A model for sharing mineral resource rent in African countries

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The debate on the sharing of mineral resource rent [1] between governments and investors is recurrent. It resurfaces especially when the prices of minerals increase. The question is an important one for African countries, more than half of which produce mineral resources. However, there are no public databases to analyse and compare the fiscal and parafiscal tools put in place by African governments in order to capture a 'fair' portion of mineral resource rent. Initiatives to increase the transparency of information on mineral resource rent sharing focus mainly on the oil and gold sectors. These initiatives use different methods (mainly discounted cash flow models and modern asset pricing models) with different assumptions regarding discount rates, sales prices, etc.

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1. Rent is defined as 'the amount by which revenues exceed all costs of production, including those of discovery and development, as well as the normal return to capital' (IMF, 2012).

•••/••• Moreover, modelling frameworks often ignore some aspects of particular countries tax systems to simplify the modelling process (Smith, 2013; Laporte and de Quatrebarbes, 2015). It is difficult to compare the results *ceteris paribus*. The best known model applied to African countries is that of the 'Fiscal Analysis of Resource Industries' (FARI) developed by the International Monetary Fund (IMF). Nevertheless there is no public and standardised valuation of the share of rent captured by African governments. A few other similar initiatives exist, for example the 'Gold Benchmarking Model', developed by the Columbia Center on Sustainable Investment (CCSI).

This absence of comparative studies of mineral resource regimes is often explained by the lack of an inventory of taxes, fees and duties applied to the sector in African mineral-producing countries. Combined with a cash flow model inspired by FARI (IMF, 2015), the database built by Laporte *et al.* (2015) now makes it possible to calculate the average effective tax rate [2] (AETR) between governments and investors for 14 African countries between 2000 and 2015.

This work enables legal taxation systems in 14 countries in Africa to be compared. It does not aim to estimate the actual sharing of mineral resource rent between governments and investors. Consequently, it is not necessary to have access to economic data relating to mines, nor to get access to the mining agreements signed by governments. The AETR is calculated on the basis of national legislation and economic data representative of African mines.

The model used is a discounted cash flow model (DCF), which takes a similar approach to that used in the FARI model developed by the IMF (IMF, 2015). The data on tax comes from the database developed by Laporte *et al.* (2015), which describes the legal taxation system ap-

plied to industrial gold-mining companies in the main African gold-producing countries between 1980 and 2015. The economic data used reflects the diversity of African mines in terms of grade and profitability. The aim of the model is to calculate an indicator which is critical in evaluating the division of mineral resource rent between governments and investors: the AETR (IMF, 2012).

► Discounted cash flow model: method and assumptions regarding economic data

The diversity of gold mines throughout the world and in Africa requires one or more economic structures to be selected as 'representative' of the gold sector. Three 'standard mine' structures, characteristic of African gold mines, have been constructed to test the sensitivity of the mineral resource rent sharing indicator to the economic data used. The economic structure of a mine is characterised in particular by: (i) the life cycle of the mine, (ii) its production potential, (iii) the mineral grade of the reserves, (iv) capital expenditure (CAPEX), and (v) operational expenditure (OPEX). A review of the economic data used is presented in Table 1.

In this analysis, the life cycle of the three standard mines is set at 13 years: two years of initial investment (construction and equipment), 10 years of mineral extraction and one year of mine rehabilitation. It is difficult to determine the actual life cycle of a mine a priori. Excluding extension projects, the estimated life cycle of a mine can vary enormously according to feasibility studies: between seven and 15 years, sometimes 20 years. The actual life cycle is dependent on a number of factors, such as real geological conditions and changes in world prices. These aspects, which are difficult to control, influence whether or not extraction continues.

The potential of the reserves modelled is 1.6 million (mine 1), 1.6 million (mine 2) and 3.8

2. The AETR represents the share of the mineral resource rent captured by the State on a mining project, provided that the discount rate is sufficiently high to reflect the opportunity cost of capital.

million (mine 3) ounces of gold. This assumption is consistent with the information supplied by Minex, which shows that the main operational mines considered as 'profitable' projects currently have production potential of more than a million ounces.

The difference between the three mines lies in their mineral grade. In all three cases, production is carried out using open-pit mines, with a grade of 1.8 g/t in the case of the low-grade mine (mine 1), 3 g/t for the medium-grade mine (mine 2) and 4 g/t for the high-grade mine (mine 3). Mine 3 also has an underground production with a grade of 5.5 g/t. According to Gajigo (2012), African gold mines generally have a mineral grade of between 1.8 and 6 g/t. The stripping ratio is assumed to be identical for the three open-pit mines (1/9). Conversely, the recovery rate is lowest for the low-grade mine: 86% for mine 1, 88% for open-pit mines 2 and 3, and 95% for the underground mine. The three 'standard mines' constructed have average OPEX of USD 780/oz., USD 562/oz. and USD 319/oz. respectively, depending on the grade selected in each case. When CAPEX is taken into account, the total cash cost increases to USD 917/oz., USD 668/oz. and USD 404/oz.

Table 1. Economic assumptions for the three 'standard mines'

Description of mineral	Gold		
Measure of an ounce of gold Price per ounce of gold	31.1034768 g/oz. (Troy ounce) USD 1,100/oz. (2015)		
Economic assumptions	Low-grade, open-pit	Medium-grade, open-pit	High-grade, open-pit and underground
Life cycle	13 years	13 years	13 years
Area	150 km²	150 km²	150 km²
Stripping ratio	1/9	1/9	1/9
Mineral grade	1.8 g/t	3.0 g/t	4.0 g/t (open-pit); 5.5 g/t (underground)
Recovery rate	86%	88%	88% (open-pit); 95% (underground)
Initial investment	USD 190 million	USD 150 million	USD 290 million
Length of investment	2 years	2 years	2 years
Renewable investment	USD 18 million	USD 13.5 million	USD 22.5 million
Extraction costs	USD 2.5/t of waste rock mined	USD 2.8/t of waste rock mined	USD 3/t of waste rock mined
Processing costs	USD 15/t of mineral processed	USD 20/t of mineral processed	USD 22/t of mineral processed
Administrative costs	USD 3.5 million/year from year 3	USD 4 million/year from year 3	USD 5.1 million/year from year 3
Refining and sales costs	USD 5/oz	USD 5/oz	USD 5/oz
IRR* USD 1,100/oz.	20%	47%	80%
IRR* USD 1,400/oz.	43%	69%	105%

Source: Authors. *The IRR of mining projects is calculated before application of the tax regime, for a discount rate of 10%.
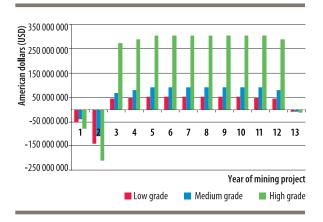
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respectively. These amounts are within the range for African gold mines, which extends from a little under USD 400/oz. to more than USD 1,100/oz. (Gajigo, 2012). Globally, the average total cash cost is USD 749/oz. (GFMS, 2015).

Initial investment (construction and equipment) amounts to USD 190 million for mine 1, USD 150 million for mine 2 and USD 290 million for mine 3; renewable investment (equipment) amounts to USD 18 million (mine 1), USD 13.5 million (mine 2) and USD 22.5 million (mine 3). Capital costs vary depending essentially on the mine's potential, the extraction rate, the grade, the technology used and geological factors.

Capital costs are funded through borrowing up to 90% or limited by the thin-capitalisation ratio set out in the country's legislation. Loans are assumed to have been obtained from non-resident agents, repayable in constant instalments, over a maximum duration of five years and at an interest rate of 6%.
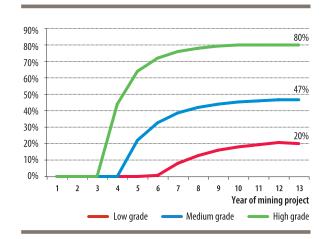
According to this economic data, the internal rate of return (IRR) of the mines is 20% for the low-grade mine, 47% for the medium-grade mine and 80% for the high-grade mine, assuming a gold price of USD 1,100/oz. (Figure 1 and Figure 2).

Figure 1. Net cash flow of the three representative mines

Source: Authors. For a discount rate of 10% and a gold price of USD 1,100/oz.

Figure 2. Internal rate of return [3] of the three representative mines

Source: Authors. The IRR of mining projects is calculated before application of the tax regime, for a discount rate of 10% and a gold price of USD 1,100/oz.

▶ Tax system used to calculate resource rent sharing

The tax data used in the discounted cash flow model comes from the legal and tax database created by Laporte *et al.* (2015). It is taken from the national legislation of each country: the Minerals and Mining Act, the Income Tax Act and all available complementary legal texts, thereby constituting the legal taxation system applied to a mine, excluding any difficulties in applying the tax and any specific mining agreements.

During the investment and mining phases (the first 12 years of the project), the model includes eight deductions paid by the mining company to the government. These are (i) three types of royalty: fees, ground rent and mining royalties; (ii) two taxes: corporate income tax and minimum tax; (iii) two withholding taxes: on dividends and on interest payments; and (iv) the payment of priority dividends to the gov-

3. The internal rate of return (IRR) is the discount rate that sets the net present value (NPV) of the project equal to zero.

ernment. On the other hand, no tax is due during the mine rehabilitation phase (Year 13).

Fees are fixed sums payable in exchange for the granting of mining rights and/or the potential renewal of such rights. Ground fees are due annually, according to the surface area of the mine allocated by the mining right. Mining royalties tax the quantity of mineral extracted. The tax base is defined differently in different countries. In the database established by Laporte *et al.* (2015), several types of mining tax base are listed. However, the legislative information does not enable a precise calculation of the amount due to be made: 'starting pit-head value of the substances extracted, whether exported or not, minus intermediary fees and charges' in Mali, 'total revenue' in Ghana, 'sale price of the product of the final stage of processing' or 'free-on-board (FOB) value of the mineral if it is exported before being sold' in Mauritania. The model therefore uses just two types of tax base: gross turnover and net turnover, that is turnover excluding refining and sales costs.

Corporate income tax applies to the company's taxable earnings. Its precise definition varies according to each country's accounting rules. For the purposes of simplification, a unique calculation method has been used in the model: the accounting income is obtained by deducting all accounting costs from the gross turnover. Accounting costs include: operational costs, interest charges, depreciation costs, fees, annual ground fees and mining royalties. Depreciation costs are calculated in accordance with national legislation (straight line depreciation, declining balance, exceptional depreciation or pooling), making a distinction between two categories of fixed asset: industrial buildings and capital goods. Taxable earnings are obtained by subtracting from accounting income any deferred losses carried over from previous years. In English-speaking countries, there is rarely a time limit on deferments. In French-speaking countries, deductions often have to be made within a limit of between three and five years, and only depreciation costs can be carried forward indefinitely. The model therefore draws a distinction between the deferment of 'ordinary' losses (excluding depreciation) and deferred depreciation. This model makes it possible to consider cases where the rules on deferring losses and deferred depreciation influence the payment of corporate income tax. In French-speaking countries, a company's gross turnover is taxed through a minimum tax. This tax is subject to a minimum and sometimes a maximum collection threshold. In the model, the amount of tax due as minimum tax is always considered an allowable deduction with regard to the amount of corporate income tax due.

Withholding taxes on interest payments tax the interest payments made to non-resident creditors. Withholding taxes on dividends tax the dividends paid out to non-resident shareholders. The mining company used in the model is assumed to be a company operating under local law whose sole activity is gold mining. Its social capital is held entirely by non-resident actors, with the exception of countries where the government requires the company to grant it a share of the capital free of charge. The payment of dividends to non-resident shareholders represents 20% of the annual earnings after tax, rising to 100% of such earnings during the final year of production. Accumulated earnings not paid out during the course of the project are assumed to be used for internal financing or extending the mine. Where the government requires the company to grant it a share of its social capital free of charge, the share transferred takes the form of preferred stock. Consequently, a supplementary dividend payment is made to the government in the amount of its share in the capital. The model does not provide for cases where the government pays to purchase an additional take in the social capital.

The model also covers specific provisions unique to each country according to legislative information. For example, in Sierra Leone annual ground fees is replaced by an annual fee; Malian legislation provides for two mining royalties, one calculated on the basis of gross turnover and the other on net turnover; in South Africa, withholding taxes on interest payments did not exist before 2015. In some countries, the AETR has been calculated despite a lack of information enabling account to be taken of fees, annual ground fees and the thin-capitalisation ratio due to their marginal impact on the indicator. As far as possible and given the available information, the model is therefore a close reflection of the actual legal situation.

That said, the model was unable to take into account three public levies which can have a impact on the AETR, due to the complexity of the tax information required to calculate them: (i) VAT credits not refunded to mining companies by the tax authority. Indeed, mining companies do not normally collect VAT because they export most of their production. Therefore, most of Minerals and Mining Acts exempt them from import VAT in order to avoid having to repay VAT credits. (ii) Customs duties payable on the importation of capital goods and fuel. On the one hand, mining companies are often exempt. On the other hand, taking them into account would require knowledge of the structure of imports. (iii) Taxes on oil products. These constraints underestimate the share of rent collected by the government.

The model assumes that the company benefits from a stability clause guaranteeing the maintenance of the tax regime throughout the life cycle of the project. The tax bases, rates, advantages and exemptions granted remain as they were on the date that the mining right was granted. By this means, the results obtained reflect the sharing of resource rent defined by a country's legislation for a given year. On the other hand, the stability clause does not mean that taxation rates remain unchanged throughout the entire life cycle of the mine. The tax regime to which a mine is subjected is not uniform over time; it changes according to the current project status. Rates can vary from year to year, according to the length of time the right has been granted for (or renewed for) and the project phase (prospecting, investment or mining).

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