MODELLING THE IMPACT OF ROYALTY TAX ON THE MINING INDUSTRY: A CASE STUDY OF ZAMBIA

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Abstract

Mineral taxation is an important exercise that every government must undertake to raise revenue. The implemented tax system must strike a balance in meeting revenue needs for both the government and mining firms. Thus, before any tax system is implemented it must be modeled for its merits and demerits both on the side of the government and mining houses. This is to instigate a win-win situation between the two parties. This paper models the impact of introducing or increasing the royalty based tax on the Zambian mining industry using Lumwana and Kansanshi Mines as case studies. The impact has been modeled using the methodological framework of the breakeven analysis which is based on linear equations of total revenue and total cost. This paper addresses the modeling of two traditional royalties namely, ad valorem and unit based. It is concluded that introducing or increasing these royalties on the mining industry increases the cutoff grade which stimulates the use of high grading mining technique. This technique generates economic and technical devastating effects on the mining industry and government. It was concluded that mineral royalty is not an equitable tax system due to the different mineralization of orebodies. The result of this research suggests that governments should diverge from regressive tax schemes to ones which are mildly progressive by implementing either a hybridized or variable rate royalty system.

Keywords: *Royalty; Modelling; High grading; Cutoff grade; Breakeven analysis*

INTRODUCTION

Zambia is a landlocked country located in the southern part of Africa. The country has very little to show for a Century of mining despite the abundant mineral resources it possess. This has mainly been attributed to the poor design of mineral taxation systems. Mining taxation is the major revenue generating device for the Zambian government despite the existence of other sectors such as agriculture. Mining comes with a myriad of benefits including employment, local infrastructure, linkages to other sectors, foreign exchange gains and government earnings (Manley, 2013). It is for these reasons that the government should seek to optimize the mineral tax base. The objective of any mineral fiscal regime should be to maximize government revenue and to attract and retain capital necessary for other mining developments. Thus, the ultimate aim of mineral taxation policy should be to tax mines as much as possible without discouraging mineral investment. Overtaxing the mines today has a potential of discouraging future exploration and production which later

interprets in lower tax payments in the future. However, from the activating theory of taxation, the ideological basis of mineral taxation is to provide revenue for the government to be channeled to developmental activities such as the construction of roads, hospitals and schools. Designing a tax system that will satisfy the objectives of both the government and mining firms to a maximum is a challenging task. Therefore, when developing a nation's tax policy it is always important to determine the unique factors that shape a nation. Thus, it can be concluded that there is no universal ideal tax system.

The success of any tax system is anchored on its international competitiveness. In today's global mobile economy, multinational enterprises have a lot of jurisdictions to choose from. An investor generally prefers a low tax jurisdiction as compared to that which is high as this is consistent with his conception of wealth maximisation.

Zambia has undergone a transition of six mineral fiscal regimes since the privitisation of its mines in 1997 and 2000.

The following provides a list of the key regimes (amended from Manley, 2013).

- ***The Development agreements (DAs):*** Negotiated with individual mines at privatization
- ***The 2008 Regime:*** Tax regime used between April 2008 and March 2009
- ***The 2009 Regime:*** Tax regime used between April 2009 to March 2012
- ***The 2012 Regime:*** Tax regime used between April 2012 to December 2014
- ***The 2015 Regime:*** Tax regime used between January 2015 to July 2015
- ***Post 2015 Regime:*** Tax regime that has been in effect since July 2015 till date

Table 1 provides a summary of the tax structure affiliated to the various mineral taxation regimes

Table 1: Key features of Zambia's mining tax regimes (Amended from Manley 2013)

Type of Tax		**DA**	**2008**	**2009**	**2012**	**2015**	**POST 2015**
Profit based tax							
Company income tax (% of profit base)							
Mineral processing and tolling (%)		35	35	35	35	30	35
Mining operations (%)		25	30	30	30	0	30
Variable profit tax in effect?		No	Yes	Yes	Yes	Yes Industrial minerals	Yes
Profit tax base details							
Capital depreciation allowance		100	25	100	25	25	25
Loss carry forward (maximum years)		5-10	10	10	10	10	10
Allowed debt to equity ratio		2:1	3:1	2:1	2:1	3:1	3:1
Revenue tax types							
Mineral royalty (%)	*Underground Mining*	0.6	3	3	6	8	6
	Open cast Mining	0.6	3	3	6	20	9
Windfall tax in effect?		No	Yes	No	No	No	No
Other tax types							

Customs duty	**Exempted in most cases**	
Export duty (on copper anodes)	No	**15% but with some waivers**

LITERATURE REVIEW

Mineral royalties can be defined as fixed payments made by mining firms to governments acting as landlords for the extraction and exhaustion of mineral resources. Regardless of the rate applied, royalties are collected for the same purpose, that is, payment acting as compensation to the land owner for the extraction of non-renewable resources (Otto *et al*., 2006). Majority of governments of mineral resource endowed economies have used the royalty system as a sound fiscal instrument of mobilizing revenue (Appiah, 2013). This may be attributed to the fact that it secures revenue as soon as production commences. This is in contrast with profit based taxes which only come into effect when the net cash flow begins to turn positive (Nakhle, 2004).

The fact that royalties are production based limits the exposure of a country to mineral price volatility. According to Otto and Cordes (2002) a mineral royalty represents the eagerness to pay for risk reduction. An alternative way for governments to reduce risk associated with mineral price volatility is by adopting smoothing strategies, such as the establishment of sovereign revenue equilisation funds and to limit spending in times of high mineral prices (Guj, 2012). Unlike most fiscal instruments the royalty tax is easier to administer and enforce (Sunley and Baunsgaard, 2001). This can be attributed to the fact that it is based on relatively simple formulation. In taxation theory, a sophisticated and complex mineral tax regime usually results in high administrative inefficiency and subsequently high compliance cost. Increasing the royalty tax (ad valorem) with a view of maximizing revenue is sparked by a number of reasons, including (Gajigo *et al.*, 2012): It is easy to administer; its effect to the sector is exclusive and lastly it represents a significant earning to the government.

Despite these advantages, royalty tax (i.e. ad valorem) has lost application in most mineral industrialised economies. Otto, *et al* (2000) asserts that over the past century there has been growing emphasis to discourage the use of royalties and to switch to profit based taxes. This is because of the demerits it exhibits. One such demerit is economic allocative inefficiency which is synonymous to non-neutrality. In the mining and petroleum context, neutrality of a tax means that its implementation does not alter the manner in which a project is undertaken; nor does it change the speed of extraction or decisions to abandon a petroleum field or close a mine (Daniel *et al.*, 2008). It must be mentioned that growing emphasis to adopt profit based taxes stems from the fact that these taxes are based on the concept of economic rent. From mineral taxation economic rent based taxes are a rational method of taxing mining investors.

It is important to note that royalties are a component of an aggregate tax system. Thus, its advantages and disadvantages can be balanced with other tax types (Otto *et al.*, 2006). In taxation it is not a single tax rate that affects a mineral fiscal system but the lump sum of all taxes.

MINERAL ROYALTY INSTRUMENTS

It is sometimes difficult to clearly define the royalty tax. This is attributed to the different interpretations put forward by various parties. For instance, what signifies royalty tax to an economist may be different when viewed from the perspective of the politician or accountant.

Guj (2012) indicates that the royalty tax can take one of the following forms:

- ***Unit based (specific) royalty tax:*** when the tax base is a physical unit (volume or weight)
- ***Ad valorem royalties****:* tax base measure of the value of sales of metal
- ***Profit based royalty tax:*** when the tax base is an accounting concept of profit
- ***Economic rent based royalty tax:*** when the tax base is a direct measure of economic rent
- ***Other methods:*** when a variety of tax bases are used, including production sharing.
- ***Hybrid systems:*** combines a profit or rent based system with an ad valorem or unit based system

THEORETICAL FRAMEWORK

This study uses the breakeven analysis to model the introduction or increment of an ad valorem/unit based royalty tax on the Zambian mining industry. The breakeven analysis can be defined as a graphical appraisal method based on the concepts of Total Revenue (TR) and Total Cost (TC) equations.

Different businesses have different interpretation of TR and TC. In the mining context, TC can mathematically be defined as:

$$TC = FC + VC * N \qquad [1]$$

Where:

TC = Total cost ($)
FC = Fixed cost ($)
VC = Variable cost per unit of ore material mined ($/t)
N = Amount of ore material mined (t)

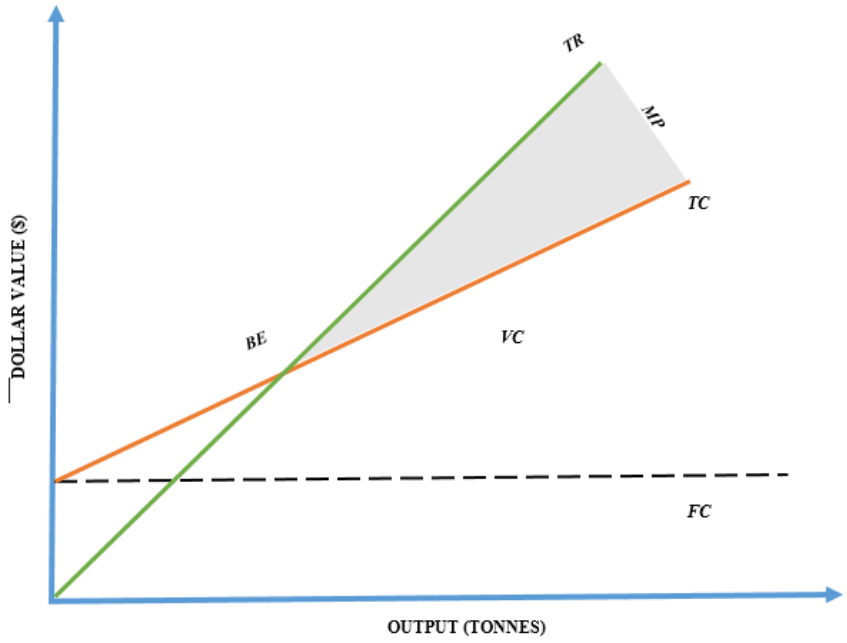
TR has the following mathematical expression:

$$TR = P * G * R * Q \qquad [2]$$

Where:

TR = Total revenue ($)
P = Copper price ($/t)
G = Grade of mineral material mined (%)
Q = Quantity of run-off-mine ore mined (t)
R = Metallurgical recovery (%)

Equations 1 and 2, can graphically be represented on the XY coordinate system as depicted in Figure 1



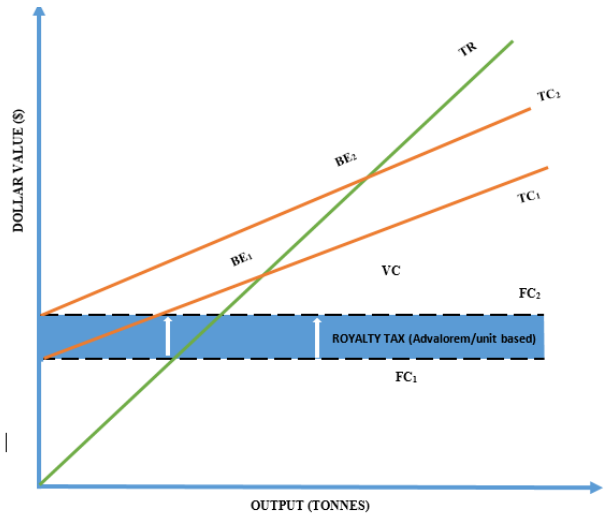
LEGEND

TC = INITIAL TOTAL COST *BE = BREAKEVEN POINT* *FC = FIXED COST*
MP = MINING PROFIT *VC = VARIABLE COST* *TR = TOTAL REVENUE*

Figure 1: Graphical representation of total cost and revenue equations

EFFECT OF ROYALTY TAX INTRODUCTION OR INCREMENT

Introducing or increasing the royalty tax increases the fixed cost of mining. This is evidenced by a shift in the fixed cost and subsequently total cost curve as illustrated in Figure 2.



LEGEND

TR = TOTAL REVENUE *BE_1 = INITIAL BREAKEVEN POINT* *FC_1 = INITIAL FIXED COST*
TC_2 = FINAL TOTAL COST *BE_2 = INTERMEDIATE BREAKEVEN POINT* *FC_2 = FINAL FIXED COST*
VC = VARIABLE COST
TC_1 = INITIAL TOTAL COST

Figure 2: Graphical representation of the shift in fixed cost and total cost

From Figure 2, the following changes can be noted when royalty tax is introduced or increased:

- Fixed and TC curves shift upward; and
- The breakeven[1]point shifts in a right upward manner.

Using Equation 2 as a benchmark for analysis, the only way in which the mining firm can increase its total revenue is through one of the following alternatives:

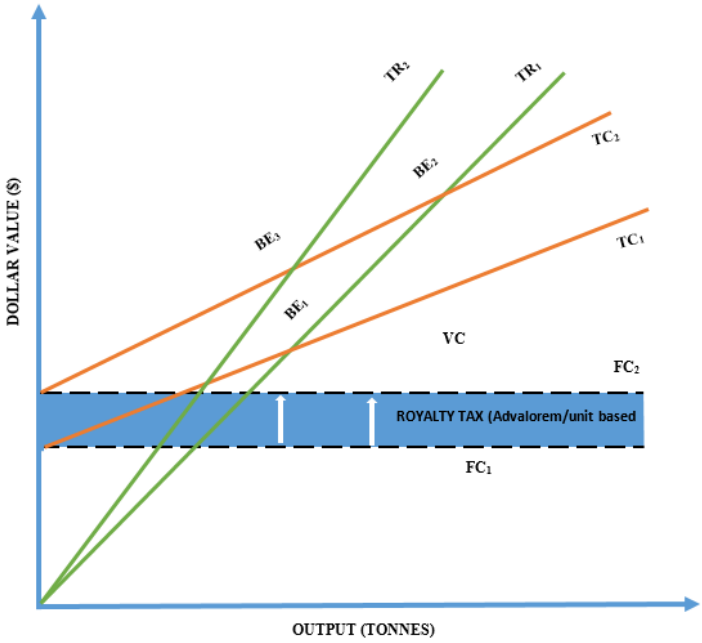
- Increase of cutoff grade[2] of ore material
- Increase of quantity of mineral material mined – However, increase in this parameter results in an increased tax burden. This is due to the fact that royalty is a production based tax.
- Increase of metallurgical recovery – An increase in this parameter has the financial implication of increased cost. This can be attributed to the fact that metallurgical technology has to be altered to attain the desired recovery.

Mineral price cannot be increased because it is an exogenous variable and thus is not within the control of the mining firm. Thus, the only rational alternative which the mining firm can undertake to offset the royalty tax burden is by increasing the cutoff grade through the mining technique of high grading[3]. Increasing the cutoff grade shifts the TR curve to the left thus trying to restore the breakeven point to its initial position as illustrated in Figure 3.

[1] Breakeven point is the point at which total revenue is equal to total cost

[2] Cutoff grade is the grade that is economically mineable

[3] High grading is a mining technique where mining is focused on extracting high grade blocks of ore as opposed to those of low grade.



LEGEND

TC_1 = INITIAL TOTAL COST
TC_2 = FINAL TOTAL COST
BE_1 = INITIAL BREAKEVEN POINT
BE_2 = SECOND BREAKEVEN POINT
FC_1 = INITIAL FIXED COST
FC_2 = FINAL FIXED COST
TR_1 = INITIAL TOTAL REVENUE
TR_2 = FINAL TOTAL REVENUE
BE_3 = FINAL BREAKEVEN POINT
VC = VARIABLE COST

Figure 3: Graphical representation of the shift in total revenue

However, it is important to note that not all mining firms can employ high grading as a means of offsetting the royalty tax burden, this is due to dissimilar mineralization of the orebodies in respective mines. The next section explains this concept using two case study mines of Zambia.

EFFECT OF ROYALTY TAX ON THE ZAMBIAN MINING INDUSTRY

Taking Zambia as a case study and looking at her two mines namely Kansanshi and Lumwana mine, the effect of increasing or introducing the ad valorem or unit based royalty tax will be discussed.

Brief information of Lumwana Mine

Lumwana Mining Company (LMC) is a copper mining enterprise owned by Barrick Gold Corporation. It is situated in the North Western region of Zambia, some 95 km south west of the provincial capital, Solwezi. The mine is a multi-pit operation, extracting approximately 20 million tonnes of ore and waste per annum and producing copper concentrates containing an average of 122,000 tonnes of copper metal per year over a thirty-seven (37) year mine life making Lumwana Mine the largest single open cut copper mine in Africa. The mining license covers 1,355km² and includes two major copper deposits, Malundwe and Chimiwungo, as well as 25 exploration prospects. The license is valid for 25 years (since January 2004) and is renewable for a further 25 years. Lumwana mine has a current cutoff grade of approximately 0.2%.

Brief Information of Kansanshi Mine

Kansanshi Mine, the largest copper mine in Africa is 80% owned by Kansanshi Mining PLC, a First quantum minerals subsidiary. The remaining 20% is owned by Zambia Consolidated Copper Mines Investment Holding (ZCCM-IH)[4]. The Mine is located in the North western region of Zambia, approximately 10 km north of the provincial capital Solwezi and 180 km North West of the Copperbelt town of Chingola. Mining is carried out in two open pits i.e Main and North West using conventional open pit methods and employing hydraulic excavators and a fleet of haul-trucks. The mine has undergone several expansions since it began operating in 2005. From an initial production capacity of 110,000 tonnes of copper, Kansanshi is now capable of producing 340,000 tonnes of copper. A multi-stage expansion project aims to increase copper output capacity to approximately 400,000 tonnes by end of 2015. Kansanshi currently mines copper at a current cutoff grade of approximately 0.6%.

Royalty Tax effect on Kansanshi and Lumwana Mine

Using the cutoff grade as a platform of claim, it can be deduced that Kansanshi Mine has an orebody that is rich in mineral when compared to Lumwana Mine. Increasing the ad valorem or unit based tax on these mines increases their fixed cost and subsequently total cost. Both of these mines will try to offset the financial burden introduced by this tax by increasing the cutoff grade through the mining technique of high grading. However, the tax will have a high fiscal burden on Lumwana as compared to Kansanshi Mine. This is attributed to the fact that Kansanshi Mine, comprising mainly of high grade blocks of ore will offset the financial burden of the tax by high grading (increasing its cutoff grade) its ore well above Lumwana Mine which is mainly dominated by low grade blocks of ore. From this analysis, it can be concluded that introducing or increasing the royalty tax on the two mines will invoke unequal financial burdens in relation to income. This fact can be attributed to the different grade of orebodies in respective mines.

High grading has other devastating effects on the host state and mining firms. The succeeding subsections give a brief highlight of these effects.

Economic implications of high grading (Host state side)

The following is a list of economic implications of high grading on the host state:

- Reduces the amount of economically exploitable reserves;
- Reduces the mine life;
- Discourages future investment;
- Future implication of narrowing tax base; and
- Future implication of high unemployment levels.

Technical implication of high grading (Mining firm side)

The following provides a list of technical implications of high grading on the side of the mining firm:

- Complicates mining sequence;

[4] ZCCM-IH is Zambia's holding company that retains shares in the mines on behalf of the Zambian Government.

- Future cost implications; and
- In underground mines, it exponentially generates problems in blasting and ground control.

DISCUSSION OF BEST PRACTICES

The role of the government should be to manage the exploitation of non-renewable mining resources and to maximize the positive externalities to their community. This should be coupled with attracting exploration and development capital that is high enough to develop and expand new and existing projects consistent with the need to continue to realize these positive externalities for as long as possible.

The following is a list of best practices that a government can undertake to epitomize the full potential of its mineral sector.

1) Model tax impact before implementation

Any tax system that is to be implemented must be modeled for its impact in terms of current and future mining investment. Undertaking this will help government design a prudent, effective and efficient tax system.

2) Induce transparency and stability in fiscal regime

Transparency[5] and stability[6] are a desideratum of Foreign Direct Investment (FDI). This is because they provide a predictable macroeconomic environment for undertaking investment. From an investors perspective of risk a stable tax regime translates in minimal volatility of revenue inflow.

3) Select a mineral tax regime that is equitable

Equity means that the impact of the tax is evenly distributed among various tax payers. Government should be able to select a mineral fiscal regime that spreads the impact of the tax fairly among various taxpayers. This will give the mining firms an incentive to invest in new and existing projects thus directly boosting Foreign Direct Investment (FDI) in the mineral sector.

4) Select a mineral tax system that has some degree of both administrative efficiency and economic allocative efficiency

Administrative efficiency of a tax system refers to the capacity of the tax authority to handle tax issues with a minimum expenditure on time, money, personnel, material etc. Economic allocative efficiency on the other hand addresses the question as to whether the same development and production activities would take place when the tax system is implemented. Any tax that is implemented has an inherent inclination to either administrative or economic allocative efficiency. It is difficult to implement a tax system that satisfies both aspects to a maximum. For instance, unit based and ad valorem royalty taxes have a high administrative efficiency but a low economic

[5] Transparency means tax collections and arrangements by governments are open to scrutiny by the public.

[6] Stability means the tax system is not subject to frequent reformation.

allocative efficiency. On the other hand economic rent and profit based royalty taxes have a high economic allocative efficiency but a low administrative efficiency. This may be attributed to the fact that profit or economic rent based taxes are complicated and sophisticated in structure when compared to royalties. To obtain a right mix and balance of these two efficiencies government must consider implementing a hybridized royalty system.

CONCLUDING REMARKS

The impact of introducing or increasing royalty tax has been modeled using the breakeven analysis. It has been deduced that introducing or increasing this tax on the mining industry leads to an increased cutoff grade and subsequently high grading of ore material. High grading is a damaging mining technique leading to negative macroeconomic and technical effects on the host state and mining firms, respectively. To alleviate these negative implications, governments of various nations including Zambia must reduce the fixed royalty tax and introduce a hybridized or variable rate royalty system. It is important to note that progressive tax policy must penalize activities that are not beneficial to the state and incentivize those activities that will bring maximum social benefit.

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