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Method for calculating the CO2 emissions of a commodities portfolio

Operating control procedure

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As part of its asset management operations, OFI AM markets commodity-exposed funds.

Although these funds do not hold the physical commodities involved, the investment firm plans to set up a strategy of acquiring CO2 certificates and then destroying them, in order to voluntarily offset the CO2 emissions produced from mining the metals that underlie the funds' performance.

The purpose of this note is to explain the calculation method chosen to estimate these emissions.

Beyond the method itself, we also put forth some paths for improvement in order to make the calculation even more relevant.

Lastly, the document also proposes an operating calculation procedure that aims to ensure its independence, traceability and implementation.

A - Method for calculating CO2 emissions per tonne of ore produced

This method was developed on the basis of research conducted by Julien Bueb, a member of France Stratégie, an institution that reports to the office of the French prime minister, and a member of the High Council for the Climate, which was set up by the French president in 2018. The method was described by its author in a France Stratégie note published in October 2020 (read here).

This method estimates each metal's CO2 emissions in order to calculate the carbon footprint of a portfolio of metals.

Each metal's CO2 emissions are calculated on the basis of four major pillars:
1 - The quantity of primary energy needed to produce one tonne of ore, expressed in GJ/t (Gigajoules per tonne).
2 - An inventory of the three largest producers of each metal and their share of global output. Such data can be found, for example, on the website of US Geological Survey and are updated each year (source: USGS)
3 - An inventory of each ore-producing country's primary energy mix, as a percentage of each type of energy. The necessary data can be obtained from the International Energy Agency and are updated each year (source: IEA)
4 - An inventory of the CO2 emission factors for each type of energy, in kg of CO2 / GJ, i.e., kilograms of CO2 per Gigajoule consumed. Such data can be found on the website of the French Agency for the Environment and Energy Efficiency (ADEME) (source: Ademe). These data are unlikely to change, unless carbon capture is developed further in the coming years. Keep in mind that this refers to emission factors, i.e., emissions calculated on a primary energy basis, or energy injected into the system of production. This is done in order to be consistent with the quantities of energy measured in 1-, which are on a primary energy basis.

Keep in mind, as well, that emission factors in renewable energies are at zero. This makes sense in energy and wind power but raises questions elsewhere, in biomass in particular. However, the French Ministry of the Environmental Transition has stated that the emission factor can be regarded as at zero in this resource, assuming that "direct CO2 emissions caused by the combustion of biomass are offset by the absorption of CO2 during the plant's growth" (read here)

Data on the quantities of primary energy needed to produce the metals mentioned in 1- are excerpted, in the France Stratégie study, from a research article by Florian Fizaine and Victor Court (read here), which summarises the various findings in this area in the scientific literature. Some of these data are older and, hence, should be treated with caution.

It was therefore decided to review other academic sources in order to ascertain the validity of the figures used. A CNRS study (lire here) conducted by Eric Drezet in September 2014 presented findings that were rather similar in industrial metals. However, data on precious metals were far higher than those presented in the France Stratégie document.

Our separate discussions with Julien Bueb and Eric Drezet revealed that there is less research and data on the precious metals market. For example, the study that France Stratégie's calculations are based on encompasses data going back to the 1970s. It was therefore decided to take the energy consumption data from the CNRS study, which are upper bound on precious metals emissions and neutral to upper bound on industrial metals. These data come from a meta-analysis conducted by the United Nations Environment Program (UNEP; read here). The source is the database of EcoInvent, which specialises in calculating CO2 emissions by analysing their life cycle. We are currently in contact with this company to find out whether these data are updated regularly.

Once all these data have been assembled, we begin by calculating, for each metal, the share of output of the top three producing countries, on a base 100.

We then calculate each producing country's CO2 emissions based on its energy mix and the CO2 emissions of each type of energy.

By multiplying each country's share of global production by the average CO2 emissions of its energy sector, we obtain an estimate of average CO2 emissions per Gigajoule of energy consumed worldwide for the production of this metal.

As the CNRS study gives the number of GJs needed per tonne of metal produced, multiplying this figure by the average value calculated yields an estimate of the number of tonnes of CO2 emitted to produce one tonne of metal.

EXAMPLE :

Platinum:

1 - Quantity of energy per tonne of ore: 190,000 GJ/t

2 - Main producing countries: South Africa (69%), Russia (13%) and Zimbabwe (9%). Rebasing: South Africa (69/(69+13+9)= 75.82%), Russia (14.29%) and Zimbabwe (9.89%)

3 - Primary energy mix of the top three producers:

Platinum	Coal	Natural gas	Oil	Nuclear	Hydro	Renewables	Biocarb
South Africa	70%	3%	15%	3%	0%	1%	9%
Russia	15%	51%	24%	7%	2%	0%	1%
Zimbabwe	17%	0%	10%	0%	2%	0%	71%

4 - CO2 emission factors by type of primary energy (in kg CO2/GJ):

Coal	Natural gas	Oil	Nuclear	Hydro	Renewables	Biocarb
104.00	56.10	73.60	-	-	-	-

5 - Calculating CO2 emissions of energy consumption by country

	kg CO2/GJ
Afrique du Sud	85,52
Russie	61,88
Zimbabwe	25,04

6 - Calculating the weighted average:

75.82% x 85.52 + 14.29% x 61.88 + 9.89% x 25.04 = 76.16 kg CO2 / GJ

7 - Calculating emissions per tonne of ore produced:

76.16 kg CO2/GJ x 190 000 GJ/t= 14,470,947.03 kg CO2 / t of platinum, or 14,470 t CO2 / t of platinum

While the France Stratégie study provides values for gold, silver and platinum – three of the components of the OFI Financial Investment-Precious Metals portfolio – it provides no data for palladium.

Based on the same methodology, the value for palladium is 12,746.98 tCO2 / t of palladium produced, rounded off to 12,747.

CALCULATING EMISSIONS FOR THE PORTFOLIO

The approach consists in estimating the equivalent of each metal held by the portfolio on the basis of:
1 - The portfolio's assets under management
2 - Each metal's weighting in the portfolio
3 - Each metal's price
Hence, in the case of the OFI Financial Investment-Precious Metals fund, which manages about 1.4 billion euros and is 105% exposed to an index composed of 35% gold, 20% silver, 20% platinum and 20% palladium (and 5% Eurodollar 3M), the following estimates can be made:
4 - Gold exposure: 105% x 35% x 1,200,000,000 = €514,500,000
5 - As the price of an ounce of gold is about $1816, the fund is exposed to the equivalent of: 514,500,000 / 1816 = 283,315 ounces of gold, or about 8.81 tonnes of gold (1 tonne = 32,150 ounces)
6 - This calculation can be used to calculate the following exposures to various metals, in tonnes:

Metal	Tonnes
Gold	8.81
Silver	381.03
Platinum	9.12
Palladium	3.79

Multiplying these quantities to which the fund is exposed by each metal's CO2 emissions produces an estimate of CO2 emissions "attributable" to the portfolio. They amount to 395,160.93 tonnes.

THE MODEL'S LIMITS AND POTENTIAL IMPROVEMENTS

The first limit of this study is the perimeter of emissions used for it. Based on a reading of the research articles on which Julien Bueb and the CNRS based their research, only Scopes 1 and 2 are taken into account. Some activities, such as recycling and transport (Scope 3) are not included.

Even so, a study released recently by Citibank, which reported comparable figures for Scopes 1 and 2, suggests that Scope 3 amounts to just 10% of Scopes 1 and 2 for all metals. Hence, the study found that metals on the whole are responsible for 10% of the planet's CO2 emissions for their Scopes 1 and 2, and 11% when including Scope 3 the three metals responsible for more than 90% of emissions (steel, aluminium and copper).

A second limit is due to the fact that the quantities of energy assumed for metal production has been extracted from research articles and are not reviewed periodically. This could be the reason for the gap between estimated emissions and the reality, as the quantity of energy needed hinges on a large number of factors, including ore content, whether it comes from an open pit or an underground mine, and others. We do not currently possess dynamic data on this subject. Even so, we work with some of our partners and with EcoInvent to try to revalue these emissions regularly, based on documents released by mining companies. If such an update is possible, we incorporate the regularly updated data into our calculations.

A third limit lies in the updating of each country's emissions. We are currently dependent on data released by the International Energy Agency on a national level, but the reality of the energy mix in the field in mining activities alone can be different. Lacking granular data, we refer to this "average mix", even though it can lead to either an underestimation or an overestimation of the sector's emissions.

And, lastly, after reviewing this methodology, OFI AM's SRI department suggested a possible source of improvement. While the calculations were rather precise in the cases of platinum and palladium, where the top three producers account for 91% of global output, the same is not true for gold or silver, where the top three producers account for just 31% and 52% of global output, respectively. We therefore decided to redo our calculations for these two metals while including more producers, to obtain a better estimate of emissions generated in producing them. The limit was set at the top 10 countries or at a level including at least 70% of global production.

As a result, the value of gold, calculated with the world's top 10 producers, accounting for 58% of global output, comes to 20,152 tCO2/t

Silver's value was calculated on the basis of the world's top seven producers, together accounting for 74.28% of global output. The emissions calculated came to 98 tCO2/t of silver produced.
Based on these new data, emissions attributable to the underlying portfolio of metals of OFI Precious Metals would be 395,160.93 tonnes, based on the CNRS data. This figure is about 48% higher than the one that would have been calculated using France Stratégie's data.

B - Operating procedure

The calculation, as described here, is conducted once per year by OFI AM's SRI team. For reasons of data availability, the calculation will be done in June, to be sure of access to the previous year's data.

On this basis, the SRI team proposes for the portfolios in question, a separate calculation of CO2 emissions for each underlying metal, per tonne for each of the portfolio's underlying metals. At each calculation period during the year, the management team will take this value and multiply it by the number of tonnes-equivalent of each metal in fund assets on the calculation date.

During the month of June, the calculation is sent to the risk management and compliance teams to organise its traceability. The calculation is monitored and validated jointly by the SRI and risk management teams.

Upon reception, the risk management team checks the calculation. If it is correct, it notifies the management, SRI and compliance teams. If not, the risk management team asks the SRI team to correct the calculation.

Once the calculation has been approved by the risk management team, compliance sets up an annual inspection to ensure that the emissions calculation conducted by the management team adhere to the methodology rules.

If the inspection finds no inconsistencies, compliance emails the management team to confirm that the calculation is valid. It retains the data that made the calculation possible to provide traceability.

If the inspection does find a discrepancy, and if it the discrepancy is more than 5% of the position concerned, compliance informs the management team, which then has five days to justify its calculation or to adjust it on the basis of compliance's recommendation and to keep compliance informed.

Taken together, all these measures help ensure an independent calculation by the SRI team and traceability of controls conducted by the compliance team.

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