

ADDRESSING INFORMATION GAPS ON PRICES OF MINERAL PRODUCTS

MINERAL PRODUCT PRICING PRACTICES
CASE STUDIES:
COPPER, GOLD AND IRON ORE

OECD Tax and Development Programme
Consultation Document 3 of 4
October 2015

Please note: This document is a draft for consultation. It does not reflect the views of the OECD or its member states, and is not for reference.

Feedback and comments on the draft can be sent to dan.devlin@oecd.org, by 18 December 2015.

Background to the Issue

The production and sale of commodities drive the economies of many developing countries, contributing to income growth, foreign exchange earnings and employment. Commodities also generate government revenue, which can in turn be used to boost living standards.

In the mining sector, corporate income taxes and royalties frequently use mineral product sales as a key component of the tax base, but like other sectors, there are base erosion and profit shifting (BEPS) risks that may reduce the revenue available to developing countries. One key BEPS risk is profit shifting via the pricing of mineral products in transactions between related parties. This issue is of significant concern to many including mineral exporting countries, the G20 and civil society. For developing countries, these risks are elevated particularly where revenue authorities are still building their sector-specific expertise and ability to detect and mitigate transfer pricing. A key issue is ensuring these authorities have the information they need to review transaction terms, coupled with the capability to apply that information effectively.

The objective of this work is to improve the industry knowledge and understanding of revenue authorities, whilst noting the diversity of mineral products, their markets and uses means the specific facts and circumstances of each transaction limit the scope for approaches that can be applied to all mineral products.

Introduction to case studies

To demonstrate the *Methodology for Improving Knowledge of Mining Industry Transformation Chains* (see related consultation draft), the OECD has prepared three case studies, analysing the transformation chains and mineral products from copper, iron ore and gold mines.

These minerals were chosen because each has products that are commonly sold in intermediate forms and because each is relevant to many developing countries. These studies are focused on medium to large-scale mines.

The findings outlined below directly incorporate a diverse range of expertise on each mineral, including survey responses received from several countries participating in the OECD's Working Party 6 on the Taxation of Multinational Enterprises: Australia, Brazil, Canada, Chile, Peru, Russian Federation and South Africa. In addition, it has also benefited from the expertise and support of officials from Argentina, Colombia, Mexico, Slovak Republic and United Kingdom, as well as officials from the African Taxation Administrators Forum (ATAF), and sector experts from market data publishers, consultancy firms, refiners, academia and development cooperation partners.¹

1. This however, does not imply that all of these participants endorse the current content of this report.

The three case studies

Copper

Copper is an important metal across numerous industries due to its thermal and electrical conductivity. Its applications include in construction and telecommunications. It is also resistant to bacteria and fungi, making it useful to applications such as cooking equipment and water sanitation. The process for transforming the copper ore to pure metal depends on the type of ore (oxide-based or sulphide-based).

Many developing countries such as Peru, Zambia and Kazakhstan export copper as a **concentrate**, which is a powder typically containing around 30 percent copper following initial beneficiation. Some countries such as Zambia also export copper **anodes** and others, as Democratic Republic of Congo, export refined copper **cathodes**.

Iron Ore

Iron ore is a bulk commodity that provides the ferrous content for steelmaking. The collective use of "iron ore" refers to several different types of deposits, which can be broadly grouped into "high-grade" and "low-grade" ores. High-grade ores of between approximately 50 to 65 percent iron are made up primarily of hematite, while low-grade ores are primarily composed of magnetite (contains up to 30 percent iron) and taconite (usually less than 30 percent iron).

Key exports for developing countries are iron ore **finest, lumps, concentrates, pellets** and **sinter feed**. For countries with higher-grade ore, these are more likely to be exported as finest or lumps, whilst for countries with lower grade ores, further domestic beneficiation is usually required to create concentrates, pellet or lump products. Along with traditional exporters such as Brazil and South Africa, Sierra Leone, Liberia and Mauritania are all emerging as iron ore exporters.

Gold

Gold is a precious metal with a strong resistance to chemical and environmental deterioration; wide use in jewellery; and function as a financial asset. Gold is mined in its own right, but it is also recovered as a by-product from other mineral deposits (such as copper) with other precious metals.

Gold is usually exported from medium and large-scale mines in developing countries as unrefined **doré** bars for refinery elsewhere (for example, the Pacific Island nations of Solomon Islands, Fiji and Papua New Guinea usually export doré to be refined in Australia).

CASE STUDY – PRICING OF COPPER PRODUCTS

The copper products most commonly traded at arm's length are copper concentrates and refined copper cathodes. Trade in copper ore is usually uneconomic because much of the ore material is gangue that is commercially worthless.² Blister and anode copper products are traded, but these markets are more opaque because transactions occur much less frequently.

Copper concentrate pricing and market conditions

Copper in concentrate is traded widely between independent parties, and final contract terms depend on the nature of the relationship between buyer and seller, as well as prevailing market conditions. In addition, terms may change over time as market conditions change (see Box below).

Copper Concentrate Market Conditions

Factors influencing prices include:

- **Customer identity:** Smelters/refiners are significant customers of concentrates, but transactions may also involve trading companies, either as stand-alone intermediaries or within corporate groups.
- **the nature of the transaction:** particularly whether it is short-term or part of a longer-term supply agreement. Longer-term arrangements may be preferred by small to medium-sized mines without extensive marketing and trading functions. In addition, mines may pay smelters to process the concentrate on their behalf (“tolling”) without transferring ownership.
- **Market dynamics:** concentrate prices are affected by demand-supply conditions in the concentrates market directly, but also upstream market conditions (including copper mine production, the availability of raw materials) and downstream conditions (including the availability of refined copper and scrap).
- **Customer needs:** smelters seek concentrates best suited for the smelter. For example, smelters often seek a combination of clean and dirty concentrates based on the tolerance of the facility to impurities (the smelter may be able to blend in dirtier concentrates without suffering a loss in performance). In addition, smelters aim to operate at peak capacity, so will consider the reliability of supply, and may prefer to purchase from mines with a reputation for consistency and reliability.

² There may be parts of a mine that do produce “direct shipping” copper ore with copper percentages around 25 percent or above – for example the DeGrussa copper and gold mine in Western Australia owned by Sandfire Resources.

Components of an agreement

The agreed price for concentrates is typically based on a formula, which is the sum of value of the contained metals ("payable metals") less the sum of deductions and penalties imposed. A typical contract would contain provisions to:

- calculate the value of payable metals;
- calculate deductions and penalties (typically, treatment and refining charges, and penalties for impurities and/or penalties for excessive moisture where needed);
- outline other concessions that may be extracted by the purchaser, such as "price participation";
- allocate related costs such as insurance, sea freight, taxes and duties; and³
- outline payment terms.

Assay of the concentrate is essential to pricing calculations, because the physical characteristics of the concentrate directly affect its price. The further away from standard specifications, the more adjustments that could be expected to attain the final agreed price.

Payable Metals - Copper Reference Price

The agreed payment will be based on the percentage of copper present in the concentrate, which is valued by referencing the price of refined copper on one of the major commodity exchanges: the London Metal Exchange (LME); Shanghai Futures Exchange (SHFE) or the Commodity Exchange Division of the New York Mercantile Exchange (COMEX). Taking the LME as an example, contracts would typically specify the "LME Grade A Settlement Quotation price" as the reference price for payable copper, averaged over some time period (the "quotation period").

For products that are early in the value chain like concentrates, contracts usually refer mechanically to this exchange price. For example, the quotation period may be the average price during the third month after the month of scheduled shipment, reflecting expected delivery time to the smelter. For copper products later in the value chain, however, the specific details of the reference price – in particular the physical location of the metal - take greater importance (discussed under copper cathodes, below).

Payable Metals – Losses

For common concentrate grades of around 30 percent copper, the payable metals percentage will typically align with the actual percentage of copper present. However,

³ Contracts between related parties may also contain commissions for the sale of the concentrate to third parties. Further research is continuing into these fees, but broadly, they relate to the functions performed by the intermediary which affects the fee structure adopted. They may be embedded into the contract by directly reducing the payable metals amount.

an adjustment is also made to account for the fact that the buyer (smelter) cannot recover all of the copper during the smelting and refining processes. Rates of recovery vary between smelters, but payments are typically adjusted in a routine way with more efficient smelters taking advantage of their efficiency by receiving essentially “free metal”. For concentrates around 30 percent copper, smelters typically pay for 96-97 per cent of the value of the copper present, so a concentrate with 30 percent copper might actually be paid for around 29 percent copper.⁴ Below 30 percent, typically the payable percentage is reduced by 1 unit (100 basis points). Below 22 percent, the deduction increases to 1.1 percent (Boliden, 2008). Conversely, if the percentage exceeds 30 percent, the smelter might reduce the recovery adjustment.⁵

Payable Metals – Precious Metals (Gold and Silver)

For gold, quantities below 1 gram per dry tonne of concentrate typically do not receive payment, because they are usually unreasonably expensive or difficult for smelters to recover. For gold above one gram per tonne, the concentrate buyer typically pays based on the London Bullion Market Association (LBMA) gold spot price (see Gold chapter for pricing information), noting that only around 97.5 percent of the material is paid for, to account for metals lost during the recovery process.⁶

For silver, typically no payment is made if there is less than 30 grams of silver per dry tonne of concentrate. Above this quantity, the weight of the silver is multiplied by the LBMA spot silver price. The quotation period for both precious metals may match the copper quotation period. Sellers typically receive around 90 percent of the value of the silver, to account for losses during the recovery process (Teck, 2013).

Charges and Penalties – Treatment and Refining

Treatment and refining charges (TC and RC) are commonly applied to concentrate sales, reducing the payment to the seller. These charges are determined both on spot markets and in longer-term contracts. In forming spot TC/RCs, mines for example may produce more concentrate than they had expected during the year, which they will sell on spot markets to independent traders or to smelters with excess capacity.

Under longer-term supply contracts, annual TC/RCs are commonly used. These are based on annual negotiations between many of the largest global mining companies and major Asian refineries on key terms applying to concentrate shipments over the coming year (Boliden, 2008). These negotiations typically conclude by December each year, and the terms frequently incorporated into similar supply arrangements between parties not involved in the agreement.⁷

⁴ 30 percent times 97 percent equals 29.1 percent.

⁵ These percentages however can vary over time and across regions - for example, one Canadian Company observes that for a concentrate with copper above 32 percent, smelters would pay 96.65 percent, rising to 96.75 percent for copper above 38 percent.

⁶ However, there appears to be a wide range of adjustments acceptable to revenue authorities – for example, the Australian state of Queensland accepts a deduction of 1 gram of gold per tonne of concentrate when applying royalties, with the adjusted quantity then reduced further by 10 percent. No adjustment is made for gold sold in any other form.

⁷ News on these negotiations is commonly reported in the financial press.

TCs are usually expressed in US dollars per tonne of concentrate. For example, the 2015 TC is expected to be around USD 107 per tonne. TCs may increase for concentrates with copper content above 40 percent, but this depends on conditions in the concentrate market (that is, if it's hard to source concentrates, smelters may reduce the charge). RCs are usually expressed in USD cents per pound of payable copper in the concentrate. For example, 2015 RC is expected to be USD 10.7 cents/pound (USD 23.6 cents per kg).

Charges and Penalties – Deleterious Elements

Concentrate purchasers will also seek deductions from payable metals for the removal of deleterious elements that exceed levels commonly found in concentrates (see Annex 1 in related consultation document 4 for a summary of these elements). Penalties may also be applied for concentrates with excessive moisture. Charges will vary, depending on the process used to smelt and refine the concentrate, but typically the penalty is a USD per tonne amount for incremental percentages above a specified threshold. If too high, excess concentrations of some elements will result in the concentrate being rejected, usually because they either exceed environmental or safety limits; are unreasonably difficult (and therefore expensive) to treat; or the materials are expensive to dispose of (such as mercury). A penalty TC for "complex concentrates" may also be imposed, but this will depend again on market conditions. For example, if smelters are struggling to acquire the amount/type of concentrates needed, this fee might be reduced or dropped.

Other terms

Additional terms may also be negotiated depending on market conditions. For example, until around 2007, smelters were able to negotiate additional payments from concentrate sellers known as "price participation" clauses, to share in higher metals prices. Another key factor affecting final price will be the costs of insuring and transporting the concentrate to the buyer. Concentrates are sold using several different incoterms (see Annex 1) depending on the bargaining power of each side.

Blister and Anode Copper

As noted, blister copper trading is less common and consequently pricing practices are more opaque. Blister and anode products are often sold from smelters to refineries, and this often is confined within corporate groups.⁸ Consequently, there is much less pricing data available.

Similar to concentrates, pricing is based on a calculation of the value of payable metals less charges and deductions. As noted earlier, at the blister stage, the product is around 98 to 99 percent copper, and sellers are paid based on the percentage of copper present. Payments are also made for precious metals, with an adjustment (reduction) applied to account for losses of metal during subsequent processes. Refining charges are also applied for the final removal of impurities, but these are lower than the RC

⁸ Within corporate groups, companies often use toll arrangements for certain transformations (e.g. refining) rather than transferring ownership of the intermediate product.

applied to concentrates, reflecting the reduced processing required. Blister and anode copper are typically sold on a CIF basis.

Refined Copper Cathodes

Refined copper cathodes are, of course, globally traded using exchanges such as the LME and COMEX. For example, copper cathode prices are quoted on the LME, where the spot price has several features:

- It is published in USD per tonne of copper, along with corresponding exchange rates;
- It is based on the last cash offer price for a copper lot, made during the second Ring⁹ session of the day that would be “settled” (that is, paid for and the warrant delivered) in two business days;
- It is “Grade A” is copper that conforms to particular standard of chemical composition (essentially 99.9935 percent pure copper).

For cathodes, price setting reflects key pricing attributes including the physical characteristics of the metal (in particular, whether it complies with chemical composition standards imposed by commodity exchanges);¹⁰ whether it is within or outside the official warehousing systems of the major exchanges; the location of the metal; and the delivery terms (in particular, how quickly the copper can be delivered – see Box below).¹¹ Costs associated with delivery typically include rental charges for the use of warehouse space, load-out charges for removing the metal from the warehouse, and delivery costs to a specified location (LME, 2013).

⁹ The Ring is an open cry trading platform that is part of the LME’s broader trading infrastructure.

¹⁰ see for example, the Physical Contract Specifications set by the LME for copper.

¹¹ Delivery date considerations are outside the scope of this paper, but their implication for price premiums are discussed in the Box on Exchange Prices and Price Premiums.

Commodity Exchange Prices and Cathode Price Premiums

Exchange prices such as the spot price quoted on the London Metal Exchange (LME) are commonly used as a reference price to calculate payable copper for products earlier in the transformation chain (such as concentrates and blister/anode products). These exchange prices also form the basis of physical trades in refined copper cathodes, but the exact payments in a particular transaction are the result of several factors such as metal quality and proposed delivery time relative to other options in the market. This means LME spot price for copper cathodes may not be the only pricing information needed by revenue authorities looking to verify the price used in a related party transaction.

Exchange prices refer to a document of possession (a “warrant”) for a standardised unit of metal (“lot”) located at one of the network of storage warehouses approved by the exchange. For example, an LME copper warrant will be copper physically located at a specific warehouse - say, Rotterdam, the Netherlands. Copper traded on exchanges such as the LME can be used for physical product delivery, but where there are no major disruptions to physical supply, this is rare (for example, for the four months of 2015, 73,375 tonnes of copper were delivered from LME warehouses, compared to 373.4 million tonnes of copper traded on the LME over the same period [LME, 2015a]).

Under certain market conditions, cathode manufacturers may be able to offer their products at prices above exchange traded prices, thereby obtaining a “premium”.¹² This is usually because they are offering products that will be physically delivered to the customer more quickly than the customer could obtain from suppliers elsewhere. The premium is typically enjoyed by all sellers offering the product to that market on those terms, although the extent of premiums may differ between sellers depending on their particular sales strategies. This is distinct from an isolated sale between two parties which may be at prices more favourable than contemporary market transactions.¹³

Whether a premium should be considered as part of a related party transaction on copper cathodes will therefore depend on the particular circumstances of that transaction. Factors to be considered would include the physical location of the metal that is being sold relative to the location of the buyer and the delivery terms available to the buyer from other suppliers (i.e. whether delivery is faster than from other sellers in the market). For example, copper cathodes shipped from Australia to a purchaser in Europe could attract a European price premium if the delivery time matches European suppliers (all other factors such as cathode quality being equal).

¹² For example, in 2015 copper cathode suppliers to European market were able to achieve premiums of around 1-2 percent over the LME cash price, based on offering prompt delivery (usually 8-10 working days).

¹³ Within the official warehousing systems of the major exchanges, premiums may also be paid in certain circumstances by cathode purchasers taking physical delivery of the metal. In particular, if the amount of metal a warehouse must deliver increases such that waiting times also rise, warrant holders wishing to receive cathodes more quickly may instead purchase a warrant that is higher in the delivery queue, paying the seller a premium over the cash price.

CASE STUDY – PRICING OF IRON ORE PRODUCTS

Iron ore products are diverse, targeting a range of customer requirements. The most traded products are iron ore fines, followed by pellets and then iron ore lumps and concentrates which make up only a small proportion of international trade (CRU, 2014). The significant size of the steel industry in China means transactions with Chinese firms plays an important role in iron ore demand. For example, China represented 55.8 percent of apparent iron ore consumption in 2012, followed by Japan at 7.1 percent and India at 6.2 percent (World Steel Organisation, 2015).¹⁴ This has led to many pricing publications focusing on transactions with delivery to Chinese ports or regions.¹⁵

Iron ore pricing has undergone considerable structural change over the last decade. Prior to 2010, the majority of iron ore contract prices were set in annual negotiations between large iron ore suppliers and steel makers, with those negotiated prices then used as a benchmark or basis for other transactions between parties unconnected to the initial negotiations. From 2010 however, contracts have moved increasingly towards quarterly or monthly terms, with an increasingly accepted iron ore spot price emerging (RBA, 2012).¹⁶ Another development is the growing use of electronic trading platforms for iron ore sales, which are membership-based and focused on physical trading. For example, the GlobalORE platform and the China Beijing International Mining Exchange (CBMX) platform are increasingly used in transactions¹⁷ by major iron ore suppliers and purchasers for standardised iron ore products involving physical product delivery, although companies advise this is still small relative to the total number of transactions involving physical delivery.

Pricing elements in iron ore product transactions

Much like other mineral products, iron ore prices are formed first and foremost by reference to the target element - in this case iron - in the product, but physical factors affecting the final agreed price also include:

- the form of product being sold (for example, fines and lumps);
- the impurities present in the product; and
- the location of the product and intended destination.

After these physical factors, other factors such as the duration of the agreement; prevailing market conditions; the reliability of the supplier; and the relative negotiating

¹⁴ In addition, Chinese steel mills in particular have sought increased vertical integration with iron ore mines, as these firms look for greater control over product supply and consistency from iron ore (and coal) mines, increasing the prevalence of intra-group transactions of iron ore products.

¹⁵ Australia and Brazil comprise around 78 percent of China's iron ore imports.

¹⁶ This change has been concurrent with an increasing use of centralised marketing entities to manage functions such as customer relationships, contract negotiations, shipping and logistics, and also to manage some financial risks.

¹⁷ GlobalORE is also underpinned by a standardised set of contract terms the Standard Iron Ore Trading Agreement (SIOTA)

skills of the parties also affect final agreed prices, albeit to a lesser extent.¹⁸ These factors can vary across regions and change over time, which adds complexity for revenue authorities reviewing whether the terms of a particular transaction between related parties are consistent with arm's length terms.

Iron content and iron ore price benchmarks

As iron ore contracts have evolved towards shorter durations and greater price transparency, price indices have emerged that are increasingly used as a reference price in iron ore transactions, rather than parties agreeing fixed prices (The Steel Index, 2013).

In particular, iron ore products are often based around the price of iron ore with 62 percent iron per dry metric tonne.¹⁹ Several pricing indices have been developed for 62 percent iron products, including:

- IODEX (published by Platts);
- Mysteel (published by Mysteel.com);
- Metal Bulletin (published by Metal Bulletin Ltd);
- TSI (published by The Steel Index);
- Argus Steel Feedstocks (ICM, published by Argus Media Ltd); and
- China Iron Ore Price Index (CIOPI, published by the China Iron and Steel Association).

These benchmark specifications are also used by many market participants to establish the price of other iron ore grades, and contract terms will frequently refer to an index price, which might then be adjusted to account for physical differences between the benchmark and the actual product.²⁰ Around the 62 percent iron grade, the price of iron ore products with iron content between 60 and 63.5 percent is usually adjusted mechanically based on the actual iron content (percentage). For example, iron ore fines with iron content of 61 percent would be adjusted (discounted) proportionately to the benchmark 62 percent price.²¹ This proportional adjustment however only applies to iron ore products that have iron content within this range.²²

In addition to this 62 percent grade, there are also pricing mechanisms for high-grade iron ore (iron content of 65 percent) and low-grade ore (58 percent), reflecting the different sub-markets for iron ore products. For higher-grades, expected prices are higher reflecting both the iron content as well as reduced levels of moisture and impurities.

¹⁸ For example, an iron ore transaction may cover a package of products such as lumps and fines with a volume discount offered.

¹⁹ As the specification suggests, dry metric tonnes are tonnages adjusted to remove the weight of moisture. For example, 10 tonnes of iron ore at 8 percent moisture equals 9.2 dry tonnes (10*0.92).

²⁰ According to Metal Bulletin Research, in 2011-12, TSI was dominant, with around 70 percent of pricing referencing this index, followed by MBIO and IODEX at around 12 percent each.

²¹ That is, the 62 percent price would be discounted by multiplying it by 61/62, or 0.983.

²² Platts observes that below 60 percent iron and above 63.5 percent, adjustments are not linear and therefore more variable.

Correspondingly, lower-grades have lower prices and typically allow for greater impurities and moisture (Platts, 2015).

Each market segment may experience unique price changes - particularly over short time horizons - as each product may not be readily substitutable because of the time required to reconfigure a beneficiation process or construct new equipment. Over longer time horizons however, iron ore product prices generally move in a correlated way. As a consequence, revenue authorities need to be careful to ensure they are examining the specific market when looking for pricing information to verify a particular transaction.

Adjustments based on physical form

Once the level of iron in the transacted product has been established, prices can be adjusted depending on the physical form of product – both positively and negatively – which may fluctuate over time in accordance with market conditions. For example, products in lump or pellet form attract price premiums relative to fines, because they are suitable for immediate use in furnaces, but this premium for shipments to China may increase during the year if cold weather in China restricts alternative local supplies of fines (Rio Tinto, 2015).²³

Commonly applied adjustments are:

- For fines: a penalty adjustment may be applied where pieces are very small (sometimes referred to as “superfines”) reflecting additional processing that may be required;²⁴
- for lumps: unusually large lumps may attract a smaller premium if they exceed a fixed percentage of the shipment, reflecting additional processing that may be required; and²⁵
- for pellets and sinter feed: premiums above fines may be paid depending on the quality of the pellets. In particular, pellets made for use in direct reduction steelmaking processes usually attract a greater premium than pellets made for blast furnaces.

Price adjustments based on size are typically negotiated between the parties depending on the transaction, but some pricing data on lump and pellet premiums is published (see data sources in Annex 2 of related consultation document 4).

Penalties and Deductions - Impurities

The level of impurities in an iron ore product directly affects negotiated prices. Higher levels of certain impurities will naturally incur penalties relative to standardised grades, because of the unwanted effects they have on the properties of iron (and therefore

²³ That is, there may be two parts to the premium calculation: iron differentials relative to standard grade fines, and then the premium associated with the pellet form.

²⁴ concentrates typically trade at a premium to fines, but this is largely because they have higher iron percentages and lower impurities, not because of physical form.

²⁵ but this should be unusual given the crushing and screening that usually occurs before sale

steel - outlined in Additional Information). The most important impurities affecting prices for iron ore products are silica, alumina, phosphorous, sulphur, and "loss on ignition" impurities, which refers predominantly to moisture content. Contracts would usually specify limits on each of these impurities, based on assay documents. In addition, alkalis (such as lithium, sodium and potassium) may affect prices if they are above trace amounts, but this is less common.

For alumina and silica, some market data is available on adjustments for each additional percentage point of impurity within a certain range. For moisture, levels do not appear to have a significant effect on prices since iron ore products such as fines and lumps are priced per dry metric tonne.²⁶ Pellets would be very unlikely to attract moisture penalties, as the induration process usually means they have no more than 2 percent moisture. For other impurities, pricing adjustment information is difficult to find.

Several factors limit the extent of impurities in iron ore products. In particular, mines usually aim to produce products that adhere to commonly traded impurity levels to ensure products are able to be offered into markets with more buyers and sellers.²⁷ In addition, certain impurities will be limited by maritime transportation rules. For example, maritime safety regulations limit moisture content of iron ore products to 16 percent (IMO, 2009). Where products materially exceed impurities commonly seen in markets, companies may accept harsher penalties if they choose to sell, but rather, they have strong incentives to blend the ore with other grades or undertake further beneficiation.

Other factors affecting prices

Adjustments based on physical location and delivery date

As noted above, the demand for iron ore from Chinese steel mills naturally means a significant amount of pricing information focuses on Chinese ports of import. Pricing publications commonly publish prices for products located at Chinese ports, on CFR terms. This means revenue authorities commonly need to adjust prices to account for differences in delivery terms.

In particular, this is often required for freight charges, to establish the price that would be paid at a different geographical location. To effectively "work backwards" to ascertain the price of the iron ore product at the origin port (that is, the FOB price), data publications commonly use 'netbacks'.²⁸ These are published estimates of shipping costs between various origin ports and China, commonly denoted in USD per wet metric tonne which can be deducted from the CFR price. Alternative data sources are also used for this purpose (see Annex 2).

The prices obtained in iron ore transactions are also affected by the expected duration of shipment and delivery date. In markets where there is an expectation that iron ore

²⁶ However, they may be more expensive to transport due to increased weight.

²⁷ This has led to the development of iron ore product "brands" that aim to offer a product with standardised features including iron present, particle size, impurities and moisture.

²⁸ contracts negotiated under the GlobalORE trading platform also use this approach

prices will fall²⁹, sellers may be able to obtain a premium relative to a pricing index if they are able to deliver more quickly than what other suppliers might commonly provide. Conversely, for product suppliers offering longer delivery times relative to those commonly available, they may be penalised by adding a discount to the index price.

Contract duration (spot and term contracts)

Iron ore product pricing is affected by the nature of the relationship between the parties, particularly whether the transaction will be once-only or negotiated as part of a longer-term arrangement (a 'term contract'/'offtake agreement'). In the latter, the product seller may offer a lower price or make adjustments to other terms as an inducement to either supplying a larger product volume or otherwise creating a stable longer-term supply arrangement (see Annex 1 for discussion of term contracts). According to market observers, iron ore fines are more likely to be traded on spot terms, particularly with Chinese purchasers (Platts, 2015), while lumps and pellets are more likely to be sold under contracts of a fixed duration such as monthly, quarterly or yearly (Metal Bulletin Research, 2015). As noted earlier, term contracts are usually priced with reference to iron ore price indices, rather than at a fixed price.

²⁹ as indicated by the futures curve sloping downwards, loosely defined as a "backwardation".

CASE STUDY - PRICING OF GOLD PRODUCTS

Common Gold Products

As noted in related consultation document 2, there are several gold mining processes used across a range of small-scale to large mines. The focus of this paper is medium to large-scale mines. Based on the methods of transformation used by these mines, doré bars and concentrates are the key intermediate gold products that are traded at arm's length.³⁰ Substantive international trading in gold ore is rare and confined regionally, since much of the material is gangue and not worth transporting long distances.

Most gold mines recover, process and smelt gold, silver and other metals into doré, before involving arm's length parties in the final refining stages. Many mines do not have the capacity to refine the doré themselves, and involving external refiners simplifies gold sales.³¹ For developing countries, the gold is most often exported as doré and refined abroad.

At arm's length, the main transaction for miners is to pay for the service of refining the doré to 99.5 percent gold (known as 'toll refining'). The gold to be refined is deposited into the customer's account with the refinery, and following refining, the customer would then choose to sell the gold to the refinery with reference to the prevailing spot price or to transfer the gold to the customer's gold account internationally (see Annex 1 on gold swap arrangements).³²

Pricing Elements

The refinery will first analyse (assay) the contents of the bar by melting it to ensure there are no pockets of inconsistent purity. Based on that analysis, the refinery will indicate the quantities of gold and silver present, quote a cost of refining, and indicate the price the refinery would be willing to pay for the metals. This is commonly presented in an "outturn" report (see Annex 1 for an example).

Pricing and payments made for doré will depend on the particular details of the transaction, including the physical properties of the gold bar and the particular details of the buyer and seller. The negotiated payment to the mine will be primarily based on the value of the gold and silver ("payable metals"), with deductions for refining charges and in some instances, other fees and taxes such as environmental charges.

³⁰ The revenue losses from non-reporting or under-reporting of the sale of gold products by artisanal miners or intermediaries is outside the scope of this study.

³¹ For example, the mine need not have the exact quantity of gold required for standardised international trades, because their supply can be mixed with that of other mines (Suchecky, 2015).

³² This approach is also used for gold from alluvial sources, although with artisanal mining the gold is usually first sold to a trader.

Payable metals and the reference price

Doré is priced based on the measured quantities of gold and silver present in each bar, with each troy ounce priced with reference to prevailing refined gold (and silver) spot prices. There are two key wholesale markets that determine the spot price of refined gold (and silver). These are the “over the counter” (OTC) market and futures exchanges.

The OTC market is an international network of transactions that occur directly between traders that are typically professional or corporate entities trading gold bars on standardised terms such as:

- a specified purity (99.5 percent or “995 fine” – see Annex 1 on measurement);
- gold content (between 350 and 430 ounces, with bars generally close to 200 ounces; and
- contract settlement in London in two business days (LBMA, 2015).

The London Bullion Market Association (LBMA) conducts an electronic auction twice per trading day to determine a gold price that approximately aligns supply and demand, publishing the result as an official “LBMA Gold Price”, most frequently quoted in \$US/ounce.³³ Market information services such as Bloomberg and Reuters then republish that information and real-time price developments based on information from key traders.

Futures markets are regulated exchanges where the price is quoted for delivery of the metal at specified future dates. The largest market is the US-based COMEX market. The next futures delivery date is sometimes used as a proxy for the spot price, although the LBMA price is the most commonly used reference price.

OTC gold transactions are conducted on bilaterally agreed terms, with most anchored closely around spot gold prices. Adjustments to the spot price are common to provide the refinery effectively a commission on the sale (that is, the refinery would take a spread on their bid and ask gold spot price, meaning the mine would receive close to, but not necessarily the full spot price). Some transactions may use an average of the LBMA price over an agreed time period (quotation period).³⁴ At the margin, the negotiating skills of the parties may affect the final agreed price, meaning small to medium sized mines with relatively lower bargaining power may achieve prices below those of large miners.³⁵

³³ Prices are also published by the LBMA in pounds sterling and euros.

³⁴ For royalty calculations, revenue authorities may prescribe a particular quotation period for valuing the metals, such as the average LBMA gold price for the calendar month in which the doré was sold.

³⁵ The refinery may offer a different price, based on their judgement as to the market savvy of the customer and potential for future business.

Pricing Adjustments

Metals lost during refining

Payments for gold in doré form may be adjusted to account for losses during the refining process, sometimes known as a “retention fee”. These adjustments are not published, but appear to be minor where major refineries are involved – around 0.1 percent for gold and 1 percent for silver. This small adjustment is in contrast to payable gold in concentrates which are typically larger since concentrates must go through more stages of transformation, each with the potential for metal losses (discussed in the copper pricing case study). The adjustment is standardised across customers, applied without reference to the actual losses incurred on that bar.³⁶

Location adjustments

For customers that elect to credit the gold into an unallocated gold account in London³⁷, the spot price may be adjusted, to approximate the cost of transporting the gold (see Annex 1 - Loco Swaps). These adjustments reflect the demand-supply balance in both the buying and selling locations. For example, a refinery located in a market with an excess of gold supply relative to domestic demand would usually sell at a discount to gold physically located in London. For example, the Loco Perth (Australia) discount is approximately US 30-40 cents/ounce to the Loco London spot price. Alternatively, locations with an excess local demand for gold relative to what the refineries in that location supply would sell at price above the London spot price, to attract the delivery of gold.³⁸ When physical gold flows are stable, the adjustments are small however.

Refining Charges (RC)

Refining charges are applied for removing impurities and separating the precious metals. Refineries may also include fees for environmental costs and for assay services, but these are typically small relative to the value of the metal.

Refining charges are set per gross ounce of precious metal, but are often negotiated for each individual gold supplier. Negotiated RCs are based on factors such as:

- the amount of gold to be processed and size of the customer (higher quantities attracting a discounted rate);
- the expected frequency of refining. For example, whether a “one off” transaction or part of a longer-term arrangement – the latter usually reducing the charge; and

³⁶ Any difference between the adjustment and actual losses is a revenue stream for the refinery, providing an incentive to ensure the refinery is operating as efficiently as possible.

³⁷ Unallocated accounts are gold accounts that operate much like bank accounts for currency. Gold amounts can be debited and credited to the account, with the balance representing the indebtedness between the two parties. They do not indicate any claim over a specific bar, in contrast to allocated accounts where specific bars are set aside.

³⁸ Put another way, where there is excess supply, the supplier will bear the cost of shipping the gold to other locations. Alternatively, in a location with strong demand, the purchaser will pay the shipping cost.

- the purity of the product to be refined. For example, doré with higher percentages of gold will usually have a lower charge per ounce relative to one with more silver, since the separation of the metals may be relatively easier.

The individual refining charges imposed are not however publicly disclosed, representing a data gap for revenue authorities verifying the appropriateness of charges used in related party transactions. However these charges may be small relative to the value of the metals, in the order of \$US1-3/gross ounce. In addition, given the factors above, it would be reasonable to presume larger mining companies, particularly operating on longer-term arrangements with the refinery, would have lower refining charges. If charges are materially higher than these levels, they may warrant closer review.

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