Royalty Rates in African Mining Revisited: Evidence from Gold Mining

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Key messages

- Mining companies in Africa have been realizing high profits due to tremendous increases in commodity prices over the past decade. This is especially true of gold, which we focus on in this brief.
- The recent wave of upward revisions of royalty rates in Africa are attempts by countries to gain some share of the windfall gains from rising commodity prices.
- Since royalty rates in Africa were set well before this period of rising commodity prices, there may be room to increase royalty rates to improve governments’ share of windfall gains while still enabling mining firms to realize reasonable returns on their investments.

1 Introduction

Several African countries have started to update their mining codes by increasing their royalty rates. In 2010, Burkina Faso indexed its royalty rates such that the effective rate varies positively with commodity (gold) prices. Specifically, the minimum royalty rate is 3%, which increases to 4% for gold prices between USD1,000 per ounce and USD1,300 per ounce, and to 5% for prices above USD1,300 per ounce. Ghana previously had an ad-valorem royalty rate that ranges from 3% to 6% for gold in its 2006 Minerals and Mining Act. However, every single mining company in the country paid only the minimum rate of 3% by taking advantage of loopholes that allowed for significant deduction of expenses. An amendment to the Mineral and Mining Act in 2010 set a flat royalty rate of 5%. Mali’s 1999 mining code, crafted with World Bank assistance, instituted a royalty rate of 3% for precious metals. As of the time of this brief, the mining code is being revised with a higher royalty rate. South Africa was the only major mining country on the continent without a royalty on mining. This changed in 2008 when it instituted a profit-based royalty (Table 1). The implementation was delayed for two years to enable firms to recover from the effects of the global financial crisis.

These policy changes have been induced by tremendous increases in commodity prices over the past decade, the benefits of which has not been shared well by mineral
rich countries. Changing the royalty rate is the preferred choice of governments in increasing their shares of mineral revenues for a number of reasons. For one, it is easy to implement even for countries with limited tax collection capacity. Secondly, its effect is exclusive to the sector, unlike changing the corporate income tax, which may affect firms in other sectors. Third, it represents the most significant source of earning for governments in the mining sector. In Ghana for example, royalties account for about 44% of government revenues from the mining sector (Ghana Chamber of Mines 2011).

This brief assesses the effect of royalties on mine profitability. Given the number of countries that are changing their mineral laws and mining codes principally by increasing their royalty rates, this brief sheds light on this contemporary issue of the optimal royalty rate. We focus on gold, one of the most important minerals in the African mining sector. Our analysis shows that royalties, as a share of production cost, are small in Africa. Other factors such as mine grade¹ have a much more significant effect on cost and profitability. In fact, the level of royalty rates that would significantly reduce profit per ounce of gold produced is far above the prevailing rates in most gold-producing African countries. The result of our analysis actually suggests that there is a case for increasing royalties, above the current modal rate of 3%, to enable countries gain a higher share of the mineral revenues.

2 What are the current royalty rates in Africa?

Before analyzing the effect of the royalty rates, we provide a brief overview of the different types of royalties, as well as the actual royalty rates on the continent. A royalty is a levy on mineral production that is assessed on companies in the extractive industry, especially mining. There are three main kinds: (i) production/unit royalty; (ii) profit-based royalty; and (iii) ad-valorem/sales royalty. The first kind of royalty is assessed on the quantity (i.e. ounces or tons) of mineral produced, and the value is independent of the commodity price. Profit-based royalty is a rate assessed on the profit of the operation. The last kind of royalty is assessed on the market value of the mineral produced, and unlike the first kind, it is highly dependent on the relevant commodity price. This is the most common royalty used in Africa. Its main virtue is that it is less onerous on mining companies relative to unit royalty when commodity prices fall and much easier to implement than profit royalty in countries where tax administration capacities are limited or where losses are uncommon.

The royalty rates applied to mining operations in our sample of twenty three African countries is provided in Table 1 (in the appendix). The average royalty rate is approximately 3.5% while the modal rate is 3%. Different categories of minerals are assessed different royalty rates mainly due to the differences in the amount of rents generated². Specifically, prices of precious stones or metals are several orders of magnitude higher than those of base metals for a given quantity. The highest royalty rates are usually assessed on mineral stones such as diamonds and gems. This group is followed by precious metals such as gold, silver and platinum, which have an average royalty rate of approximately 4%. The base metal class, the most important of which is iron, is assessed a slightly lower rate, the average being 3%.

With the exception of South Africa, which recently imposed a profit-based royalty, all other African countries for which data are available utilize ad-valorem royalty as of mid-2011. Furthermore, almost all royalty rates in Africa are fixed, with only a few exceptions where they are indexed to the price of some commodity (Gajigo et al. 2012a).

3 The Case for Higher Royalty Rates in Africa

Centering of royalty rates around 3% in Africa is due mainly to the influence of multi-lateral development banks, principally the World Bank (Gajigo et al. 2012a). The reforms initiated were designed to attract foreign capital into a sector that had previously been dominated by state-owned companies (World Bank 1992). Key aspects of these reforms included the reduction of royalty rates to around 3% as a way of increasing the returns to private investors since royalties count as a cost of production (Akabzaa and Butler 2003).

¹ The grade of a gold mine is a measure of the richness of the ore. It measures the amount of gold (in grams) per ton of ore extracted. The higher the grade, the richer the mine in gold, and consequently, the lower the cost of production per unit of gold extracted. It varies significantly between mines, and also over time within the same mine.

² While table 1 provides royalty rates for only base metal and precious metals, royalty rates on various categories of commodities tend to be positively correlated within countries.)
The logic of implementing low royalty rates is intuitive. Since an ad-valorem royalty (the most common in Africa) is part of a firm’s cost of production, increasingly higher royalty rates can potentially create distortions in the optimal level of production, or the cut-off grade of mines. This has the potential to negatively impact investment in the sector. For instance, a marginal mine may be commercially unviable if the royalty rate is too high. This argument assumes implicitly that the share of royalty in firms’ production cost is significant.

While the case for low royalty rates is based on coherent argument (Otto et al. 2006; World Bank 1992), it is seldom backed by empirical evidence. In this brief, we shed light on this issue by analyzing the relationship between royalties and profitability in arguably the most important precious mineral, gold. The analysis uses data from 29 mines in Botswana, Burkina Faso, Ghana, Guinea, Mali, Niger and South Africa between 2008 and 2010.

Cost is defined as the full operating cost, and it includes expenses that are normally excluded from “cash cost” such as depreciation, tax payments (including royalties) but excludes financing. The average annual cost per ounce of gold produced is USD 634 (the median is USD 635). The average annual royalty cost per ounce of gold is USD 43 (the median is USD 57). As one would expect, there is some relationship between royalty and total cost but the relationship is not strong (Figure 1). In fact, the slope of the line in Figure 1 is not significantly different from zero. On the other hand, other factors such as the mine grade (measured in grams per ton), have a more significant impact on production costs. The grade of a gold mine is a measure of the richness of the ore, which indicates the amount of gold (in grams) per ton of ore extracted. So the higher the grade, the lower the cost of production per unit of gold extracted. It varies significantly between mines, and also over time within the same mine. This fact can be observed in Figure 2 which shows a clear and significant negative relationship between mine grade and production cost. Consequently, grade is an important variable to include in any analysis of the determinants of profits in this industry. Other important variables that need to be controlled for are the price of the commodity itself and the country-specific situation in a particular year.

We next determine the effect of royalties on the cost of production, controlling for other variables. In a multiple variable regression controlling for mine grade, year and country effects, there is no significant negative relationship between royalties and cost of production as shown in Figure 3.

The ultimate test of the burden of royalties is their actual effect on profits. To test this, we assess the effect of royalties on profits while controlling for other variables. We define profit as the difference between revenue and cost. Revenue denotes the product of price (average for that particular year) and the quantity of gold produced. The average annual profit per ounce of gold of the mines in the sample is USD 355 (the median is USD 349). The average mine profit increased by approximately 23% per annum over the period. None of the mines experienced a loss over the period covered, and average gold production was 202,727 ounces (the median is 137,000 ounces) per annum.

The variables we control for are location, year of production and mine grade. The country fixed effects controls for all time-invariant (over the sample period) country level variables that affect mining such as fiscal regimes, macroeconomic climate, state of the infrastructure, environmental and labor regulations. The year dummies also capture changing commodity prices. As with production cost, there is no significant negative relationship between royalties and profit once grade, country and year effects are controlled (Figure 4).

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3 The cut-off grade is the minimum grade (grams per ton) of ore below which the mine cannot be commercially viable. It depends on price forecasts and other macroeconomic variables that affect profitability.

4 In terms of the share of exploration capital in Africa that it attracts (Sharlach 2011).

5 The following mines were covered (between 2008 and 2010): Ahafo, Bambanani, Beatrix, Bogoso/Preestea, Chirano, Damang, Docmorris, Essakane, Evander, Free State, Joel, KDC, Kalgold, Kiniero, Kusasalethu, Mana, Masimong, Mupane, Phakisa, Sadiola, Samir Hill, South Deep, Tarwa, Tehepeng, Vaal River, Virginia, Wassa, and Yatela. Further description of the data is presented in Table A3 of Gajigo et al. (2012a).

6 To produce the results depicted in Figures 2, 3, 4 and 5, we carried out semi-parametric regressions. Specifically, we estimate:

\[ Y_{it} = \beta x_{it} + \gamma Z_{it} + \theta + \epsilon_{it}, \]

where \( Y_{it} \) is the dependent variables in country \( i \), mine \( m \) at time \( t \) (e.g., cost in Figure 2), \( Z \) is a vector of variables that enter linearly, \( \epsilon \) is the expected zero-mean error term, and finally \( x \) represents the variables (e.g., royalty per ounce in Figure 3) depicted graphically that enters the equation non-parametrically without any functional form assumption.
Figure 1 The relationship between per unit production cost and royalties in Africa

Source: Authors' computations using data from annual reports of mining firms.

Figure 2 The relationship between per unit production cost and mine grade in Africa, controlling for country and year effects

Source: Authors' computations using data from annual reports of mining firms.
Figure 3 The relationship between per unit production cost and royalties, controlling for mine grade and country fixed effects

![Figure 3](image1)

Source: Authors’ computations using data from annual reports of mining firms.

Figure 4 Relationship between royalty and profit, controlling for country fixed effects, grade and year

![Figure 4](image2)

Source: Authors’ computations using data from annual reports of mining firms.
The fact that royalties per unit of production have no significant effect on both production cost and profit is surprising given the earlier comment on the possible adverse effect of royalties cost and investment. However, this puzzle can be partly explained by two facts. First, the share of royalties in the production cost in African gold mines seems to be low. The average royalty share of production cost in our sample is 6.6% and the median is 7.8% (Figure 6). As a result, the level at which royalties, as a share of costs, begin to have a significant effect on mine profit is far above the prevailing average rate in Africa (Figure 5). Second, gold prices have risen on average by 5% in real times and 8% in nominal times per annum since 1990 (Figure 7). So commodity price levels in the past few years are far above the level when decisions were made to fix the royalty rates of many African countries at around 3%. Given this significant gold price increase, it is not surprising that royalty rates have almost ceased to be a significant burden for most gold mining operations.

It is possible that royalties can be a significant part of production cost but fail to explain variations in profit if the royalty’s share of cost is similar across mines. However, this is unlikely to be the case. Specifically, the variation in royalty share of cost is significant (Figure 6), and much higher than other variables such as revenue.
Figure 6 The distribution of royalty share (%) of cost across gold mines in Africa between 2008 and 2010

Kernel density estimate

Median (6.6)  Mean - 7.8

Source: Authors’ computations using data from annual reports of mining firms.

Figure 7 Annual gold prices between 1990 and 2011

Another way to determine if royalties are significant burdens on firms is to examine the relationship between the average cut-off grade of mines and the average royalty rates across countries. This relationship can be meaningful since royalty rates can negatively impact investment decisions by raising the cut-off grade of the mines (Otto et al. 2006). In other words, because marginally profitable mines can become commercially unviable, there may be an induced shift towards the operation of mines that are high-grade. If this indeed occurs in practice, we should observe that the average cut-off grade of mines in high-royalty countries to be elevated relative to those in low-royalty countries. In fact, this argument has been used to argue for lower royalty rates in African mining (World Bank 1992). Figure 8 shows that the average cut-off grade of gold mines in Africa falls somewhere in the middle of the distribution of cut-off grades for other parts of the world. Specifically, it is higher than Asia and the Americas but lower than the average in Australia, Canada and Europe. In addition, Figure 9 shows no positive correlation between royalty rates and average cut-off grade (while the coefficient of the slope is negative, it is not significant). This finding suggests that African royalty rates are not unusually high. Furthermore, it reinforces the earlier finding that royalty rates on the continent are unlikely to be high to the extent of affecting investment decisions on the margin.

Another indirect way of assessing the burden of fiscal regimes on mining firms is to examine the perceptions of multi-national mining firms. The perceptions of these firms can be informative since their investment decisions should be sensitive to cost, which include royalty rates and overall tax payments. We therefore examine how Africa’s taxation regimes fare relative to other regions from the viewpoint of multi-national mining firms. To address this question, we use survey data from the Fraser Institute that compiles annual survey of international mining companies about their perceptions of the taxation regimes of mineral-rich countries. Figures 10 and 11 reveal that African	extsuperscript{7} countries, on average, perform quite well, especially relative to other developing regions. Specifically, the taxation regimes in Africa are not far out of the norm. Figure 10 further shows that, on average, about 3.4% of the firms surveyed would not invest in African countries due to their tax regimes	extsuperscript{8}. Only Australia and Canada perform better on this variable. This finding is highly relevant for mining operations. As documented in various papers (Curtis 2011; Gajigo et al. 2012a & 2012b, Stürmer 2010), it is a common occurrence for mining concessions to be negotiated in ways that violate fiscal regimes encoded in mineral laws and mining codes on the pretext that such violations are necessary to attract investments in the region. The results of our analysis provide no evidence for this view.

4 Conclusion

The empirical findings in this brief provide suggestive evidence that there is room to increase royalty rates in gold mining. On top of that, there is evidence that modest increases in royalty rates have limited impact on profitability of mines. For instance, Otto et al. (2006) estimated that the financial internal rate of return (IRR) of a mining operation falls by only 2 percentage points when the royalty rate goes from 0% to 3% on a model gold mine	extsuperscript{9}. In an industry where the IRRs are well over the cost of capital, increasing royalty rates up to 5% is consistent with investors earning very high returns, barring an unprecedented fall in commodity prices (Gajigo et al. 2012b). This is of policy relevance for several reasons. Royalties bring in needed revenues for cash-strapped governments (ADB 2010). Secondly, earning higher revenues from mining that still allows investors to realize high returns is a prerequisite for a fair sharing of resource rents (Gajigo et al. 2012b). Thirdly, by ensuring a fair sharing of resource rents, the incentives of governments and the private investors are better aligned, which reduces the likelihood of future renegotiation of mining concessions or some government actions with negative implications for investments.

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	extsuperscript{7}The African countries covered in the sample are: Botswana, Burkina Faso, D.R. Congo, Ghana, Guinea Conakry, Madagascar, Mali, Namibia, Niger, South Africa, Tanzania and Zambia. Figures 10 and 11 uses data from surveys conducted between 2005 and 2010 (inclusive). Zimbabwe has been excluded from the data because of the general perception issues during the relevant time that is not indicative of the issues in its mining sector.

	extsuperscript{8}Taxation regimes on the books may not always be enforced to the letter of the law. However, taking into account the generous tax exemptions provided by African countries suggests that Africa’s performance may be underestimated here (Gajigo et al. 2012a).

	extsuperscript{9}We replicated a similar finding on the financial model of an actual gold mining operation in Africa.
Figure 8 Average cut-off grade of gold mines (with 95% confidence intervals)

Source: Raw Metals Group, 2011.

Figure 9 Average cut-off gold mine grade and royalty rates across countries

Note: For countries with multiple royalty rates across different sub-national units, we chose the median value to denote the royalty rate in that country. Source: Raw Metals Group, 2011.

Figure 10 The percentage of mining companies that would not invest due to tax regimes

Note: The responses are averaged between across countries and time. Source: Fraser Institute of Mining Companies, 2005/6 to 2010/11.

Figure 11 The perception of mining companies on whether taxation regimes deterrents or not to investment

Note: The responses are averaged between across countries and time. Source: Fraser Institute of Mining Companies, 2005/6 to 2010/11.
References


Stürmer, M. 2010. "Let the good times roll? Raising tax revenues from the extractive sector in sub-Saharan Africa during the commodity price boom”, Discussion Paper, GDI.

### Table 1. The royalty rates in major African mining countries

<table>
<thead>
<tr>
<th>Countries</th>
<th>Enactment Year of the Mining/ Mineral Code/ Legislation</th>
<th>Royalty Rates</th>
<th>Precious Metals</th>
<th>Base Metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>1999</td>
<td>5%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>Burkina Faso*</td>
<td>2003</td>
<td>3%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Cameroon§</td>
<td>2001 (amended 2010)</td>
<td>2.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central African Republic</td>
<td>2010</td>
<td>3%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Congo, Democratic Republic of</td>
<td>2002</td>
<td>2.5%</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Congo, Republic of</td>
<td>2005</td>
<td>5%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>Gabon</td>
<td>2000</td>
<td>4% to 6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ghana**</td>
<td>2006 (amended 2010)</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guinea</td>
<td>1995</td>
<td>5%</td>
<td>3.5%</td>
<td></td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>1995</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liberia</td>
<td>2000</td>
<td>3% - 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mali</td>
<td>1999</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mauritania</td>
<td>2008</td>
<td>4%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td>2005</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Namibia</td>
<td>1992</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niger</td>
<td>2006</td>
<td>5.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria†</td>
<td>2007</td>
<td>Not specified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senegal</td>
<td>2003</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>2009</td>
<td>5%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>2004 (royalty added 2008)</td>
<td>0.5% - 7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td>2010</td>
<td>4%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td>2003</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>2008</td>
<td>5%</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

Note: The data was obtained directly from the countries’ mining codes or mineral acts. *3% is the minimum rate. Actual royalty rates are indexed to gold prices, they increase to 4% for gold prices between USD1,000/ounce (oz) and USD1,300/oz, and 5% for prices above USD1,300/oz. **The original 2006 act specified a range of 3% to 6%, however an amendment has changed the rate to a fixed level at 5%. # This particular royalty rate was introduced in 2006, well after the mineral act of 1992. †Leaves royalty rate to the discretion of the Minister of Mines. §Not specified in the mining code but the corporate tax code.