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**REAL OPTIONS TO VALUE A MINING PROJECT UNDER 2 UNCERTAINTIES:
A QUANTITATIVE MODEL FOR REVENUE SHARE AND MINING FISCALITY**

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This presentation comes from a paper of Ndiaye & Armstrong [1] and addresses two questions, firstly considering two sources of uncertainties on the economic evaluation of an open pit gold mining project and secondly evaluating how much the different stakeholders stand to gain from the mining project's revenues.

Geological and technical uncertainties comes from gold grades variations inside the deposit and are modelled by geostatistical conditional simulations while financial uncertainties, coming from gold spot prices fluctuations are modelled by a geometric brownian motion.

A real options framework was used to take account of these two inherent uncertainties and the operating flexibility (that is, the possibility for the company to stop mining if the commodity price drops and/or the reserves prove to be lower than that had been envisaged). By this approach, we were able to envisage scenarios for developing an extension to the main deposit as a function of future values of the commodity prices.

Globally we found that the traditional DCF metrics undervalues the project whilst the Sequential Real Option (SRO) - the metric set up from our real options model - clearly maps and assesses the upside potential and the downside risk of the project. A synthetic case-study of a gold mine in West Africa was used to illustrate how this procedure could be applied in practice.

Beyond a better economic evaluation of the project, the purpose is to contribute, by a quantitative approach, to two current problems in the global mining industry:

- Determining the impact of the mining tax regime (taxes and royalties) when commodity prices are high or low, and when the deposit proves to be richer or poorer than anticipated.
- Determining an equitable split of revenues from mining for all the stakeholders (including the local communities).

Low income developing countries, with economies mostly based on mining revenues face problems to fairly assess the value of a mining project and adjust their fiscal taxation policy to many aspects of the project's profitability framework like geological and financial uncertainties.

By carefully analyzing the breakdown of the cash-flows generated, we were able to estimate the amounts received by the local community and by the national community (outside the mining area), the taxes and royalties received by the government and the profits made by the mining company. The procedure proposed should provide governments and NGOs with more objective data for making policy decisions, which is important within the context of “Social License to Operate”.

Reference:

[1] Ndiaye A. A., Armstrong M. (2013) Resources Policy 38: 113 - 122.

