terms) over time since 2009, the revenue is obviously not enough to address the needs of government. This is why the government has indicated that it is not getting enough from the minerals sector. Redistribution objective has also not been achieved as the process has tended to be defined simply by the mine cost structure (supplies, utilities, workers, and taxes/government). Community Share Ownership Trusts and Employee Share Ownership Trusts have not been very successful due to lack of clarity on the indigenization policy. The difficulty (lack of ease) of doing business has remained a sticking point in investment promotion. The tax structure has remained complex (multiple tax heads) and its administration equally complex (multiple regulatory instruments and collecting agencies).

From a qualitative point of view the study makes several recommendations on an optimal fiscal regime. There is need to make royalties deductible for income tax purposes to make the regime more efficient, and also to enhance the formalization of the artisanal and small-scale mining sector

so that more royalties can be collected. For SMLs there is need to do away with the APT and consolidate the general mining CIT with the special CIT, which will improve simplicity and economy of collection. While there is some attraction to apply the RRT, it should be implemented at a moderate rate. To reduce the burden of compliance and administration, there is need to simplify the fiscal regime to a few heads, regulations and collecting agents. This is especially necessary for the artisanal and small-scale miners, who, in addition, need education on simple book-keeping and basic technical issues of mining and processing.

The quantitative analysis leads to a number of conclusions. Generally, annual government revenue inflow under all fiscal scenarios tends to fall as the mine increases capacity beyond 900,000 tons run of mine. Profitability (NPV) of the typical mine generally falls beyond 600,000 tons. This could indicate that a typical gold mine in Zimbabwe is capitalized up to about 600,000 tons ROM and any operations beyond that imply higher costs associated with capacity deficits. The fall in government revenue beyond the 900,000 ton mark is even steeper when the tax rates on all tax heads are higher and there are more stringent HRD and R&D expenditure requirements as in the proposed fiscal and harshest fiscal scenarios.

A fiscal scenario which is characterized by reduced rates on major tax heads (royalties, CIT, withholding taxes and resource rent tax) results in increased mine viability at all grades and mining rates, hence in low-grading, resulting in de-sterilization of resources. In more extreme cases this is accompanied by increased mining rates. Thus, ore grades exploited are more sensitive than mining rates to changes in fiscal rates; hence mine lives tend to increase under reduced fiscal rates, whereas the converse would normally be expected. This brings with it high NPVs, but reduced annual government inflows. The highest annual fiscal revenue inflows are experienced when the highest fiscal rates are charged, in which case mine viability will be at its lowest and mines high-grade and slightly moderate their mining rates. This leads to lower mine life expectancies hence the high government inflows are experienced in the short-term as mines soon close. Note that investment values normally follow NPVs. It is noted that the proposed fiscal scenario and the stipulations on HRD and R&D are estimated to increase annual government revenue by 83% (about US$128m), but would reduce mine viability by 66% and sterilize resources. However, mining as a business venture would remain profitable.

Under the current fiscal regime annual net mine receipts (undiscounted cash flow) are greater than annual government revenue from the sector throughout the life of the mine except in the investment year. While this might be interpreted to mean that the current fiscal regime favours the mining industry, the picture would be different if we were to introduce all forms of taxes, charges and levies at all levels of government. Assuming that there is efficient revenue collection and no illicit financial outflows from the mining industry, the probability would be that the government position would be favoured. However, because of the suspected existence of illicit flows and very inefficient revenue collection the actual situation remains unclear.

An analysis of different price scenarios under the proposed fiscal regime yields two conclusions. Mine viability and annual fiscal inflows tend to increase almost monotonically with price. Both mining rate and concentrate output tend to be maintained over a broad range of prices due to capacity limitations of the current mines.

This study proposes a slightly different (but similar) fiscal regime to the base scenario recommended in the 2012 mining sector policy study. The envisaged optimal mining fiscal regime would require the following changes to the current fiscal regime: (i) a slight (10%) increase of royalty from 5% to 5.5% after royalty to make it a slight (10%) increase of royalty from 5% to 5.5%; (ii) maintain the corporate income tax rate at 25%; (iii) adopt the HRD and R&D proposed in the 2012 study as a percentage of payroll; (iv) peg withholding taxes at 17% and 19.5% for non-tax haven and tax haven destinations respectively; (v) apply a resource rent tax of 25% of resource rent (assuming a normal profit of 10% of total costs); and (vi) increase effort by government in conjunction with mining industry to reduce labour cost from the current 36% of total costs to 25%.

However, the quantitative analysis does not seek to prescribe the number of tax heads or to seek the simplification of the fiscal regime. This argument has been made under the qualitative analysis. It is important to note that this model remains useful whether one has simplified the regime to a few tax heads or has increased them. The model, would be useful in analysing the benefits of either option from the perspective of government revenue and industry competitiveness.

8. Limitations of the Study and Suggestions for Further Research

We have already indicated that the study only covers the gold sector and the results, while they can be scaled up from the typical (average) gold mine to the gold sector level, they cannot be used to deduce results for the whole mining sector. However, the model developed for gold can be used for any other mineral by simply populating the model with the technical and financial data or information pertaining to the mineral being analyzed, albeit with some adaptation dictated by the specific nature of the mineral being analyzed. The analysis could be extended to other minerals with increased access to disaggregated data, through the Chamber of Mines of Zimbabwe.

The use of this model, its further development and updating, is limited by accessibility of comprehensive data on the mining sector, in particular mine level data. Currently, the Ministry of Mines and Mining Development is involved in two initiatives, which when fully implemented, would provide enough information to operationalize and even improve it by introducing more variables or parameters and increasing its coverage to the mine population. The two initiatives are the cadastre system and the databank project. The former seeks to computerize the title management system. This would obviously improve the mine coverage as well as make it possible to incorporate geographical spread into the analysis.

The databank project would provide comprehensive information required by all mining stakeholders including government, tax authorities, potential investors, current miners, researchers and the academia, et cetera. Thus, this project would be supported by primary data gathering processes made possible by the decentralization of the Ministry of Mines and Mining Development to provincial offices together with the design of a standard data collection tool applicable at mine level.

Clearly, a number of issues which the study initially hoped to cover have not been covered due to data challenges and these remain areas for further research. The specific objective to estimate the additional revenue from the proposed royalties and taxes has been addressed only relative to the tax heads in the proposed regime (which leaves out many other taxes, fees and charges) and also as computed from the model (both for current revenue and new revenue by applying the current rates and the proposed rates respectively). Trying to include every form of fiscal charge

would make the conception of the model complicated right from the beginning. The mine fiscal model (quantitative model) predicts fiscal revenue only on the basis of prices and fiscal scenarios and not on the basis of changes in production levels and cost structures. This is because the latter two are largely endogenous while the former two are exogenous. For example, production level is a function of the price and the operating environment. Cost structure changes would require a separate detailed modelling of costs, which could not be managed in the time and scope of the current study.

The quantitative model has not attempted to compute the effective rate of taxation in the mining sector. While this would have added value to the paper in terms of fiscal recommendations, a complete effective tax rate would require that all tax heads be included in the model, which would make it more complicated. In future studies this is a recommended objective, which could be computed sequentially by incrementally making the model more complex. Also further studies could attempt a retrospective estimation of fiscal revenues based on actual historical changes in fiscal regimes, which will be a proper test of the model, though this would likely run into data problems at mine level. This study acknowledges that there are numerous (almost countless) possible simulations that can be done. However, the approach adopted in the study and the results are indicative of a possible approach forecasting revenue, depending on improved accessibility of disaggregated mine level data.

The use of the model for control purposes would be on a trial and error basis (that is, the policy maker would try various fiscal scenarios as done for a few scenarios in this study, and find which scenario yields the required revenue target). Recommendations on improving state capacity to administer the new fiscal regime has not been comprehensively treated separately from the general critique of the fiscal system because the proposed fiscal regime has, apparently for analytical simplicity, been made less complicated than the raft of fiscal charges under the current regime.

References

1. Bai, J. & Zeitlhofer, M. (n.d.). *Developing a Microsimulation Model to Forecast Australian Company Tax Revenue*. Modelling Development Unit, Australian Taxation Office. Retrieved 30 March 2016 from http://www.mssanz.org.au/MODSIM99/Vol%202/Bai.pdf. Also retrieved 13 April 2016 from www.mssanz.org.au/MODSIM99/Vol2/Bai.pdf.
2. Basov, V. (2015). The world's top 10 gold mines. Retrieved 15 June 2016 from http://www.mining.com/the-worlds-top-10-gold-mines/
3. Bastable, C.F. (1903). Chapter VII: The Canons of Taxation. Chapter of *Public Finance*, 3rd Edition, revised and enlarged, Macmillan, London. Chapter retrieved 15 October 2013 from http://oll.libertyfund.org/title/275/35256
4. Burns L (2015), Mining Resources: Regulation and Revenue Management Overview of Fiscal Regimes for Extractive Industries, Presentation at Australia awards, The University of Sydney, February 2015
5. Chamber of Mines of Zimbabwe (2014). 2014 Annual Report. Harare.
6. Chamber of Mines of Zimbabwe (2015). 2015 Annual Report. Harare.
7. Chimsasa, L. (1996), Mining in Zimbabwe: The Impacts of Economic Structural Adjustment Programme on Small-Scale Mining. Dissertation (unpublished) for the LLM Degree in Resource Law and Policy: Specialization in Mineral Law, Policy and Economics. *Centre for Petroleum and Mineral Law and Policy, University of Dundee*.
8. Christian Aid and SOMO (2011). An Outline Of The Mining Taxation Regime In Zimbabwe; Zimbabwe Environmental Law Association (ZELA), http://hrbcountryguide.org/wp-content/uploads/2013/10/Mining-Taxation-in-Zimbabwe.pdf
9. Cobham, A (n.d.). Taxation policy and development Oxford Council on Good Governance http://www.taxjustice.net/cms/upload/pdf/OCGG_-_Alex_Cobham_-Taxation_Policy_and_Development.pdf
10. Deloitte, International Tax Highlights 2016, https://dits.deloitte.com/, various countries
11. Fraser Institute Annual Survey of Mining Companies: 2015 https://www.fraserinstitute.org/sites/default/files/survey-of-mining-companies-2015.pdf
12. Gamboa, J.S.A. (2002). Development of Tax Forecasting Models: Corporate and Individual Income Taxes. *Philippine Institute for Development Studies, Discussion Paper Series N0. 2002-06*. Retrieved 30 March, 2016 from http://unpan1.un.org/intradoc/groups/public/documents/apcity/unpan005056.pdf.

13. Gentry, W.D. & O'Neil, T.J. (1984), Mine Investment Analysis. *Society of Mining Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers*, New York.
14. Hawkins, T. (2009), The Mining Sector in Zimbabwe and its Potential Contribution to Recovery. *UNDP Zimbabwe Comprehensive Economic Recovery in Zimbabwe Working Paper Series, Working Paper 1*. Retrieved December 22, 2009, from UNDP website: http://www.undp.org.zw.
15. Hesketh J. (1997). *Head Office Administration Costs*. British Columbia Ministry of Employment and Investment Information Letter. Retrieved 05 May 2016 from https://www.sbr.gov.bc.ca/documents_libraries/notices/MTA11.pdf.
16. Jourdan, P; Chigumira, G; Kwesu, I and Chipumho, E (2012), Mining Sector Policy Study, ZEPARU Working Paper Series
17. KPMG (2014), Trends in taxation kpmg.com/mining, KPMG Global Mining Institute https://www.kpmg.com/BR/PT/Estudos_Analises/artigosepublicacoes/Documents/Tax/trends-in-taxation.pdf
18. Lupane Gas Development Company (LUPGAS) *2004 Reports*
19. Mabhena and Moyo (2014)
20. Macku, V., Ostensson, O. and Fortunato, P. (2010). *Group Activity on legal framework for investment in Mali*. Hand out at UNCTAD Virtual Institute Workshop on the Teaching, Research and Policy Design of Natural Resources and Economic Development, Dar-es-Salaam, Tanzania, 12-16 July 2010.
21. Minh Le, T. (n.d.). *Tax Base and Revenue Forecasting*. Paper presented at Workshop on Public Finance Management in Bhutan, Washington D.C., August 16-20, (year?).
22. Ministry of Mines and Mining Development, MMMD (2011). *Investing in the Mining Sector in Zimbabwe, "Unlocking our mineral resource potential"*
23. Mlambo, L. (2010). *Zimbabwe Geological Report*. Report prepared for the Raw Material Group, Sweden.
24. Mlambo, L. (2012a). A Simple World Market Model for Gold: Assessing the Significance of the Model and its usefulness in Prediction. In Hoque, T. (ed.) (2012), *Proceedings of Fourth Annual American Business Research Conference*, New York. Accessible at: http://wbiconpro.com/215-Lyman.pdf. 4-5 June, 2012.
25. Mlambo, L. (2012b). Estimation of Resource Depreciation and Scarcity Using the Hotelling Rent Concept: Application to Two Base Metal Resources in Zimbabwe. *International Journal of Physical and Social Sciences (IJPSS), Vol.2, Issue-12, pp.470-498, December.*
26. Mlambo, L. and Mungoni, M. (2011). Tantalite Production in Zimbabwe and the Role of World Price Trends in the Past Three Decades. *Global Conference on Business and Finance Proceedings, Vol. 6, No. 2*, pp. 226-235, San Jose, Costa Rica, May 24-27, 2011.
27. Mugandani, E.T. &Masiya, T.T. (2011). *Introduction to Basic Geology and Extraction of Metals*. Short Course in Mineral Identification and Metal Extraction Products Identification for MMCZ: Inspectorate & Monitoring Department, University of Zimbabwe, Harare.

28. Mugumbate, F. (2010). *Exploration Opportunities in Zimbabwe*. Zimbabwe Geological Survey. Retrieved 17 February, 2012, from http://zimminingindaba.com/uploads/2010%20Presentations/Indaba%202%20of%207/Mineral%20potential%20of%20Zimbabwe%20-%20Forbes%20Magumbate.pdf.
29. Mungoshi, J. (2014). *Resuscitation of Zimbabwe's Iron and Steel Production Industry: Risks and Opportunities*. Paper presented at the IMR-Chamber of Mines Beneficiation Conference, 27-28 February 2014, Elephant Hills Resort, Victoria Falls.
30. Mupamhadzi, D.(2016). Value Chain Analysis Report. Done for CBZ.
31. Mupamhadzi, D., Kwesu, I. & Mlambo, L. (2014). *A Critical Review of the Mining Fiscal Regime in Zimbabwe: Towards an Optimal Structure*. Report done for the Chamber of Mines of Zimbabwe.
32. Otto, J., Andrews, C., Cawood, F., Doggett, M., Guj, P., Stermole, F., Stermole, J. and Tilton, J. (2006). Mining Royalties (A Global Study of Their Impact on Investors, Government, and Civil Society). *Directions in Development (Energy and Mining)*. World Bank.
33. PricewaterhouseCoopers, http://taxsummaries.pwc.com/uk/taxsummaries/wwts.nsf/ID/tax-summaries-home, various countries
34. Roussos, P. (1988). *Zimbabwe: An Introduction to the Economics of Transformation.* Baobab Books. Harare
35. Rudawsky, O. (1986). *Mineral Economics: Development and Management of Natural Resources*. Developments in Economic Geology 20, Elsevier. Amsterdam.
36. South African Revenue Service (SARS), http://www.sars.gov.za/
37. Tina, S. (2009). *Canons of Taxation (Basic Principles of Taxation*). Retrieved 15 October 2013 from http://www.conveylive.com/a/Canon_of_Taxation.
38. Trench, A., Gemell, C., Venables, T., Curtis, M. & Sykes, J. (2015). *Evaluating the Attractiveness of Fiscal Regimes for New Gold Developments: African and South American Peer Country Comparisons*.
39. Tutor2 (n.d.). Tutor2u (…). *Principles of a Good Tax System*. Retrieved 15 October 2013 from http://www.tutor2u.net/economics/content/topics/fiscalpolicy/tax_principles.htm
40. www.kitco.com
41. Zimbabwe Environmental Law Association, ZELA (2012). *An Outline of the Mining Taxation Regime in Zimbabwe*. ZELA. Harare.

Appendix

Appendix 1: The Survey Questionnaire

Mineral mined: .....

MINING AND PROCESSING TECHNICAL DATA

1. What is the current cut-off grade for your mine (g/t)? (i).....g/t

2. What two other possible cut-off grades have you exploited/considered or would possibly consider in future? (ii).....g/t; (iii).....g/t

3. Please indicate against each of the three cut-off grades, the respective cumulative reserves (with the lowest cut-off having the biggest reserve figure and vice-versa).

Cut-off grade, g/t	**Cumulative Reserves, tons**
(i)	
(ii)	
(iii)	

4. What is your current ore recovery rate in mining (%)? (i).....%

5. How would the above (ore recovery rate) change if the mine were to choose each of the other two alternative cut-off grades? (ii).....%; (iii).....%

6. What is your current plant recovery rate (in processing/concentration) (%)? (i).....%

7. How would the above (recovery rate in concentration) change if the mine were to choose each of the other two alternative cut-off grades? (ii).....%; (iii).....%

8. What is the grade of your final marketed product (processed output) (e.g. concentrate, matte, etc)? .....g/t or .....% mineral content.

MINING AND PROCESSING FINANCIAL DATA

9. What is your current mining cost per ton of ore mined? (i).....US$/ton of ore

10. How would the above change if you were to mine at the other alternative cut-off grades? (ii).... US$/ton of ore

11. What is your current average concentration cost (per ton of concentrate)? .....US$/ton or oz of concentrate

12. Please indicate your production (in tons of ore) and the respective total mining (excluding concentration) costs for the past 5 years (2011 – 2015). Fill Table below.

Year	Ore Mined, tons	**Total** Cost of Mining Ore, US$
2011		
2012		
2013		
2014		
2015		

13. What is the initial capital investment required for your current capacity/ROM (assuming you were operating at full capacity)?.....US$

14. What is the estimated salvage value (at mine closure) as a percentage of the total capital investment?.....%

Appendix 2: Original Mine Data

CUT-OFF GRADES FROM THE SEVEN SURVEYED MINES (g/t)

Mine	1	2	3	4	5	6	7
Level 1	1.65	2.50	2.00	3.86	1.80	1.99	1.99
Level 2	1.82	2.68	2.06	4.00	2.00	2.07	2.07
Level 3	2.00	2.69	2.07	4.69	2.16	2.10	2.10

CUMULATIVE RESERVES FROM THE SEVEN SURVEYED MINES (t)

Mine	1	2	3	4	5	6	7
Level 1	13,200,000	10,698,000	13,548,000	1,863,207	548,000	3444490	409980
Level 2	7,000,000	6,736,000	8,852,000	1,224,425	390,000	2420690	269040
Level 3	5,600,000	3,040,000	4,537,000	608,000	207,000	1196880	133519

RANGE OF ROMS FROM THE SEVEN MINES THAT HAVE BEEN ACTIVE IN PAST 5 YEARS (t)

Mine	1	2	3	4	6	7	
Lowest ROM	950,587	277,000	243,000	78,000	47,308	78,324	
Highest ROM	1,215,089	346,945	291,916	108,000	92,670	123,287	

ORE RECOVERY RATE IN MINING FOR THE SEVEN MINES (DECIMALS)

Mine	1	2	3	4	5	6	7
Level 1	0.91	0.88	0.90	0.90	0.85	0.95	0.75
Level 2	0.89	0.85	0.85	0.85	0.85	0.95	0.72
Level 3	0.87	0.85	0.85	0.85	0.85	0.95	0.67

RECOVERY RATE IN CONCENTRATION/PROCESSING FOR THE SEVEN MINES (DECIMALS)

Mine	1	2	3	4	5	6	7
Level 1	0.82	0.88	0.85	0.87	0.87	0.69	0.84
Level 2	0.82	0.9	0.88	0.9	0.87	0.75	0.87
Level 3	0.84	0.9	0.88	0.9	0.87	0.75	0.89

GRADE OF FINAL MARKETED PRODUCT (%)

Mine	1	2	3	4	5	6	7
Level 1	79	93	64	70	45	89	88

CONCENTRATION COST PER OUNCE OF CONCENTRATE ($)

Mine	1	2	3	4	5	6	7
Cost	16	18	22	35	16	18.55	15.61

SALVAGE VALUES (% OF CAPITAL INVESTMENT)

Mine	1	2	3	4	5	6	7
Cost	3	30	30	30	30	13.09	21.89

Appendix 3: Parameters for a Typical Zimbabwe Gold Mine

LEVEL	Cut-off, g/t	AOG, g/t	TR, t	ORRM, dec.	RR, t	RRPE, dec.	FMOG, %	CR, t
I	2.26	2.39	6,244,525	0.88	5,477,341	0.83	75.429	379,385.78
II	2.39	2.48	3,841,736	0.85	3,270,964	0.86	75.429	355,996.12
III	2.54	2.54	2,188,914	0.84	1,841,815	0.86	75.429	344,152.34

Mine Life Expectances (LE)

Level	I	II	III
RR,t	5477340.8	3270964	1841815
ROM, t	LE1	LE2	LE3
300,000	18.3	10.9	6.1
600,000	9.1	5.5	3.1
900,000	6.1	3.6	2.0
1,200,000	4.6	2.7	1.5

Notes:

Cut-off grades are averages of cut-off gardes submitted by the mines (Appendix 2). The same applies to the respective cumulative reserves.

TR = Total reserves. These are averaged from the cumulative reserves in Appendix 2

AOG = Average ore grades, which are weighted averages of the cut-off grades included under each level, with cumulative reserves as weights.

ORRM = Ore recovery rate in mining. These are averages of mine submissions in Appendix 2.

RR = Recoverable reserves, which are products of ORRM and TR

RRPE = Recovery rate in processing or extraction (that is, concentration). These are averages of mine submissions in Appendix 2.

FMOG = Final marketed output grade (that is, concentrate grade). These are averages from mine submissions in Appendix 2.

$$CR_i = \frac{Concentrete\ grade_i}{Average\ grade\ for\ ore_i\ *Recovery\ rate\ in\ concentration_i}$$

CR = Concentration ration which is given by:

LE under each level are quotient of respective RR divided by each optional ROM.

Appendix 4: Regression Data for Cost Function Estimation

c	q	q2	q3
23,475.2700	0.9506	0.9036	0.8590
18,660.4950	1.0438	1.0894	1.1371
25,530.0920	1.0982	1.2061	1.3246
26,424.4040	1.1871	1.4091	1.6727
28,838.8040	1.2151	1.4764	1.7940
406.2490	0.0177	0.0003	0.0000
8,448.0000	0.2640	0.0697	0.0184
7,872.0000	0.2460	0.0605	0.0149
7,776.0000	0.2430	0.0590	0.0143
8,928.0000	0.2792	0.0779	0.0218
9,341.3120	0.2919	0.0852	0.0249
6,925.0000	0.2770	0.0767	0.0213
7,600.0000	0.3040	0.0924	0.0281
7,400.0000	0.2960	0.0876	0.0259
8,000.0000	0.3200	0.1024	0.0328
8,673.6250	0.3469	0.1204	0.0418
3,900.0000	0.0780	0.0061	0.0005
5,000.0000	0.1000	0.0100	0.0010
5,400.0000	0.1080	0.0117	0.0013
4,600.0000	0.0920	0.0085	0.0008
4,900.0000	0.0980	0.0096	0.0009
1,734.0000	0.4730	0.2237	0.1058
1,465.0000	0.0698	0.0049	0.0003
1,706.0000	0.0781	0.0061	0.0005
2,417.0000	0.0927	0.0086	0.0008
2,285.0000	0.0891	0.0079	0.0007
2,263.0000	0.0783	0.0061	0.0005
2,549.0000	0.0775	0.0060	0.0005
3,177.0000	0.0897	0.0080	0.0007
3,718.0000	0.1037	0.0107	0.0011
3,062.0000	0.1233	0.0152	0.0019

c is in US$'000, q is in mt.

Appendix 5: Estimated Total Costs (US$) of Mining from Econometric Functions

ROM	Level I (TCM1)	Level II (TCM2)	Level III (TCM3)
300,000	7,507,495.77	7,507,495.77	7,507,495.77
600,000	11,689,772.09	11,689,772.09	11,689,772.09
900,000	17,320,387.49	17,320,387.49	17,320,387.49
1,200,000	28,274,617.51	28,274,617.51	28,274,617.51

Appendix 6: Cost Computations

ROM, t	Level I					
	TCM1, US$	ACM1, US$/to	AFC1, US$/tc	CC, US$/tc	HOC/tc	ATC1, US$/tc
300,000.00	7,507,495.77	25.02	9,494,123.73	711,325.41	10,205,449.13	20,410,898.27
600,000.00	11,689,772.09	19.48	7,391,555.45	711,325.41	8,102,880.86	16,205,761.72
900,000.00	17,320,387.49	19.24	7,301,231.86	711,325.41	8,012,557.27	16,025,114.53
1,200,000.00	28,274,617.51	23.56	8,939,156.46	711,325.41	9,650,481.86	19,300,963.72

ROM, t	Level II					
	TCM2, US$	ACM2, US$/to	AFC2, US$/tc	CC, US$/tc	HOC/tc	ATC2, US$/tc
300,000.00	7,507,495.77	25.02	8,908,797.77	711,325.41	9,620,123.17	19,240,246.34
600,000.00	11,689,772.09	19.48	6,935,855.76	711,325.41	7,647,181.16	15,294,362.32
900,000.00	17,320,387.49	19.24	6,851,100.74	711,325.41	7,562,426.15	15,124,852.29
1,200,000.00	28,274,617.51	23.56	8,388,045.00	711,325.41	9,099,370.41	18,198,740.81

ROM, t	Level III				
	TCM3, US$	ACM3, US$/to	AFC3, US$/tc	HOC/tc	ATC3, US$/tc
300,000.00	7,507,495.77	25.02	7,278,119.37	7,989,444.78	15,978,889.56
600,000.00	11,689,772.09	19.48	5,666,307.34	6,377,632.74	12,755,265.49
900,000.00	17,320,387.49	19.24	5,597,065.99	6,308,391.40	12,616,782.80
1,200,000.00	28,274,617.51	23.56	6,852,685.90	7,564,011.31	15,128,022.61

Notes:

TCM = Total cost of mining
ACM = Average cost of mining ore
AFC = Average feed cost per ton of concentrate. It is given by multiplying the CR by ACM.
HOC = Head Office Costs (these are assumed to be equal to the direct costs of mining and concentration per ton of concentrate produced)[20]
CC = Concentration costs
ATC = Average total cost (per ton of concentrate)
to = ton of ore

tc = ton of concentrate

[20]Hesketh (1997) states that "Generally, direct operating costs are a good indicator of the extent to which activities generate the need for overhead expenditures" (p.3).

Appendix 7: Prices, Revenues, Costs and Profits

Level I								
ROM,t	Conc.output, t	f.o.b price, US$/tc	R, US$	ATC, US$/tc	TC, US$	Annual Profit	LE	LTP
300000	0.790751836	34,386,465.85	27191160.99	20410898.27	16139955.27	11051205.72	18.2578	201770731.40
600000	1.581503671	34,386,465.85	54382321.99	16205761.72	25629471.65	28752850.33	9.128901	262481931.40
900000	2.372255507	34,386,465.85	81573482.98	16025114.53	38015666.2	43557816.78	6.085934	265090005.40
1200000	3.163007343	34,386,465.85	108764644	19300963.72	61049089.98	47715553.99	4.564451	217795290.20
Level II								
300000	0.842705824	34,386,465.85	28,977,675.05	19,240,246.34	16,213,867.66	12,763,807.39	10.90321	139,166,521.71
600000	1.685411649	34,386,465.85	57,955,350.10	15,294,362.32	25,777,296.42	32,178,053.68	5.451607	175,422,100.48
900000	2.528117473	34,386,465.85	86,933,025.14	15,124,852.29	38,237,403.35	48,695,621.79	3.634405	176,979,592.88
1200000	3.370823297	34,386,465.85	115,910,700.19	18,198,740.81	61,344,739.52	54,565,960.67	2.725803	148,736,084.73
Level III								
300000	1.031515888	34,386,465.85	35,470,185.84	15978889.56	16,482,478.45	18,987,707.39	6.139383	116,572,808.00
600000	2.063031775	34,386,465.85	70,940,371.67	12755265.49	26,314,518	44,625,853.68	3.069692	136,987,603.70
900000	3.094547663	34,386,465.85	106,410,557.5	12616782.8	39,043,235.72	67,367,321.79	2.046461	137,864,596.70
1200000	4.12606355	34,386,465.85	141,880,743.3	15128022.61	62,419,182.68	79,461,560.67	1.534846	121,961,238.70

Notes:

Prices are assumed to be constant across ROMs and also across levels
This particular table is based on current prices
R = Total revenue
TC = Total costs
LPT = Life time profits before adjustments

All profit figures in this table are befire adjustments for taxes, government stipulations on R&D, HRD, etc.

Appendix 8: Capital Investment, Salvage and Depreciation

ROM, t	Capital, US$	Salvage, %	Salvage, US$	DI	ADL1	ADL2	ADL3
300,000	31,431,673	22.5685714	7,093,680	24,337,993	1,333,019	2,232,185	3,964,241
600,000	62,863,346	22.5685714	14,187,359	48,675,987	5,332,075	8,928,741	15,856,964
900,000	94,295,019	22.5685714	21,281,039	73,013,980	11,997,169	20,089,667	35,678,168
1,200,000	125,726,692	22.5685714	28,374,718	97,351,973	21,328,300	35,714,964	63,427,855

Notes:

DI = Depreciable Investment
ADL1 = Annual depreciation for level 1. ADL2 and ADL3 are interpreted similarly.

Appendix 9: Proposed (Base) Fiscal Scenario

Item	**Rate, %**
CIT, %	25
Royalty, % of gross revenue	2
Mineral Export tax on unprocessed exports, % of gross revenue	0
Fiscal Stabilization fund, % of RRT in $ terms	30
Exp. On HRD/R&D, % of pay-roll, which is in turn 36% of total costs	5
Withh.tax on expat. Divid non tax haven, % of expat dividends	15
Withh.tax on expat. Divid tax haven, % of expat dividends	30
RRT, % of Resource Rent	40.5
Capital Gains Tax on exploration license transfers, % of the licence transaction value	50
Pay roll, % of TC, assumption	36
Normal profit, % of Total Cost (including depreciation), assumption	10
Discount rate, %	22

Appendix 10: Current Fiscal Scenario

Item	Rate, %
CIT, %	25
Royalty, % of gross revenue	5
Mineral Export tax on unprocessed exports, % of gross revenue	0
Fiscal Stabilization fund, % of RRT in $ terms	0
Exp. On HRD/R&D, % of pay-roll, which is in turn 36% of total costs	0
Withh.tax on expat. Divid non tax haven, % of expat dividends	15
Withh.tax on expat. Divid tax haven, % of expat dividends	15
RRT, % of Resource Rent	0
Capital Gains Tax on exploration license transfers, % of the licence transaction value	20
Pay roll, % of TC, assumption	36
Normal profit, % of Total Cost (including depreciation), assumption	10
Discount rate, %	22

Appendix 11: Easiest Fiscal Scenario

Item	Rate, %	Notes
CIT, %	10	As in Colombia
Royalty, % of gross revenue	1	As in Brazil
Mineral Export tax on unprocessed exports, % of gross revenue	0	
Fiscal Stabilization fund, % of RRT in $ terms	0	
Exp. On HRD/R&D, % of pay-roll, which is in turn 36% of total costs	0	
Withh.tax on expat. Divid non tax haven, % of expat dividends	4	The lower limit in Chile
Withh.tax on expat. Divid tax haven, % of expat dividends	4	The lower limit in Chile
RRT, % of Resource Rent	0	Australia removed RRT completely after finding it not useful.
Capital Gains Tax on exploration license transfers, % of the licence transaction value	10	Half the current rate in Zimbabwe
Pay roll, % of TC, assumption	23	As in the neighbouring South Africa
Normal profit, % of Total Cost (including depreciation), assumption	10	
Discount rate, %	18	The maximum lending rate prescribed by the Reserve Bank of Zimbabwe.

Appendix 12: Harshest Fiscal Scenario

Item	Rate, %
CIT, %	30
Royalty, % of gross revenue	10
Mineral Export tax on unprocessed exports, % of gross revenue	0
Fiscal Stabilization fund, % of RRT in $ terms	30
Exp. On HRD/R&D, % of pay-roll, which is in turn 36% of total costs	10
Withh.tax on expat. Divid non tax haven, % of expat dividends	30
Withh.tax on expat. Divid tax haven, % of expat dividends	35
RRT, % of Resource Rent	50
Capital Gains Tax on exploration license transfers, % of the licence transaction value	50
Pay roll, % of TC, assumption	36
Normal profit, % of Total Cost (including depreciation), assumption	10
Discount rate, %	22

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