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INTERGOVERNMENTAL FORUM
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Sustainable Development



Public consultation document

Determining the Price of Minerals: A Transfer Pricing Framework

Schedule A: Bauxite

Interested parties are invited to send their comments no later than 14 July 2023 by e-mail to CTP.BEPS@oecd.org in Word format (in order to facilitate their distribution to government officials). All comments should be addressed to the Global Relations and Development Division, OECD Centre for Tax Policy and Administration.

Please note that all comments on this public consultation document will be made publicly available. Comments submitted in the name of a collective "grouping" or "coalition", or by any person submitting comments on behalf of another person or group of persons, should identify all enterprises or individuals who are members of that collective group, or the person(s) on whose behalf the commentator(s) are acting.



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This practice note has been prepared under a program of cooperation between the Organisation for Economic Co-operation and Development (OECD) Centre for Tax Policy and Administration Secretariat and the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), as part of a wider effort to address the challenges developing countries are facing in raising revenue from their mining sectors particularly on the topic of mineral pricing.

It reflects a broad consensus between the OECD Secretariat and IGF but should not be regarded as the officially endorsed view of either organization or of their member countries.

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OECD: www.oecd.org/tax/beps/

IGF: www.igfmining.org/beps

Introduction

In the mining sector, royalties and corporate income taxes are generally based on the value of the mineral transacted. Consequently, it is critically important that any transactions involving the purchase and sale of minerals are valued correctly. Due to the frequency and scale of related party transactions, the potential risk to tax revenues posed by transfer pricing non-compliance can be high, particularly around the value of the extracted minerals.

The transfer price is the price of a transaction between two entities that are part of the same economic group of companies. The price transacted between the two related entities is the “transfer price” and the process for setting the price is referred to as “transfer pricing.” Whereas commercial transactions between independent enterprises are generally determined by market forces, transactions between associated enterprises may not be, giving rise to concerns about the potential for “transfer mispricing” and posing significant challenges for tax authorities in monitoring and assessing such transactions.

The arm’s length principle is the international standard that determines transfer prices for corporate income tax purposes by multinational enterprises (MNEs) and tax administrations. When independent enterprises transact with each other, the conditions of their commercial and financial relations (e.g., the price of the good) are generally determined by market forces. However, when associated enterprises transact with each other, their commercial and financial relations may not be directly affected by external market forces in the same way as transactions between independent enterprises. Therefore, for corporate income tax purposes, the profits of associated enterprises may be adjusted as necessary to ensure that the arm’s length principle is satisfied, that is, the conditions of the commercial and financial relations that they would expect to find between independent enterprises in comparable circumstances.

Establishing the arm’s length conditions involves gathering vast amounts of information (both publicly available and in the taxpayer’s possession) in order to determine what independent parties would have agreed to in comparable circumstances, that is, the conditions that might be expected to operate between independent entities dealing wholly independently with another in comparable circumstances. When applied to the mining sector, particularly in relation to minerals where publicly available information on industry and pricing data is not readily available, there are both practical and technical challenges in applying the arm’s length principle. These challenges are further amplified in resource-constrained and lower-capacity tax administrations in developing countries.

In recognition of this, the Organisation for Economic Co-operation and Development (OECD) Centre for Tax Policy and Administration Secretariat and the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF) have prepared this practice note to address the transfer pricing challenges faced when pricing minerals from an administrative and policy perspective.

About This Schedule

This mineral pricing schedule complements the practice note *Determining the Price of Minerals : A Transfer Pricing Framework*. The practice note provides a framework to identify the primary economic factors that can influence the pricing of minerals (“mineral pricing framework”) using transfer pricing principles. This schedule shows how the framework can be applied to bauxite.

Framework: Using the Comparable Uncontrolled Price Method to Determine the Price of Minerals Sold

There are three primary factors to consider when applying the comparable uncontrolled price (CUP) method to related-party mineral sales. These are:

1. The characteristics of the product, such as the physical features and quality of the commodity.
2. The economic circumstances that existed at the time the sales agreement was entered into, that is, the period of the arrangement.
3. Contractual terms such as quantity transacted, transportation terms, payment terms, insurance, quotation periods, foreign exchange, and treatment and refining charges.

Importantly, this framework is premised on the following overarching conditions:

- a. The hypothetical seller is treated as a mining enterprise that is part of a larger multinational mining group.
- b. Being part of the multinational group, the mining enterprise would have access to knowledge and intelligence of the commodity market conditions from its sister companies or its parent entity. This market knowledge and intelligence should include an awareness that the producing mine is one of a finite number of production entities in the world, and it produces a scarce resource that is the source of value creation.
- c. It is on this basis that the hypothetical mining enterprise, operating wholly independently, would assess all of the options realistically available to it with the full benefit of market intelligence and knowledge that the wider MNE group has access to, and sell at the highest possible price, taking into account its commercial objectives.

Schedule A - Bauxite

Bauxite and Market Conditions

Bauxites are residual rocks in which alumina trihydrate and monohydrate minerals are predominant, typically as gibbsite, boehmite, and diasporite.

Bauxites are the main sources of aluminum. Bauxite is purified using the Bayer process to produce aluminum oxide, typically called alumina. During the Bayer process, gallium may also be recovered. Alumina is used predominately in the smelting of aluminum metal; however, there are many industrial uses for alumina.

Physical Characteristics of Bauxite

Bauxite is an important ore of aluminum, composed mainly of Al, Fe, Si, Ti oxide, and hydroxide minerals. There are two types of bauxite, of lateritic or karstic origin. Lateritic bauxite is the most common, around 90% of global resources, and is formed by the intense weathering of surface rocks. In geosciences, lateritic bauxites (silicate bauxites) are distinguished from karst bauxites (carbonate bauxites). Lateritic bauxites were formed by lateritization of various aluminum silicate rocks, such as granites, gneisses, basalts, syenite, clays, and shales. The aluminum hydroxide in the lateritic bauxite deposits is almost exclusively gibbsite.

Bauxite is typically formed through unique aluminous rock weathering events in a tropical environment where the hydrology allows the removal of silica. The weathering may form the principally economically significant ores of gibbsite and boehmite, which are amenable to the production of alumina through an industrial transformation known as the Bayer process. As bauxites have formed from a variety of rock types, there are usually minor quantities of residual mineral elements that may become concentrated in bauxites.

The economic value of bauxite is dictated by its behaviour in the Bayer process. Gibbsitic ores are more valuable than boehmitic ores because they are less expensive to process. Processing gibbsitic bauxite can be done at low temperature, whereas boehmitic and diasporic bauxite require high-temperature processing—and hence higher energy costs. Bauxite ores are typically reddish brown, but pure bauxite ores may be white or buff brown.

Figure 1. Bauxite Extraction, Brazil



The tropic and sub-tropic regions appear to provide the ideal climatic conditions for bauxitization. Gibbsitic bauxite is only found in these areas.

This process of bauxitization leaves behind traces of silica, moisture, organics and other impurities that negatively affect the cost of refining the commercially valuable mineral components and therefore can attract a discount to the market price.

Bauxite Production and Reserves

The following tables provide an overview of the top bauxite-producing and consuming countries. The top bauxite-producing countries are outlined in Table 1. The largest producer of bauxite is Australia, and the largest exporter is Guinea, with the product predominantly being sold to China. China is world's largest consumer of bauxite (to produce alumina), followed by Australia as seen in Table 2.

Table 1. Bauxite production and reserves (million tonnes)¹

Country	2019	2020	2021	Reserves
Australia	105,000	110,000	104,000	5,300,000
China	70,000	92,700	86,000	1,000,000

¹ United States Geological Survey. (2021). *Bauxite and alumina*. <https://pubs.usgs.gov/periodicals/mcs2021/mcs2021-bauxite-alumina.pdf>

Guinea	67,000	86,000	85,000	7,400,000
Brazil	34,000	31,000	32,000	2,700,000
India	23,000	20,200	22,000	660,000
Indonesia	17,000	20,800	18,000	1,200,000
Jamaica	9,020	7,550	5,800	2,000,000

Table 2. Alumina production (kilotonnes)²

Country	2019	2020	2021
China	72,500	73,100	74,000
Australia	20,200	20,800	21,000
Brazil	8,700	10,300	11,000
India	6,690	6,560	6,800
Russia	2,760	2,870	3,100
Jamaica	2,170	1,620	1,200
Saudi Arabia	1,840	1,810	1,800

Components for an Agreement for the Sale of Bauxite

As with any commodity, the terms and conditions of a sales and purchase agreement are specific to that commodity, that is, terms that impact price, logistics, and risk transfer. The key components of a bauxite sales and purchase agreement are:

- Payable mineral—the commercial value of bauxite is determined primarily from the quantity of **available alumina**.
 - Available alumina is defined as the portion of the total amount of alumina in a bauxite that can be extracted through digestion by a commercially viable process. Available alumina has a direct impact on alumina production costs and, at the time of writing, each 1% of reduction results in a reduction of about USD 8 per tonne of alumina production. The available alumina in bauxite typically ranges from 33% to 55%, which varies depending on the mine and country the bauxite is extracted from.
 - Base quality—The alumina content in the bauxite is typically specified as a percentage that is expected to be delivered.

² United States Geological Survey. (2021). *Bauxite and alumina*. <https://pubs.usgs.gov/periodicals/mcs2021/mcs2021-bauxite-alumina.pdf>

- Penalty and premium adjustments are made based on the actual bauxite quality, that is, available alumina and base quality in each shipment and any impurities that are present.
- Impurities have an impact on the price of bauxite:
 - Reactive silica is the most economically significant impurity due to the direct impact it has on the cost of refining. Higher-reactive silica content leads to higher requirements of caustic soda when refining bauxite to alumina and, at the time of writing, each 1% increase in reactive silica in bauxite increases the consumption of more than 20 kg of caustic soda. The reactive silica content in the bauxite typically ranges from 1% to 12%, which varies depending on the region and the mine. The lower the reactive silica, the more desirable the bauxite is. There are price premiums and discounts for bauxites depending on the levels of reactive silica.
 - Iron oxide (hematite and goethite)—Iron oxides typically pass through the alumina refining process in a benign manner and accumulate as a waste stream known as “bauxite residue” or “red Mud.”
 - Titanium dioxide (rutile and anatase)—Titanium dioxide (TiO₂) also concentrates in the bauxite residue during the Bayer process of alumina production along with iron minerals. High titanium dioxide content can result in excessive and tenacious scales forming inside refining equipment and can occasionally result in price discounts for bauxites.
 - Other contaminants with negative economic impacts during refining include organic material (total organic carbon), sulphur-containing minerals (e.g., pyrite), and phosphorous-containing compounds.
- By-products—Special techniques can recover commercial quantities of minor elements, such as gallium and vanadium, from the red mud residue. Gallium is a rare metal that is used in electronics and is critical to the manufacture of semiconductors. Many bauxite miners lack the know-how and techniques to commercially recover vanadium or gallium; therefore, this factor generally does not need to be accounted for.
- Moisture—Moisture has no value in alumina production and can pose problems in handling and crushing as well as high evaporation load in the refinery. Higher moisture content also adds to the cost of transportation by increasing the weight of the bauxite. In some cases, it is necessary to dry bauxite prior to exporting in order to reduce weight. However, completely dry bauxite is also not preferred as this can cause heavy dusting during handling and transportation. The moisture in bauxite generally ranges from 7% to 15%, with moisture from Indonesian bauxite being around 15%. Some arm’s length contracts will have moisture rejection clauses due to the refineries being in colder climates such as Russia, China, and Canada, where bauxite can freeze if the moisture content is higher than 6%, making it difficult to handle the ore.

- To assess the available alumina and reactive silica of a particular bauxite ore, alumina refineries request representative samples and check the metallurgical and mineralogical characteristics before importing the ore from a particular mine.
- While the buyers of bauxite are concerned with available alumina and reactive silica, most bauxite mining companies prefer to sell their ore based on total alumina and total silica content. They do not guarantee actual levels of available alumina and reactive silica. Contracts are, therefore, based almost exclusively on total alumina and silica content, as well as moisture. A bauxite sale contract does not typically incorporate all the metallurgical parameters, including organics and minor elements.
- Incoterms—Depending on the arrangements negotiated between the buyer and seller bauxite can be sold at the load port (free on board, or FOB) or delivery port (cost and freight [CFR] or cost, insurance, and freight [CIF] basis). The shipping costs are generally referenced to a dry bulk carrier freight (Capesize, Supramax, and Panamax) rate given the quantity of bauxite transacted.
- Quotational period—The price is generally negotiated between the buyer and seller directly, hence there is no standard or requirement for a quotational period.
- Duration—Contracts may be for one cargo, or for many millions of tonnes delivered on a multi-year contract. Typically, multi-year contract prices are negotiated periodically or linked to indices such as the London Metal Exchange (LME) aluminum price.

Bauxite Pricing Fundamentals

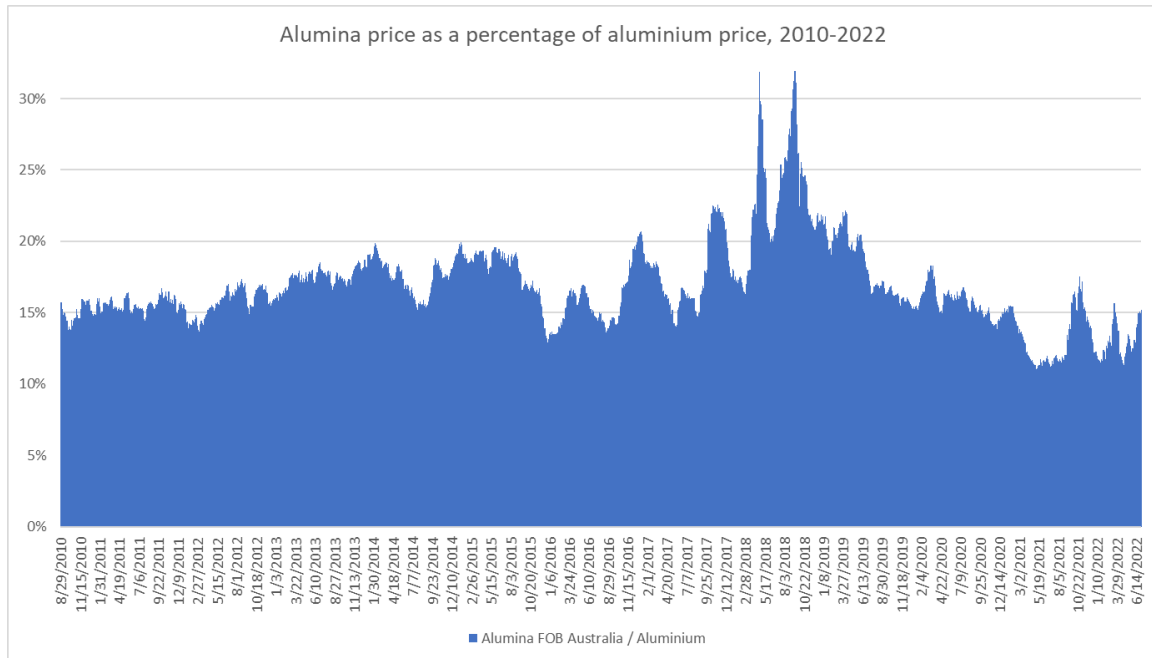
Bauxite is a mineral that is valued for its aluminum oxide (alumina) content, with the vast majority of bauxite used for aluminum production. Historically, this has meant that demand for bauxite has had a close linkage to alumina production and subsequently aluminum production. Outside of alumina, bauxite is used in other industrial applications, such as calcined products, aluminum cement, and chemical products.

Since 2010, however, the connection between bauxite, alumina, and aluminum has started to diverge for a number of reasons. For example, the correlation between alumina and aluminum pricing started to see fractures as alumina input costs, such as caustic soda, increased, while demand for aluminum was conversely dampened by the secondary aluminum recycling market, which was less cost intensive than producing fresh aluminum.

In 2018, the alumina market also experienced one of its most volatile years resulting from sanctions imposed on US Rusal by the United States, force majeure leading to a partial closure at Norsk Hydro's Alunorte mine, and a worker's strike at an Alcoa facility in Australia. This combination of events pushed alumina prices to record highs of over USD 700 while aluminum products remained static between USD 2,000–USD 2,100. This underscored the trend toward an independent demand and supply dynamic for alumina and aluminum and subsequently has led to physical alumina contracts being priced on alumina indices calculated by pricing agencies rather than as a percentage of an

aluminum LME price. Recent price variations confirmed the trend, as primary aluminum prices rose to new heights in 2021 and 2022 without as significant an increase in alumina prices.

Figure 2. Alumina as a % of the aluminum price, 2011–2022



Source: Fastmarket - Alumina index, fob Australia, \$/tonne and LME Aluminium 3M Official, accessed July 2022, <https://www.fastmarkets.com/>.

Determining the Price of Bauxite

Historically, determining a price for bauxite given its unique characteristics was inherently difficult due to the lack of global seaborne trade for bauxite and the degree of vertical integration in the aluminum value chain, which meant the price discovery process for bauxite was not well established. The only point of reference on the market was the price of aluminum on the LME, which was used in bauxite and alumina contracts in Jamaica and Guinea, for example.

In recent years though, several pricing data agencies have started collecting price intelligence and publishing bauxite prices due to the growth of seaborne bauxite trade. Driven largely by Chinese imports, the availability of pricing data has increased, thereby facilitating the price discovery process and allowing the development of bauxite price indices. Examples of bauxite pricing data can be found published by Asian Metal, CRU Group, Fastmarket, and the CM Group. Each of these is accessible through a subscription service.

The availability of pricing indices themselves does not represent a substitute for an arm's length price that would be agreed between independent parties. It does, however, present a reliable starting point to compute an arm's length price. In order to determine

whether it is appropriate to be using such indices, it must be first established whether independent parties in negotiations in fact use these indices and, if so, to what extent.

To answer this question, collaborative interviews were undertaken with industry participants directly involved in bauxite contract negotiations. All industry participants confirmed that these indices were used as a form of intelligence (in addition to internal company intelligence gathering and industry knowledge) on what the indicative market price of bauxite would be at any given time. Although not determinative of the contracted price of bauxite for a given purchase, the indices nonetheless provided valuable pricing information and discovery.

It is, therefore, reasonable, practical, and in accordance with the arm's length principle that tax authorities similarly are able to use these indices as a starting point to determine an arm's length price for bauxite.

Bauxite Price Indexes

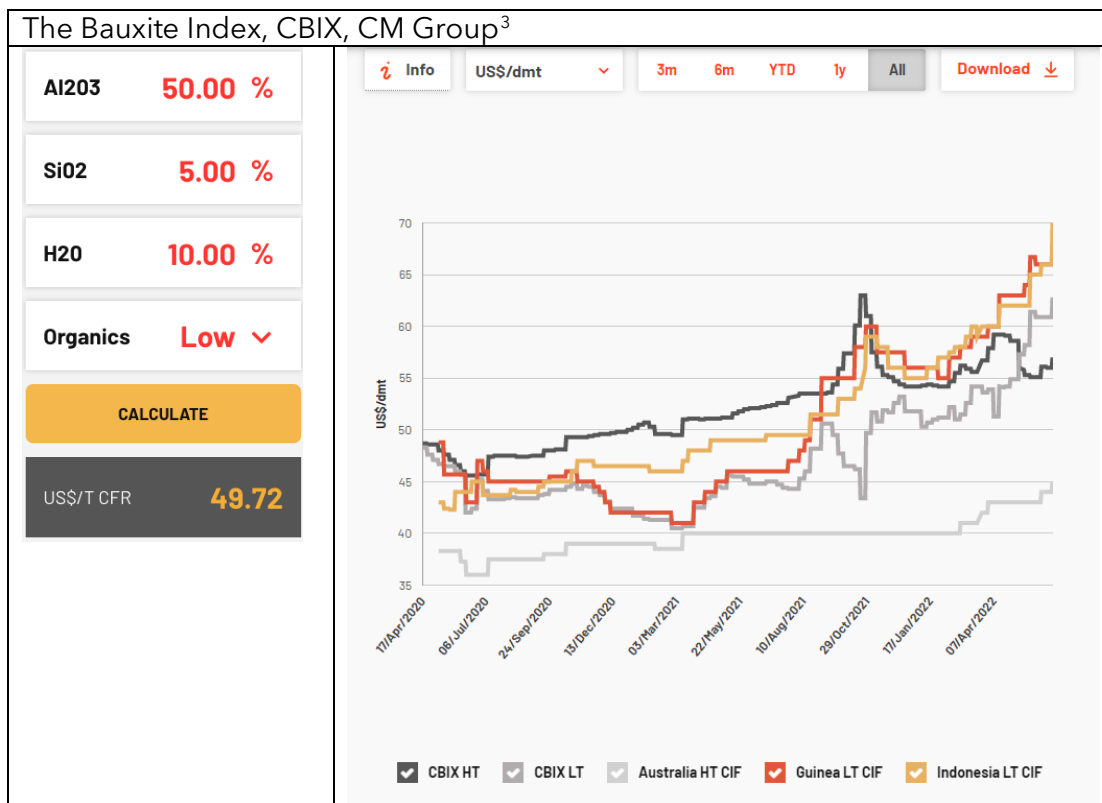
CBIX

CBIX has a calculator tool whereby the user is able to enter the physical characteristics of the bauxite, and adjustments are able to compute the indicative market price on a given day. In addition, CBIX publishes index prices for the following five types of bauxites:

- Guinea LT (T.Alumina 45%, T.Silica 3%)—standard Guinea ore CIF Qingdao, low-temperature refining.
- Indonesia LT (T.Alumina 48%, T.Silica 8%)—standard Indonesian ore CIF Qingdao, low-temperature refining.
- Australia HT (T.Alumina 54%, T.Silica 9%)—standard Australian ore CIF Qingdao, high-temperature refining.
- CBIX LT (T.Alumina 50%, T.Silica 5%)—trade-weighted aggregate of all low-temperature refining ores CIF Qingdao ViU adjusted to the standard CBIX grade reference ore.
- CBIX HT (T.Alumina 50%, T.Silica 5%)—trade-weighted aggregate of all high-temperature refining ores CIF Qingdao ViU adjusted to the standard CBIX grade reference ore.

These prices are updated weekly and available retrospectively. Figure 3 presents the five pricing indexes published by CBIX as described above. As you can see, there is significant variation in the pricing of the indexes, which highlights the importance of selecting the most appropriate index and conducting the required comparability adjustments to achieve an arm's length price. Furthermore, it's important to test the extent to which the index is used to price transactions between unrelated parties: if it is not being used in the market, then questions arise regarding its appropriateness for use between related parties.

Figure 3. Bauxite pricing indexes



Fastmarket

Fastmarket is another price-reporting agency which reports bauxite index prices on a FOB basis for production from Brazil and Guinea. The specifications and details regarding the indexes are presented in Table 3. However, Fastmarket decided to discontinue the Guinea FOB index price and replace it with an index price on a China CIF basis instead,⁴ confirming that the most accurate market prices are found at the point of import into China.

Table 3. Fastmarket bauxite index

MB-BX-0015 - Bauxite FOB Trombetas, Brazil	MB-BX-0016 Bauxite, CIF China, USD per dry metric ton (dmt)
<ul style="list-style-type: none"> Units: USD per tonne per dry metric tonne Basis: FOB Brazil (other delivery terms normalized) Chemical specifications: Total alumina - min 50.5%; max 55%; total silica - min 4.3%; max 5.6%; reactive silica - min 4%; max 5%; Fe - max 12%; Ti - max 1.5%; moisture content - min 9%; max 10% Trade size: Minimum 20,000 tonnes 	<ul style="list-style-type: none"> Quality: Total alumina 50%; total silica 5%; Fe 20% max; moisture content 7% min, 10% max; organic carbon 0.15% max Quantity: Min 40,000 tonnes Location: CIF China Timing: Within 2 months Unit: USD per dmt

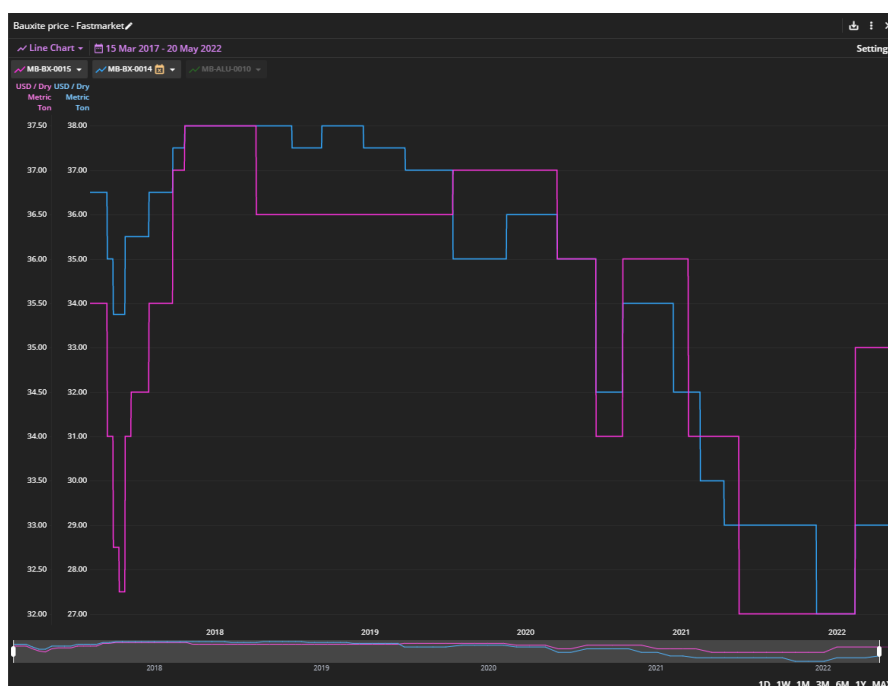
³ The Bauxite Index. (n.d.). *Guinea's booming bauxite industry - 2023 update report*. <https://thebauxiteindex.com/>.

⁴ Fastmarkets. (2022). *Proposal to launch bauxite cif China price assessment, discontinue fob bauxite prices*. <https://www.fastmarkets.com/insights/proposal-to-launch-bauxite-cif-china-price-assessment-discontinue-fob-bauxite-prices>

- Payment terms: 30 days after loading (other payment terms normalized)
- Loading port: Trombetas (other ports normalized)
- Loading window: Within 2 months
- Delivery method: Bulk carrier
- Publication: Fortnightly on Thursdays between 2 pm and 3 pm London time

- Payment terms: LC (other payment terms normalized)
- Publication: Monthly; third Thursday of the month, 3 pm–4 pm London time
- Notes: Bulk carrier; accepted origins—Guinea, Australia, and Indonesia

Figure 4. Fastmarket bauxite index



Source: Fastmarkets. (2022).

Asian Metal

Asian Metal publishes the following bauxite price indexes collected from Chinese customs data:

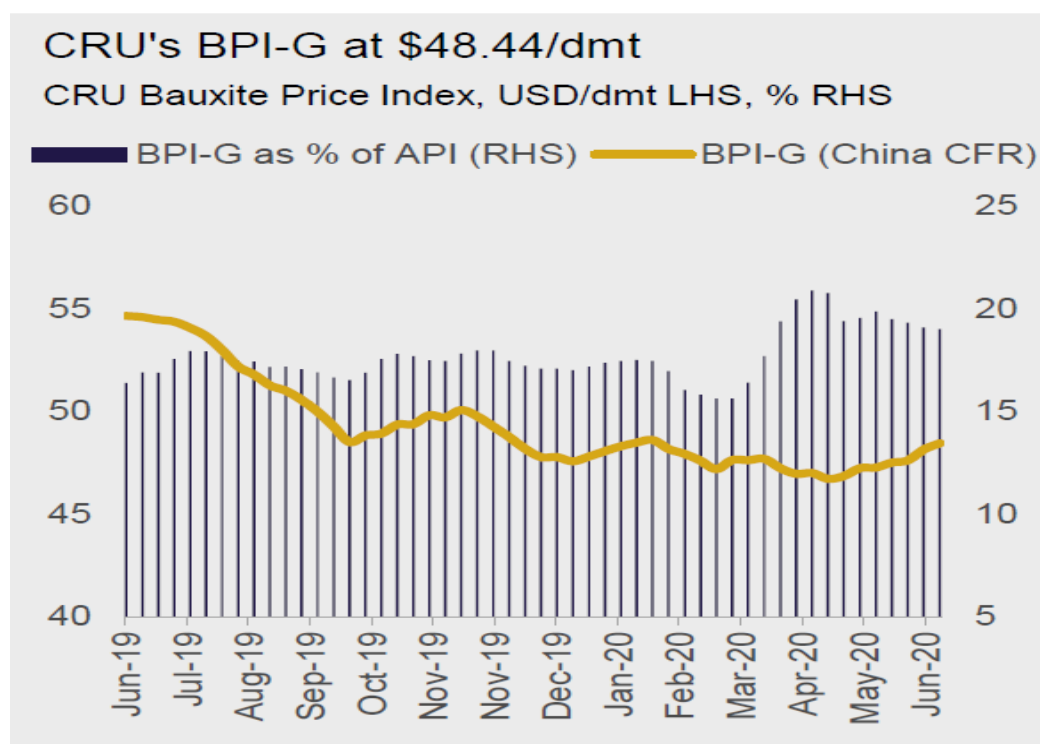
- Indonesian 47% min CIF China, USD/dt: Al₂O₃ 47% min, reactive SiO₂ 5% max, Lot : 55,000–110,000 mt (daily)
- Indonesian 49% min CIF China USD/dt: Al₂O₃ 49% min, SiO₂ 3.5% max, Lot: 150,000–200,000mt (daily)
- Guinean 45% min CIF China, USD/dt: Al₂O₃ 45% min, SiO₂ 3% max, H₂O 12% max, Lot : 200,000–500,000 mt (daily)
- Chinese bauxites Al₂O₃ 60% min, Al/Si 5.0, SiO₂ 12% max, Ex-VAT Delivered China Lot: 10,000–300,000 mt

CRU

CRU also publishes a price index for bauxite. According to the company,

CRU's bauxite price assessments are based on a combination of primary research and trade data, which are adjusted based on freight rates, caustic soda prices and value in use. The prices published are a 30-day trailing average of imports to China. Information on prices is gathered and normalized to a benchmark specification of 50% available alumina, 5% reacting silica, on a dry tonne basis, using CRU's bauxite and alumina cost model.

Figure 5. CRU Bauxite Index⁵



Comparability Adjustments

Characteristics of the Product

Bauxite is a mineral that is valued for its aluminum oxide (alumina) content. The value of the bauxite is adjusted based on the payable alumina in each shipment. If referencing a bauxite price index from a reputable price-reporting agency, with a baseline payable alumina figure that is different to the controlled transaction, then an adjustment is required to account for this difference. The most accurate method of conducting this

⁵ Ling, W. (2023). *Aluminium raw materials*. <https://www.crugroup.com/analysis/aluminium-raw-materials/>

adjustment is by reviewing arm's length sales and purchase agreements of bauxite and identifying how this adjustment is conducted between independent parties in comparable circumstances. From a limited access to such contracts, we have concluded that the adjustments for the payable alumina tend to be:

- For each 1% of Al₂O₃ above or below the applicable benchmark, the price shall be increased or decrease by (fractions pro rata) USD 1 per dmt. Such an adjustment may be limited to a small range of alumina content around the benchmark that fit within the specifications of the buyer, for example, 42–48% Al₂O₃.

The most economically significant impurity in bauxite is silica (SiO₂) due to the direct impact it has on the cost of refining. The level of silica present in the bauxite and its impact on pricing will vary. Similar to the adjustment for payable alumina, the most accurate method of accounting for different levels of silica is by reviewing arm's length sales and purchase agreements of bauxite and identifying how the pricing methodology operates in relation to the presence of silica. The rule of thumb is that, on a weight basis, any mass of silica that reacts in the refining process will cause an equal loss of caustic soda, and an equal loss of alumina to the red mud. Thus, silica is a key determinant of any bauxite's economic value.⁶ From a limited access to such contracts, we have concluded that the adjustments for the silica tend to be:

- For each 1% of total silica (SiO₂) above or below the applicable benchmark, the price shall be increased or decreased by (fractions pro rata) USD 1 to USD 4 per dmt. Such an adjustment may be limited to a small range of silica content around the benchmark that fits within the specifications of the buyer, for example, 1%–4% SiO₂.

The other determinant of the price of bauxite is moisture (the H₂O content). The level of moisture present in the bauxite ore and its impact on pricing will vary. Similar to the adjustment for payable alumina and silica the most accurate method of accounting for different levels of silica is by reviewing arm's length sales and purchase agreements of bauxite and identifying how the pricing methodology operators in relation to the presences of moisture.

The rule of thumb is that small changes in moisture content from the benchmark do not affect processing costs like alumina or silica content do, as such should not affect pricing, but some contracts contain rejection clauses for very high moisture levels. There is generally no need for a specific pricing adjustment for H₂O content in bauxite ore because when calculating the price of bauxite ore from benchmark prices, only the dry ore is valued, which excludes the H₂O content, all prices are on a dry metric tonne basis.

Economic Circumstances

As outlined earlier, the bauxite market has followed that sectoral trend with the advent of the growing seaborne bauxite market trade and the creation of bauxite price indices. From a transfer pricing perspective, this allows tax authorities to account for the temporal

⁶ The Bauxite Index. (n.d.). *Bauxite 101*. <https://thebauxiteindex.com/about/bauxite-101/>

factors arising from global supply and demand by referencing index prices that correspond to the period in which related-party sales contracts are entered into.

In short, by referencing a bauxite price index from a reputable price-reporting agency, one is able to account for both global supply and demand factors as well economically significant aspects of the payable aluminum content and penalties for silica and moisture.

Factors around the general structure of the production and consumption entities are not expected to have a material bearing on the bauxite prices. Although there are some dominant players in the bauxite industry, the market is fragmented enough that there is no singular or small group of producers or consumers that are able to influence the market price of bauxite.

The production history, the general reliability of a producer, and the size of the production mine itself may have an influence on price. As a general rule, a track record of stable production (including stable quality of bauxite) and larger mines can attract a premium on price. Smaller mines or newly developed mines may offer discounts to attract buyers or may only be able to sell to traders who can consolidate production with another mine in order to sell to an alumina refinery. This would be expected to decrease over time as a mine established its supplier credentials. An adjustment for this factor can only be thought of as a directional quantity, and there is insufficient empirical evidence to suggest a precise adjustment. Therefore, for practical reasons, it may be reasonable to have no adjustment for this economic factor.

Contractual Terms

Outside of the factors discussed earlier in this framework, the other economically significant adjustment relevant to the sale and purchase of bauxite is the assignment of transportation responsibilities. The quantum of this adjustment is dependent on the proximity of the mine to the alumina refinery.

For seaborne trade made between related parties on an FOB basis, it may be appropriate to consider adjustments from the bauxite index price. Some indices, for example, represent the CFR landed price into a particular port.

The other consideration is if the related-party trade is delivered into another port on a CFR basis. If this is the case, the freight component of the index needs to be stripped out completely to compute a FOB price, before “adding back” the CFR component calculated for the shipping route from the origin and destination port. This can be done by using internal shipping costs from the multinational enterprise (internal CUP). If a sales contract references a particular pricing index, the contract may contain a shipping adjustment to account for different load ports than the index. Alternatively, one can use a shipping index such as the Baltic Dry Index, a shipping index that reports on the dry bulk carrier costs for shipping raw materials.⁷ Using the former is preferable as it more accurately reflects the actual costs incurred by the MNE, whereas the Baltic Dry Index is more reflective of quoted market prices at a certain period as opposed to actual costs. Freight deals

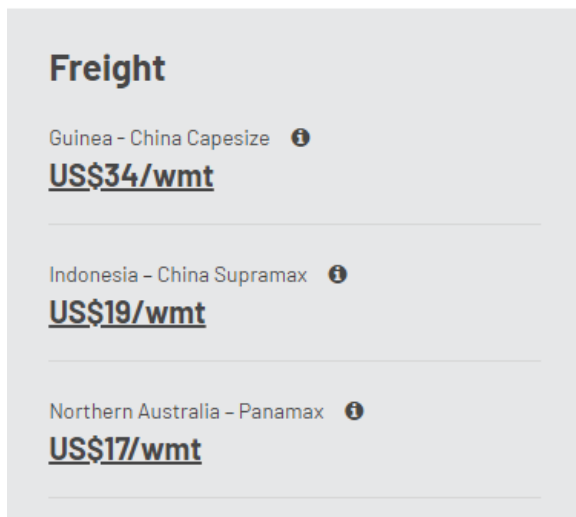
⁷ Baltic Exchange. (n.d.). *Independent information for the dry bulk market*.
<https://www.balticexchange.com/en/data-services/market-information0/dry-services.html>

negotiated for longer-term contracts can vary significantly from the spot market, which can be quite volatile.

Other companies publish bulk freight index prices for minerals, such as S&P Platts, for many routes and a variety of mineral commodities transported in bulk worldwide. They publish a Time Charter Equivalent assessment in USD/day and price indexes of USD/MT for each route.⁸

Specifically for bauxite, CBIX publishes freight rates per tonne for three popular transport routes of bauxite to China: Guinea–China via Capesize, Indonesia–China via Supramax, and Northern Australia–China via Panamax as outlined in Figure 6 as an example. They are based on Baltic Exchange Indices and Singapore Bunker Prices, updated weekly and available retrospectively.

Figure 6. CBIX bauxite freight indexes⁹



Worked Example

A practical example in applying the bauxite index.

On July 25, 2022, there was a sale of bauxite from Guinea.

The sale of 1 metric tonne of bauxite had the following characteristics:

- Al₂O₃ – 44%
- SiO₂ – 2%
- Moisture – 8%
- Transport cost on Capesize vessel that week (CBIX): USD 33.30/wmt

⁸ S&P Global. (n.d.). *Shipping price assessments catalog*.

<https://www.spglobal.com/commodityinsights/en/our-methodology/price-assessments/shipping>

⁹ The Bauxite Index. (n.d.). *Guinea's booming bauxite industry - 2023 update report*.

<https://thebauxiteindex.com/>. Offered as an example only.

The CBIX Guinea LT Index (45% min CIF China, Al₂O₃ 45%, SiO₂ 3%) was USD 67/dmt.

Sample sales contracts use the following adjustments:

- Al₂O₃:
 - For each 1% of Al₂O₃ above 45%, the price shall be increased by (fractions pro rata) USD 1 per dmt.
 - For each 1% of Al₂O₃ below 45%, the price shall be decreased by (fractions pro rata) USD 1 per dmt.
- SiO₂:
 - For each 1% of total silica (SiO₂) below 3% the price shall be increased by (fractions pro rata) USD 1 per dmt.
 - For each 1% total silica (SiO₂) above 3% the price shall be reduced by (fractions pro rata) USD 1 Per dmt.
- Moisture above 15% will lead to the rejection of the shipment.

A sales and purchase price at the point of export (FOB) Guinea would be:

Price =

1. CBIX Guinea LT Index Price: USD 67/dmt
2. Al₂O₃ Adjustment: -USD 1 (1% less than the standard 45% Al₂O₃)
3. SiO₂ Adjustment: +USD 1 (1% less than the standard 3% SiO₂)
4. Freight Adjustment: USD 33.30/wmt
5. Freight Adjustment on a dry ton basis : $USD\ 33.30 / (1\% - 8\%) = USD\ 36.20/dmt$
6. Guinea FOB price: $USD\ 67 - 1 + 1 - 36.20 = USD\ 30.8/dmt$

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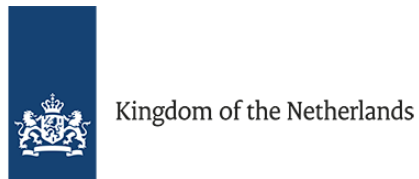


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Appendix 1. Sources of Information for Bauxite¹⁰

Provider	Use	Reference
Asian Metals	Bauxite pricing information	https://www.asianmetal.com/Aluminum/
Bloomberg	Commodity, pricing, and company information	Commodities - Bloomberg
CBIX	Bauxite pricing information	The Bauxite Index Bauxite Industry News, Prices and Trends
CRU	Bauxite pricing information	Bauxite Price & Market News Alumina Market & Price Index Carbon News & Pricing CRU (crugroup.com)
Fastmarkets	Bauxite pricing information	https://www.fastmarkets.com/insights/proposal-to-launch-bauxite-cif-china-price-assessment-discontinue-fob-bauxite-prices
Guinea safe harbour	Example of bauxite safe harbour	https://www.itie-guinee.org/arrete-relatif-au-prix-de-reference-applicable-a-la-vente-de-la-bauxite-en-republique/
Platform for collaboration on Tax (IMF, OECD, UN & WBG)	Additional information on commodity pricing	Addressing Difficulties in Accessing Comparables Data for Transfer Pricing Analyses (oecd.org)
S&P Capital IQ	Commodity, pricing, and company information	S&P Capital IQ Pro S&P Global Market Intelligence (spglobal.com)
USGS	Bauxite production and reserves information	https://pubs.usgs.gov/periodicals/mcs2021/mcs2021-bauxite-alumina.pdf

¹⁰ Websites accessed in January 2023.