Public consultation document

Determining the Price of Minerals
A transfer pricing framework for copper

DRAFT FOR CONSULTATION

Interested parties are invited to send their comments to the authors no later than 5 September 2025, by e-mail addressed to:

- IGF Global Mining Tax Initiative at tax@iisd.org, **and/or**
- OECD Centre for Tax Policy and Administration at CTP.BEPS@oecd.org

Messages should contain "copper consultation" in the subject line and comments should be in Word format (to facilitate their distribution to government officials).

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IGF INTERGOVERNMENTAL FORUM on Mining, Minerals, Metals and Sustainable Development

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Determining the Price of Minerals

A transfer pricing framework for copper

DRAFT FOR PUBLIC CONSULTATION

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This practice note has been prepared under a program of cooperation between the OECD Centre for Tax Policy and Administration Secretariat and the 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 complements action by the Platform for Collaboration on Tax and others to produce practice notes on top-priority tax issues facing developing countries.

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OECD: www.oecd.org/en/about/programmes/beps-in-mining.html

IGF: www.igfmining.org/financial-benefits

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Introduction

About This Schedule

This mineral pricing schedule complements the practice note *Determining the Price of Minerals: A Transfer Pricing Framework* (Viola et al., 2023). 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 copper concentrates and copper cathodes.

Importantly, this mineral pricing schedule does not replace, alter, or affect the Organisation for Economic Co-operation and Development's (OECD) Transfer Pricing Guidelines (TPGs) (OECD, 2022) interpretation of Article 9 OECD Model Tax Convention (OECD, 2017), or the application of countries' domestic transfer pricing laws and the interpretation of those laws by the respective tax administration.

Framework: Using the comparable uncontrolled price method to determine the price of minerals sold

In applying the comparable uncontrolled price method to related-party mineral sales, the comparability factors or economically relevant characteristics outlined in Paragraph 1.36 of the 2022 OECD TPGs are to be considered. Paragraph 1.37 of the 2022 OECD TPGs further notes that the extent to which each factor is economically relevant in a particular transaction depends on the extent to which it would be taken into account by independent enterprises when evaluating the terms of the same transaction were it to occur between them. An accurate delineation of the arrangement should be undertaken in accordance with Chapter I of the 2022 OECD TPGs, considering all five comparability factors and the economically relevant characteristics of the transaction. Considering this, there are three primary comparability or economically relevant factors to consider that are particularly relevant when applying the comparable uncontrolled price method to scenarios involving related-party mineral sales.[1] These are as follows:

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

[1] Even though only three comparability factors are explored in detail, it does not diminish the importance of the other two comparability factors (business strategies and functional profile) when accurately delineating the transaction as outlined in the 2022 OECD TPGs.

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

1. The associated mining enterprise (i.e., the seller) is treated as a mining enterprise that is part of a larger multinational mining group.
2. 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 finite resource that is a primary source of value creation.
3. It is on this basis that the associated 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 multinational enterprise group has access to, and sell at the highest possible price, taking into account its commercial objectives.

Application to Copper

Copper and Market Conditions

A metallic element, non-precious metal, copper is a chemical element in the IB group of the periodic table with an atomic number of 29 and an atomic mass of 63.546. Copper sometimes occurs in pure form "native copper," but is more often found as an element in minerals, with the two most common ones being sulphide ores and oxide ores.

Given its characteristics—a great conductor of heat and electricity, its corrosion resistance, and its malleability and ductility, copper can be used in domestic, industrial, and high technology applications. Copper is the best non-precious metal conductor of electricity as it encounters much less resistance compared with other commonly used metals. It is corrosion-resistant and antimicrobial; it can be used to eliminate pathogens and reduce the spread of diseases, as well as to improve the efficiency of energy production and distribution systems. Copper can be alloyed to produce bronze or brass. Copper is one of the most recycled metals: all products made from copper can be recycled and recycled copper loses none of its chemical or physical properties.

According to the Copper Development Association, cited by the latest United States Geological Survey (USGS), global end-use markets for copper and copper-based alloys are estimated as follows: building construction, 45%; electrical and electronic products, 22%; transportation equipment, 16%; consumer and general products, 10%; and industrial machinery and equipment, 7% (USGS, 2024).

Depending on their level of vertical integration, copper miners produce copper concentrate, copper blister, copper anodes, or copper cathodes. Copper concentrate and blister is sold to smelters or traders, copper anodes are sold to refineries or traders, and copper cathodes are sold to downstream fabricators or traders. Downstream fabricators can later transform these cathodes into different end-use products, i.e., shapes, wire rod, tube, sheet, plate, strip, and casting.

Copper products across the value chain are traded internationally. Major product categories of traded copper include copper concentrates, copper blister and anodes, copper cathodes, and copper scrap. See definitions in Table 1.

Table 1. Types of copper products

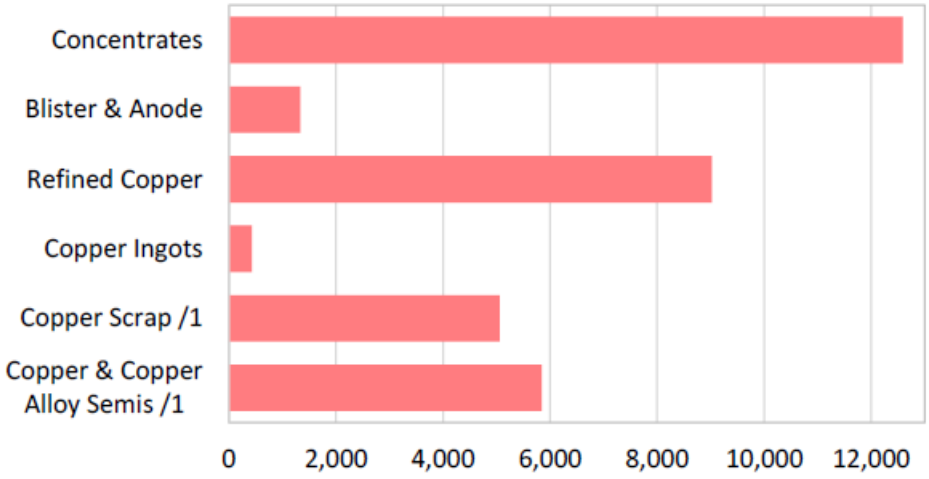
Copper ore	Raw mined material, rarely traded Nowadays, usually less than 1% copper (but it can be higher) Most common types of ore: copper oxide and copper sulphide See more here
Copper concentrates	Raw material for copper smelters Typically, contains about 30% copper Transported in bulk See more here
Copper matte, blister, and anodes	Matte and blister are intermediary products within the smelting process. Copper matte ranges from 58% to 60% copper, copper blister 98% Anodes are raw material for copper refiners, averages 99% copper See more here
Copper cathodes[2]	Raw material for the production of high-purity copper and copper alloy products, such as wire rod, billet, or ingots Refined copper derived from mine production is known as "primary copper production" Produced from copper blister and anodes Purity of 99.99% See more here
Copper shapes and alloys	Semis fabricators process refinery products, such as cathodes, into semi-finished copper shapes and copper alloys using both unwrought copper materials and direct melt scrap as raw material feed. Semis fabricators are considered to be the "first users" of refined copper Copper shapes and alloys can be further transformed by downstream industries for use in end-use products, such as automobiles, appliances, electronics Produced from copper cathodes See more here
Copper scrap	Raw material for refined copper Refined copper produced from recycled scrap is known as "secondary copper production" Recycling of copper is based on a variety of raw materials (e.g., semi-finished products, wire, strip, cuttings, miscellaneous unalloyed wire, sheet, gutters, boilers, valves, machinery parts), ranging from low-grade copper scrap, containing only a few percent of copper, to very high-grade copper, as well as pure copper close to 100% See more here

Source: Authors, based on data from the University of Arizona, CargoHandbook, the International Copper Study Group, and Worrell and Reuter (eds, 2014).

[2] We use "refined copper," "refined copper cathodes," or "copper cathodes" interchangeably.

Gangue, "the worthless rock or vein matter in which valuable metals or minerals occur," makes up a large portion of the ore. If its copper content is too low, copper ore does not have any commercial value. If the copper content within the ore reaches a viable level, it can be extracted commercially. Copper from sulphide ore is concentrated and sold as copper concentrate, to be further refined, while copper from oxide ore can be directly transformed into copper cathodes. The two dominant forms of traded copper on the global market are copper concentrates and copper cathodes.

Figure 1. World copper exports by product category, 2023 (thousand metric tons copper, unless otherwise noted)



Source: World Copper Factbook, International Copper Study Group (ICSG), 2024.

Physical Characteristics of Copper Deposits

Undiscovered copper resources derive from the two most significant sources of global copper supply: porphyry deposits and sediment-hosted deposits. (World Copper Factbook, 2024, p.7). Oxide and sulphide copper deposits can be found in both porphyry and sediment-hosted deposit types; with porphyry deposits typically associated with large, intrusive, igneous bodies and sediment-hosted deposits forming within layers of sedimentary rock sequence.

The USGS estimated that 3,500 million metric tons of undiscovered copper resources may exist globally[3] (Assessment of Undiscovered Copper Resources, USGS, 2015). There are 2,100 metric tons of identified copper resources.[4] South America hosts the largest undiscovered and identified copper resources, 21% and 38%, respectively. Table 2 provides an overview of the world regions that host the largest undiscovered and identified copper resources in porphyry deposits worldwide. Data per country is not available.

[3] With 3,100 metric tons from porphyry deposits and 400 metric tons from sediment-hosted deposits.
[4] Of which 74% come from porphyry, 10% from sediment-hosted deposits, and the remaining 16% from other type deposits.

Table 2. Copper resources in 10 regions (in millions metric tons)

Region	Undiscovered (mean estimate)	Identified
South America	800	750
North America	470	400
Central and Eastern Asia	140	450
Southeast Asian Archipelago	130	300
Middle East	61	200
Southeast Asia	56	420
Europe	51	140
Central America and Caribbean	43	170
Eastern Australia	15	21
Northeast Asia	8.8	260
Total	3.5 billion	1.5 billion

Source: Authors, based on data from USGS, 2015.

The ocean floor is believed to contain important mineral resources, including copper. The International Copper Study Group has identified three off-shore copper projects that could be producing in the near future: the Solwara project, located in the Bismarck Sea, Papua New Guinea; the polymetallic nodules project in the Clarion-Clipperton Zone of the Pacific Ocean; and the manganese nodules project in Japan's exclusive economic zone in the Pacific Ocean (World Copper Factbook, 2024). Some countries may authorize deep sea mining within their exclusive economic zones. However, the legal framework to authorize mining in the deep sea in international waters is still under discussion at the International Seabed Authority.

Copper Production Processes: From ore to cathode

Copper cathodes can be obtained from mined ore or from scrap.

Refined Copper Production From Mine Production

Primary copper production—copper extracted from primary raw material sources—starts with the extraction of copper-bearing ores, either sulphide or oxide ores. There are three basic ways to mine copper: surface or open pit, underground, and in situ leaching. Surface or open-pit mining is the predominant copper mining method in the world.

Surface mining is feasible when the ore bodies of the rock are large and located close to the surface. They can be extracted without mining underground. There are many advantages of open-pit mining compared to underground mining, including:

- Trucks and heavy equipment can be used to move large volumes of ore.
- Equipment is not restricted by the size of the mine.
- It is a generally faster and easier production method.
- It has lower capital and operating costs, which means lower grades of ore are economic to mine.

As minerals are increasingly difficult to locate, there has been an increase in the number of underground mines. An underground mine is built when the ore body is located deep underground, and commercially viable ore is unable to be reached via surface mining. To enter an underground mine, miners use a horizontal or vertical tunnel typically known as a shaft. An underground mine is practical when

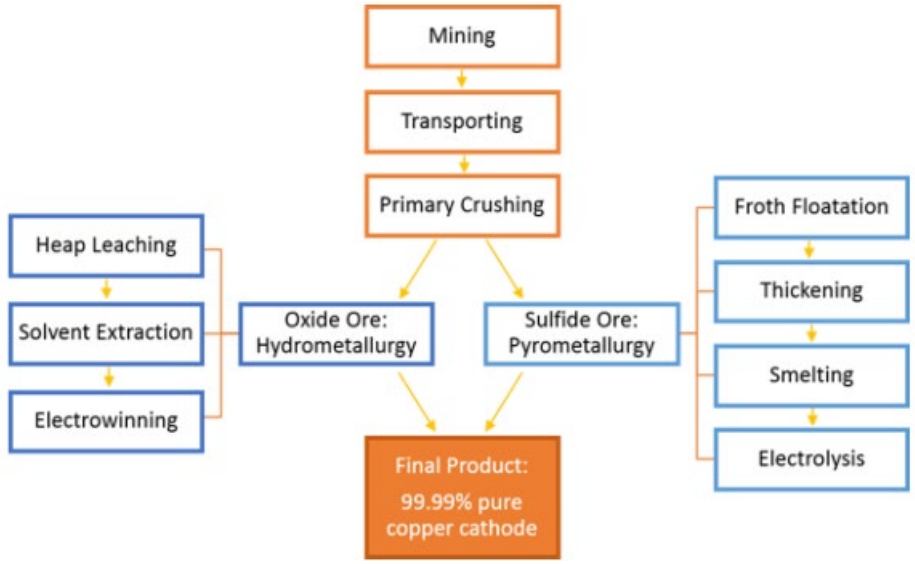
- the grades or quality of the orebody are high enough to cover mining costs
- underground mining has a lower ground footprint than open pit mining
- the ore body is too deep for the project to be profitable by open pit mining

Whether through open pit or underground mining, the production process starts with extracting the copper bearing ore from the earth's crust. The copper content within the ore ranges from a minimum grade of 0.3% to 1%, sometimes higher, especially for underground mines. A higher percentage of copper content within the ore increases the efficiency of the mine as less ore needs to be processed to achieve the same level of copper concentrate output. The copper ore is then crushed to reduce its size from a boulder to a golf ball which enables easier transportation and processing.

Following crushing, copper ores are processed differently, depending on their chemistry. In summary:

- sulphide ores undergo a pyrometallurgical process:
    - sulphide ore is often less abundant
    - pyrometallurgy process is more expensive
    - sulphide ore is often a higher-grade ore (contains more copper)
    - more copper is extracted from sulphide ore than oxide ore deposits
- oxide ores undergo a hydrometallurgical process:
    - oxide ore is often more abundant near the surface
    - hydrometallurgy process is less expensive
    - oxide ore is usually lower-grade (contains less copper)

Figure 2. Processing of sulphide and oxide ores



Source: University of Arizona Report (https://superfund.arizona.edu).

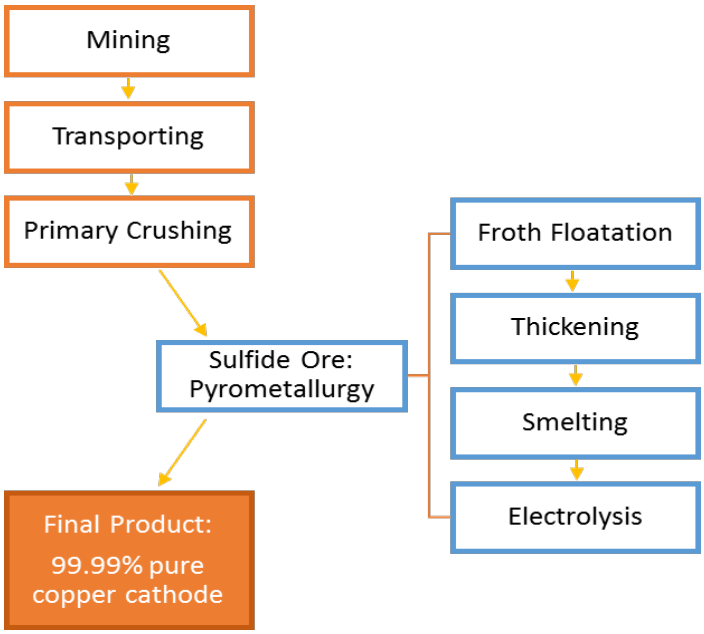
Production Process of Copper Occurring in Sulphide Ores

Copper sulphide ores are generally treated using pyrometallurgy—a process where the mined ore is crushed and ground and is, via the application of heat (smelting), turned into copper metal. This process includes four basic steps: (i) froth flotation, (ii) thickening, (iii) smelting, and (iv) electrolysis.

Following mining, transporting, and crushing, the crushed ore is further processed at a mill where it is ground even finer by semi-autogenous grinding or ball mills. Then liquid is added to make it a slurry. The slurry is placed in a tank and a process called froth flotation is used to separate the copper minerals from the gangue. The next stage is the thickening stage. The froth is poured into large tanks called thickeners. The final product of the thickening stage is copper concentrate (which may contain small quantities of other metals); this copper concentrate is then sent to a smelter.

Copper concentrate typically contains about 30% copper, although that percentage can vary from 20% to 35%. The other two main elements in the concentrate are iron and sulphur. Copper concentrate is then processed in a series of smelting and refining stages. The copper concentrate is first sent through the smelting furnace to be heated up to 2,300°F. This step produces a combination of matte—a mixture of copper, sulphur, and iron— and slag, a dense, glassy material made of iron, silica, and other impurities. The copper matte created by the smelting furnace contains 58% to 60% copper. The matte is then taken to another furnace called a converter to have the remaining iron and sulphur burned off. This step produces blister copper, which contains 98% copper, which is then taken to the anode smelter. The blister copper is fire-refined, or increasingly, remelted and cast into anodes stabs (99%). In a refinery, the anodes undergo a process called electrorefining or electrolysis. The output of electrorefining is refined copper cathodes, assaying over 99.99% copper.

Figure 3. Processing of sulphide ore



Source: University of Arizona Report (https://superfund.arizona.edu).

Production Process of Copper Occurring in Oxide Ores

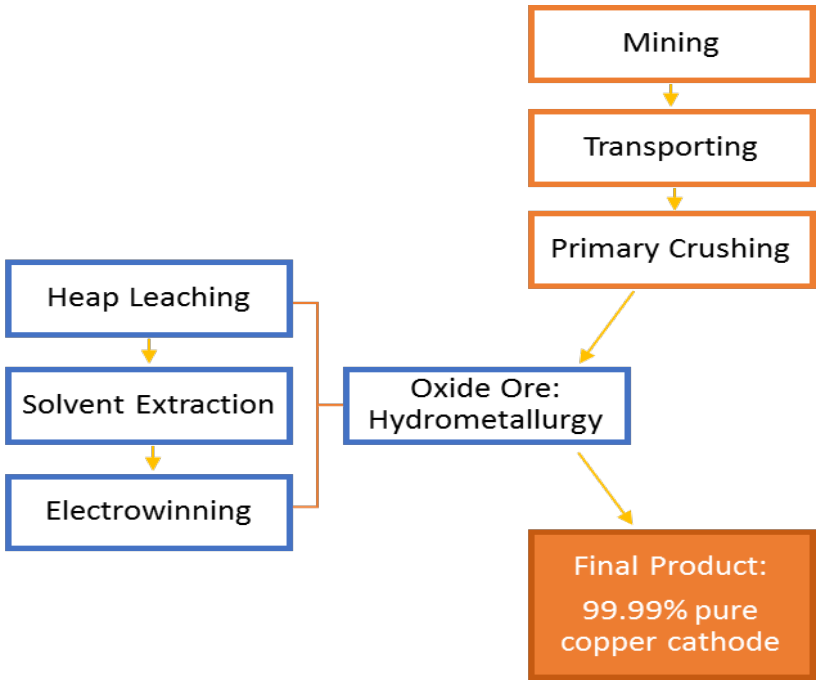
Oxide ores are often processed using hydrometallurgy. There are three steps: (i) a heap leaching process, (ii) a solvent extraction process, and (iii) electrowinning (SX-EW).

Heap leaching is the process where the crushed ore is put on lined heaps which are sprayed with diluted sulphuric acid to generate a pregnant leach solution (PLS). The resulting PLS of sulphuric acid and copper sulphate is collected in a small pool. The copper compound can now be seen at concentrations of about 60% to 70%. In the hydrometallurgical route, copper is extracted from mainly low-grade oxide ores, but also some sulphide ores.

The solvent extraction process causes the copper to migrate from the PLS to the solvent.

The last step is electrowinning. Pure copper cathodes are generated by sending an electrical current from an inert anode through the copper in solution in the solvent (electrolyte) to a negative electrode (electrowinning process). The output (i.e., refined copper cathodes) is the same as through the processing of sulphide ore by smelting and electrorefining. The SX-EW process is less costly compared to obtaining copper cathodes via sulphides ores as it eliminates the need for building a smelter, but its copper recovery rates are less attractive.

Figure 4. Processing of oxide ore



Source: University of Arizona Report (https://superfund.arizona.edu).

Smelters and refineries need to run at capacity to be commercially viable. Therefore, they require a constant supply of copper.

Refined Copper Production From Scrap

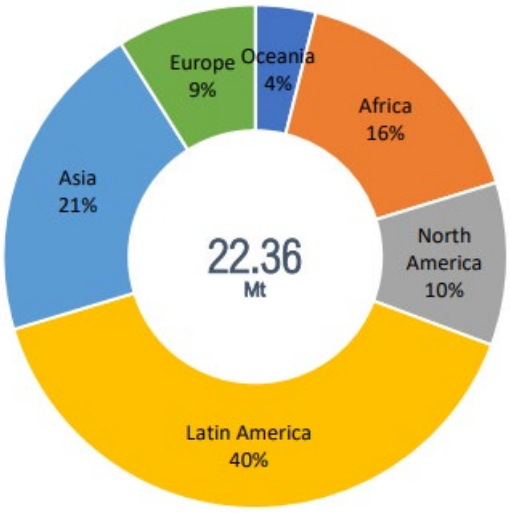
Copper scrap derives from either metal discarded in semis fabrication or finished product manufacturing processes ("new scrap") or obsolete end-of-life products ("old scrap"). Refined copper produced from recycled scrap is categorized as "secondary copper production." Secondary producers use processes similar to those employed for primary production. ICSG estimates that in 2023, at the refinery level, secondary copper refined production reached 16.9% of total refined copper production.

Copper Production and Reserves

There are three distinct stages of the copper value chain: the copper mine, the copper smelter, and the copper refinery.

In 2023, copper mine production worldwide reached 22.4 million tonnes of copper. South America represented 40% of total copper mine production. Chile was the largest producer of mined copper with an output of 5.3 million tons, while Peru, which has experienced a significant surge in copper mine production since 2015, accounted for 12% of the world's output. The top five operating copper mines by capacity in 2024 were Escondida (Chile, 1,350 thousand Mt), Grasberg (Indonesia, 800 thousand Mt), Collahuasi (Chile, 600 thousand Mt), Morenci (United States, 570 thousand Mt), and Cerro Verde (Peru, 550 thousand Mt) (World Copper Factbook, ICSG, 2024).

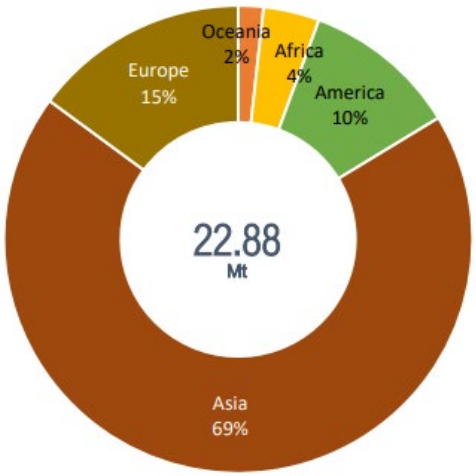
Figure 5. Share of copper mine production by region in 2023



Source: World Copper Factbook 2024, ICSG.

Copper smelter production worldwide in 2023 reached 22.9 million tonnes of copper blister. Asia's share of global copper smelter production represented 69% in 2023. In 2023, China accounted for more than 50% of world copper smelter production, with an output of 11.8 million tonnes, followed by Japan (7%), Chile (5%), and Russia (4%). The top five operating copper smelters by capacity in 2024 were Nanguo Copper (China, 675 thousand Mt), Guixi (China, 520 thousand Mt), Adani (India, 500 thousand Mt), Jinguan (China, 480 thousand Mt), and Chuquicamata (Chile, 450 thousand Mt) (World Copper Factbook, ICSG, 2024).

Figure 6. Share of copper smelter production by region in 2023



Source: World Copper Factbook 2024, ICSG.

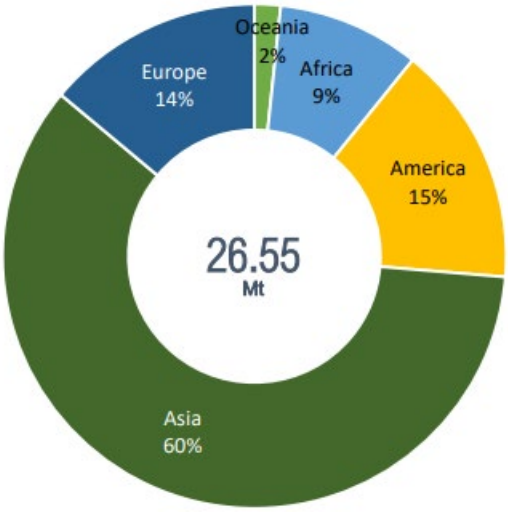
Mine La Escondida, in Chile
Credit: Bpierreb, Wikimedia Commons, CC BY SA 3.0 license.

Dexing Copper mine in Jiangxi Copper Group Co. Ltd., in China
Credit: Alamy.

Refined copper production worldwide amounted to 26.5 million tonnes in 2023. Asia's share of global refined copper production has surged dramatically from 21% in 1990 to 60% in 2023. In 2023, China produced 12 million tonnes of refined copper, approximately

45% of the world's total. In 2023, the Democratic Republic of the Congo (DRC) outperformed Chile, becoming the second-largest producer of copper cathode. The top five operating copper refineries by capacity in 2024 were Guixi (China, 1100 thousand Mt), Jinchuan Gansu (China, 700 thousand Mt), Shandong Fangyuan (China, 700 thousand Mt), Daye/Hubei (China, 600 thousand Mt), and Yanggu C&D (Chile, 600 thousand Mt).

Figure 7. Share of copper refined production by region in 2023



Source: World Copper Factbook 2024, ICSG.

Guixi Smelter of Jiangxi Copper Corporation, China
Credit: MNXANL, Wikimedia Commons, CC BY-SA 4.0 license.

Global copper reserves are estimated at 980,000 million tonnes in 2024 (USGS, 2025). Table 3 provides an overview of the top copper-producing countries and reserves.

Table 3. Mine and refinery production and reserves (in million metric tons)

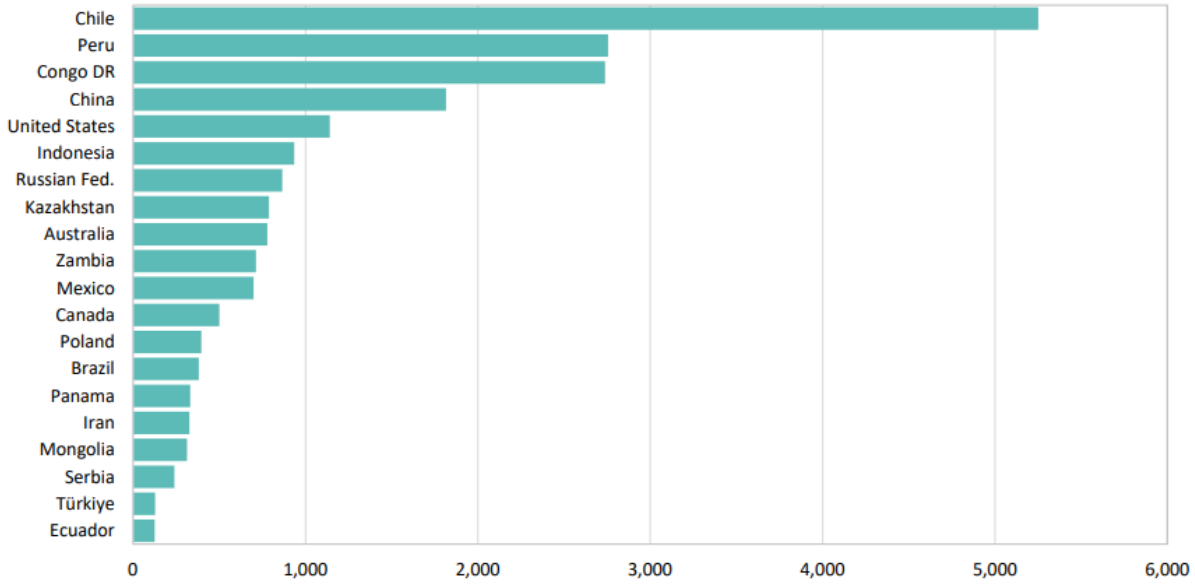
Country	Mine production		Refinery production		Reserves
	2023	2024	2023	2024	
Australia	778	800	882	890	100,000
Canada	500	450	315	320	8,300
Chile	5,250	5,300	2,080	1,900	190,000
China	1,820	1,800	12,000	12,000	41,000
Congo (Kinshasa)	2,930	3,300	2,170	2,500	80,000
Germany	-	-	609	630	-
India	27	30	509	510	2,200
Indonesia	907	1,100	225	350	21,000
Japan	-	-	1,490	1,600	-
Kazakhstan	740	740	458	470	20,000
Korea, Republic of	-	-	604	620	-
Mexico	699	700	509	350	53,000
Peru	2,760	2,600	403	390	100,000
Poland	395	410	592	590	34,000
Russia	890	930	1,000	960	80,000
United States	1,130	1,100	882	890	47,000
Zambia	712	680	222	170	21,000
Other countries	3,020	2,700	2,460	2,500	180,000
World total[5]	22,600	23,000	27,000	27,000	980,000

Source: Authors, based on data from USGS, 2025.

Figure 8 presents the top 20 copper mine-producing countries in 2023 (in thousand metric tons), with Chile being the largest producer, accounting for about 25% of the global supply of copper mine production.

[5] Rounded figures.

Figure 8. Copper mine production by country: Top 20 countries in 2023



Source: ICSG, World Copper Factbook, 2024.

Global copper mine production has increased significantly, with production doubling on average every 25 years. This rapid growth in production is forecast to continue due to the expected increase in demand for raw copper which is primarily driven by clean energy technologies.

Essentially all companies involved in copper mine production are integrated up to the sale of copper concentrates to smelters and traders. Some companies are fully integrated from copper mine production to copper cathode production, especially those running older projects or required by host states to refine copper domestically. For instance, in Chile, the largest producer of copper concentrates, the state-owned company Codelco, has some integrated smelting and refining capacity, like the Chuquicamata refinery. In China, the domestic production of copper concentrate is significantly less than the country's smelting and refining capacity, and the country imports the vast majority of its copper raw materials needs.

Copper Pricing Fundamentals

As with most minerals, supply and demand factors continue to be the most important element in determining copper prices, with specific factors particularly influencing the price of copper.

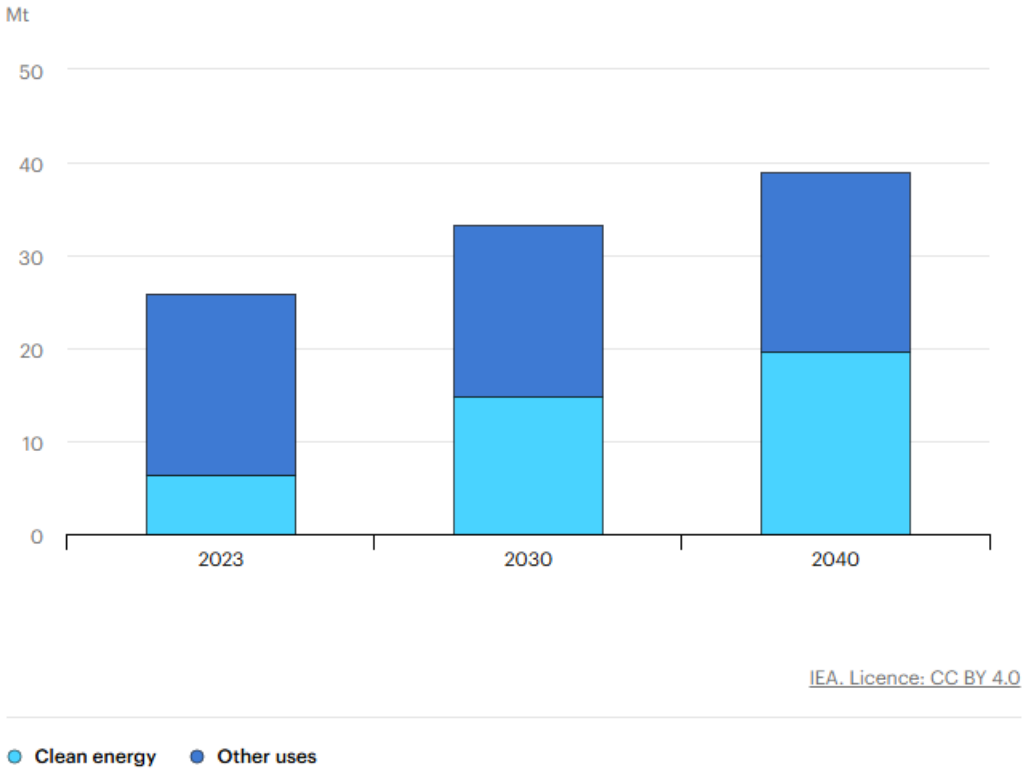
Demand

Copper is valued for its payable metals content and purity. Historically, refined copper demand has been dominated by construction and electricity networks, responsible for 30% and 15% of global demand in 2023, respectively (Global Critical Minerals Outlook, 2024). Outside of building construction, copper is used in other industrial applications

and transportation equipment, as copper is used in the manufacture of key components in all modes of transport.

Due to its unparalleled mix of qualities—electronic conductivity, longevity, ductility, and corrosion resistance—copper is the sole essential mineral found in all of the most significant clean energy technologies, including electric vehicles (EVs), solar photovoltaics (PV), wind, and electrical networks. In other words, clean energy technologies drive substantial growth in copper demand. The share of clean energy technologies in refined copper demand has grown modestly in recent years from 22% in 2015 to a quarter in 2023.

Figure 9. Global copper demand in the Net Zero scenario, 2023–2040



Source: International Energy Agency, Global Critical Minerals Outlook, 2024.

Copper is required for lithium-ion batteries for EVs, in the anode current collector, as well as for wiring in the battery packs for EV motors.

Recycling continues to play a critical role in the current and future demand for copper. Recycling may extend the life of resources and reduce energy use, certain emissions, and waste disposal, if it is managed properly. According to ICSG predictions, 32% of copper used worldwide in 2023 originated from recycled sources. Some nations rely heavily on recycled copper to meet their internal copper needs.

Supply

The supply of mined copper is less concentrated than the supply of other important energy transition minerals. In 2023, the top three producing countries accounted for 47% of global mined copper supply. Chile is currently the largest producer, accounting for a quarter of the world's supply in 2023—more than twice that of the next largest producer. However, due to deteriorating ore grades, aging assets, a lack of investments in expansion, and other countries increasing their production, Chile's share of global production has fallen from 30% in 2015. In parallel, the DRC has recently surpassed Peru as the second-largest producer, doubling its share of global supply from 6% to 12% in the same time frame. The top three copper mines in 2023 produced over 10% of global copper production: these were Escondida in Chile, PT Freeport Indonesia (Grasberg) in Indonesia, and Collahuasi in Chile. The lack of large-scale copper mining projects in the pipeline poses challenges for future copper supply. Based on the current project pipeline, mined copper supply will reach about 25 metric tons in 2026, and then will decline as assets age and grades go down (Global Critical Minerals Outlook, 2024). Moreover, 1.5% of the world's copper supply came from Cobre Panama which is now shut down. Additionally, there is an increased attention to the impending shortage of mined copper.

Copper refining is more concentrated than mining, with the share of refining capacity of the top three countries being 60%, including 45% for China itself.

Copper recycling and direct use of scrap is set to increase substantially from 2030, providing a major source of supply in the future.

For a copper mine producer, the absolute level of the underlying copper metal price is the most important factor that determines its profitability. However, copper mine producers—similar to other stakeholders like traders—have limited to no ability to impact the underlying copper price and are ultimately "price takers."

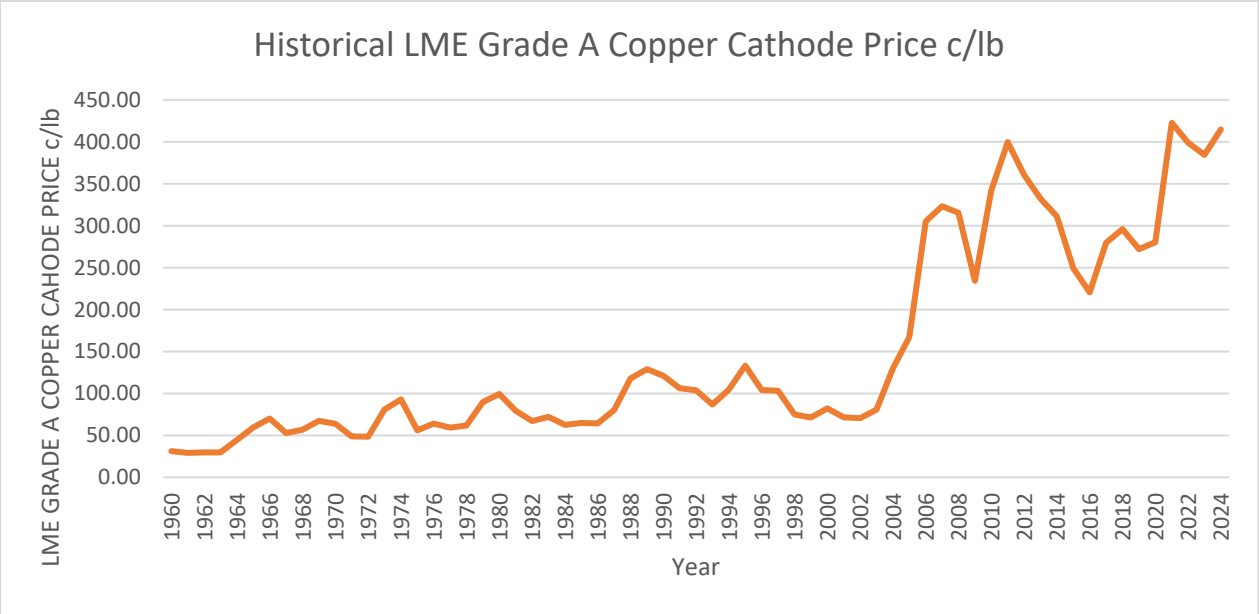
Treatment and Refining Charges

Non-integrated copper mine producers selling to a smelter, or a trader are liable to pay treatment and refining charges (TC/RCs)—fees paid to smelters for processing copper concentrates into refined metal. These charges also fluctuate based on supply and demand factors (although these are far less complex than for copper prices—see below), therefore the level of these charges are important factors impacting copper mine producers' profitability. Awareness of the pricing history of both the elements impacting non-integrated miners is critical to understand more recent market developments. For TC/RCs, supply is the total amount of copper concentrate produced by mines and demand is essentially equal to the smelting industry's total operating capacity. The industry cannot easily adjust to actual refined copper demand because running a smelter/refinery at less than full capacity is very detrimental to its economics, and the international metal exchanges are buyers of last resort in times of market surplus.

Copper Prices

In the 26-year period from 1978 to 2004, copper prices were, certainly by more recent standards, relatively stable. Nominal copper prices on the London Metal Exchange (LME) averaged USD 0.90/lbs, with prices operating within a fairly tight range. Annual benchmark TC/RCs averaged USD 0.191/lbs, roughly the equivalent of TC/RCs of USD 75 per dry metric ton (dmt) and USD 0.075/lbs for a 30% copper concentrate with a 96.7% payable and a 1-unit minimum deduction. TC/RCs represented 21.2% of the copper price over that period and industry participants embraced the concept that long term copper prices would average USD 0.90/lbs and TC/RCs would represent something in the low to mid 20% range of copper prices.

Figure 10. Historical copper prices (LME)



Source: ICSG.

This resulted in three different long-term contract structures coexisting, with equivalent outcomes under the prevailing assumptions at the time:

- Benchmark TC/RCs including price participation (most commonly structured at +/- 10% at USD 0.90/lbs)
- Benchmark TC/RCs without price participation
- Price sharing: where the combined TC/RC is defined in the low- to mid-20% of LME copper prices

Copper prices rallied 28.5% to USD 1.67/lbs in 2005, and 82.6% to USD 3.05/lbs in 2006, indicating the USD 0.90/lbs long-term copper price assumption had lost its validity and was no longer appropriate. The three contract structures would therefore not be equivalent over the long term. Escondida established the 2007 benchmark at USD 60/dmt and USD 0.06/lbs with **no price participation**. **All benchmark settlements since have been without price participation**. Given this shift in the copper market, price sharing contracts are no longer used. Instead of three different contract structures, there is now

essentially one (benchmark without price participation), although some producers have started to sell long-term on an index-linked basis.

Starting in the late 1990s, several non-physical market participants entered the market for copper. Commodities were seen as an asset class and pension funds wanted exposure to commodities. As a result, they shifted their portfolios to include commodities, which had an impact on the demand for, and therefore, the price of copper.

Pricing has not changed as much for TC/RCs as non-physical involvement is essentially non-existent and the smelters' supply is constrained by the mines' output. Recent years have seen smelter capacity grow faster (mainly in China) than mine output which has put downward pressure on TC/RC levels. To the extent that an event impacts the copper concentrate supply and demand balance, it can have a significant impact on the TC/RCs.

For mines producing copper cathodes, the important factors impacting profitability are copper metal prices and cathode premiums. They are also further impacted by the market price for sulphuric acid. Higher sulphuric acid prices are a negative for SX-EW operations and a positive for smelters, including integrated refinery operations, as they contribute toward reducing smelting costs through increased acid by-product credits.

Components for an Agreement for the Sale and Purchase of Copper

Copper is mostly sold by miners in concentrate form (to be smelted or refined into copper cathodes) or as copper cathodes to first-use customers for further downstream processing. As a result, there are two main forms of sales and purchase agreements for copper: (i) the sale and purchase of copper concentrates, and (ii) the sale of copper cathodes.

Although product customization for each customer is still the norm, especially for trace impurities, there has been a convergence in the limits of "typical" impurities in copper concentrates. The main copper concentrate producers are now able to produce a quality acceptable to most buyers (smelters/refiners or traders). Therefore, these buyers can source their copper concentrates from an increasing number of sellers, and sellers can offer their copper concentrates to different customers.

The global copper cathode market is expected to witness high demand due to the growing applications of the material in the health care industry, and the rapid deployment of renewables and EVs.

As with any mineral product, the terms and conditions that impact the price of a sales and purchase agreement are specific to that commodity. Copper concentrate sale and purchase agreements have historically been a one-on-one negotiation between the buyer (smelter/refinery/trader) and the seller (a production entity). Traders have gained an important place in the copper industry in recent years.

There are different forms of contracts for the sale and purchase of copper. This section attempts to describe the main elements of these contracts between independent parties

to assist tax administrations in applying the arm's-length principle. As outlined earlier in this toolkit, this mineral pricing schedule does not replace, supersede, alter, or affect the 2022 OECD TPGs and should be read in conjunction with the main mineral pricing toolkit (Viola et al., 2023).

Sale and purchase agreements for copper concentrates have the same structure but will contain different terms and conditions than those for copper cathodes because the product is different, as are the parties involved. They are, therefore, reviewed separately below.

Regardless of the type of copper product, buyers request representative samples and check metallurgical and mineralogical characteristics before importing copper concentrates or copper cathodes. These characteristics are the basis of the contract and price negotiations.

Copper Concentrates

Copper concentrate prices are typically based on a formula, which captures the total value of all payable metals less the sum of deductions and penalties imposed.

The key components of a copper concentrate sales and purchase agreement are as follows:

- Product description:
    - Copper concentrate's description is significantly more complex than refined copper cathodes primarily because copper concentrate production is not homogeneous. There is a range of copper concentrate specifications depending on the source. Most contracts give approximate ranges for each of these elements, but they can be different for different mines.

- Payable metal:
    - Copper: The payable copper will be based on the percentage of copper present in the concentrate, adjusted for expected/negotiated process losses. That figure will be multiplied by the (most commonly LME) copper price. For instance, contracts will typically specify the "LME Copper Grade A Settlement Price"[6] as the reference price for payable copper, averaged over a quotational period. As the LME Copper Grade A Settlement Quotation Price is the price for the finished copper product (99.99% copper), the copper concentrate seller will only receive payment for the payable percentage of copper content within the copper concentrate which is referred to as "Payable Metal."
    - Gold and silver: They are often by-products in copper concentrate. Quantities below a set threshold are deemed uneconomical for the smelter to recover, hence, no payment is made for these metals under

[6] LME Copper, London Metal Exchange.

those thresholds. Both gold and silver payables are priced based on London Bullion Market Association (LBMA)[7] quotations.

- See Table 4 for standard payable metal rates.

Table 4. Payable metal rates

Copper (Cu) payable	96.7% of contained Cu, subject to a minimum deduction of 1 unit (1 percentage point). Minimum deduction impacts concentrate grades below 30.5% LME Copper Grade A Settlement Price averaged over the quotational period
Gold (Au) payable	No payment if Au is less than 1g/dmt • 90% of LBMA gold AM/PM price if gold content is 1 to 3g/dmt • 94% if 3g to 5g/dmt • 95% if 5g to 7g/dmt • 96% if 7g to 10g/dmt • 97% if more than 10g/dmt
Silver (Ag) payable	No payment if Ag is less than 30g/dmt 90% of LBMA silver price averaged over the quotational period if Ag content is equal or more than 30g/dmt

Source: Authors, based on typical metals purchase agreements or metal refining contracts.

- Quantity and duration: The quantity refers to the volumes of copper concentrate to be transferred from the seller to the buyer. The duration is the length of the sales and purchase agreements.
  - Miners generally try to have 80% to 85% of their expected output sold on long-term agreements, ranging anywhere from 1 to 12 years. Quantity tolerances are granted to the seller for individual shipment purposes for operational reasons on longer-term contracts (+/- 5% quantity per shipment are accepted without penalty). However, this does not to apply to the fixed overall tonnage which has to be delivered under the contract.
  - Volumes can range from a single spot shipment to large multi-year contract structures.
  - Even though copper concentrate shipments typically contain about 8% to 9% moisture, contractual quantity is generally denominated in dmt.

- Treatment and refining charges:

  Treatment and refining charges (TC/RCs) are a key fixture in copper concentrate sales, reducing the payments to the seller, regardless of whether the contract is a spot sale or a longer-term agreement. Spot TC/RCs are determined by prevailing market conditions for spot sales of copper concentrate, which are reported by trade publications and price reporting agencies.

  Under longer-term contracts, annual benchmark TC/RCs are most commonly used. These benchmark TC/RCs are generally defined once a major miner has reached

[7] The Independent Precious Metals Authority, LBMA.

agreement on key terms with a major smelter—in recent years often Chinese—applying to concentrate shipments over the coming year. These negotiations typically start around the time of the annual LME Dinner[8] and can drag on for a couple of months. They are then reported by trade publications and their terms are commonly incorporated into similar supply arrangements between parties not involved in the agreement.

Treatment charges (TC) are quoted in USD/dmt and refining charges (RC) are quoted as below:

- Copper (Cu) – RC in USc/lbs of payable copper
- Gold (Au) - RC in USD/oz of payable gold
- Silver (Ag) – RC in USc/oz of payable silver

Commonly used sources of pricing information for benchmark TC/RCs are S&P Platts, Fastmarkets, Wood Mackenzie, CRU, and Shanghai Metals Market.

TC/RCs are variable and subject to their own, quite specific, supply and demand factors, with the caveat that economics largely dictate that the smelters' demand equals their operating capacity. The industry's convention is to have the RC figure (in USc/lbs) be 10% of the TC figure (in USD/dmt), but this is only a convention, not backed by an objective rationale.

- Penalties for impurities:

  Buyers of concentrates will ask for deductions or penalties for the elimination of harmful components that are present in concentrations at higher than usual levels. Some newer mines have fairly high levels of impurities, and several established mines have seen their impurity levels increase. As a result, penalty terms are somewhat fluid and vary based on the mine or project.

  Table 5 shows indicative thresholds for penalties for some impurities.

[8] Tuesday evening of LME Week in October: https://www.lme.com/en/events/lme-week/lme-dinner.

Table 5. Indicative penalties for impurities

Element	Penalty trigger (parts per million [ppm])	Penalty (USD/dmt per extra 1,000 ppm fractions pro rata)
Arsenic (As)	2,000	3
Antimony (Sb)	500	15
Bismuth (Bi)	200	25
Cadmium (Cd)	300	30
Fluorine (F)	300	15
Mercury (Hg)	5	3,000

Source: Authors, based on typical metals purchase agreements or metal refining contracts.

Rejection limits may be applicable if the quantities of impurities are too high, usually due to the materials exceeding safety or environmental regulations, being too difficult (and hence expensive) to remove, or expensive to dispose of, such as mercury.

- Delivery terms: Depending on the arrangements negotiated between the buyer and seller, copper concentrate can be sold at the delivery port, dispatch port, or an intermediate location. It is most commonly sold on a Cost, Insurance and Freight Free Out (CIFFO) basis to a named port or main Chinese ports, main Japanese ports, main Korean ports, or main European ports. Another commonly used term when copper concentrate is sold at the delivery port is Free on Board Stowed Trimmed (FOBST). There are also parity clauses which allows the buyer to request shipments to locations not contractually defined. In such a case, the buyer would be responsible for any charges the seller incurs from a freight perspective relative to shipping to the contractually defined destinations.
- Title and risk: Risk of loss passes to the buyer once the material crosses ship's rail at the port of shipment for CIFFO and FOBST contracts. Title typically passes to the buyer when provisional payment is made.

Table 6. Common incoterms used to sell copper concentrates

CIFFO	Seller provides the goods and pays for the ocean freight and insurance. The cost of unloading the goods at the destination port is on the account of the buyer.
FOBST	Bulk shipments. Seller is responsible for loading the goods aboard the vessel as well as stowing and trimming the cargo.

Source: Authors, based on metals purchase agreements and metal refining contracts.

- Quotational period (QP): When referring to a price index or assessment, the QP is subject to negotiation between the parties. It can be different for all payable elements. Predominantly deferred for copper concentrate (Month of shipment +4, or 3 MAMA – Month after month of arrival). Often there are early QPs (Month of

shipment – 1) for silver and gold. QPs are mostly fixed within the contract, as only fixed QPs allow for effective hedge programs for sellers.

- Payment conditions: Commonly 90% provisional payment against a full set of Bills of Lading. There is other supporting documentation based on the seller's provisional weights and assays and provisional prices at the time of shipment, with final payment to be made once all necessary inputs are known. Some sales contracts, particularly to traders, will have a second provisional payment 2 months following the arrival of the vessel at the discharge port. This payment covers the difference between the original provisional payment and the total contract value, based on data available at the time (which might not yet include final QP prices).
- The weighing, sampling and moisture determination (WSMD) clause: This clause specifies a number of critical factors such as: (i) the location, (ii) the method for determining the wet weight and the moisture content of the cargo, (iii) the size of the sampling lots and the methodology to be used for taking the samples to determine the final quality of the cargo. For well-established smelters this is commonly completed at the port of discharge or at the receiving smelter, depending on the specific circumstances. The seller has the right to be represented at the WSMD operation. For others, it may be done at the load port with a small deduction allowance.
- The assaying, assay exchange, splitting limits, and umpire parameters: It defines the assay method to be used (typically fire assay with correction for cupellation losses for silver and gold), the assay exchange process, the level of splitting limits for all payable and penalty elements, and the umpire procedure to be followed. Some miners request that, if intermediaries are involved, the entire assay exchange process takes place directly between the mine and the receiving smelter.

Copper Cathodes

- Material description: copper cathodes meeting LME[9] copper Grade A specifications. Buyers who can accept material that does not meet LME copper Grade A specifications will insist on a lower cathode premium than the one prevailing for LME copper Grade A cathodes.
- Quantity and duration: can vary from a single spot shipment to large multi-year contract structures—commonly denominated in metric tons.
- Delivery terms: most commonly sold on a CIF Liner Terms basis.
- Price: the quotational period average of the LME Grade A Copper Settlement price plus a copper cathode premium. For longer-term agreements the premium may reset periodically as agreed between the parties or by reference to commonly used premiums, such as the Codelco terms. Cathodes have their own specific supply and demand parameters which largely determine the copper cathode premium levels. Given the homogeneous nature of LME Grade A copper cathodes, the pricing is standard, i.e., LME Grade A Copper Settlement price plus a premium, and a seller **would not** accept a lower price for its product.

[9] Contract specifications, London Metal Exchange.

- Quotational period: most commonly the month following the month of shipment.
- Payment terms: Typically, 5 to 10 days prior the vessel arrival at the discharge port.
- Title and risk and other clauses: as per copper concentrates.
- Seller's weights and assays to govern.

Determining the Price of Copper

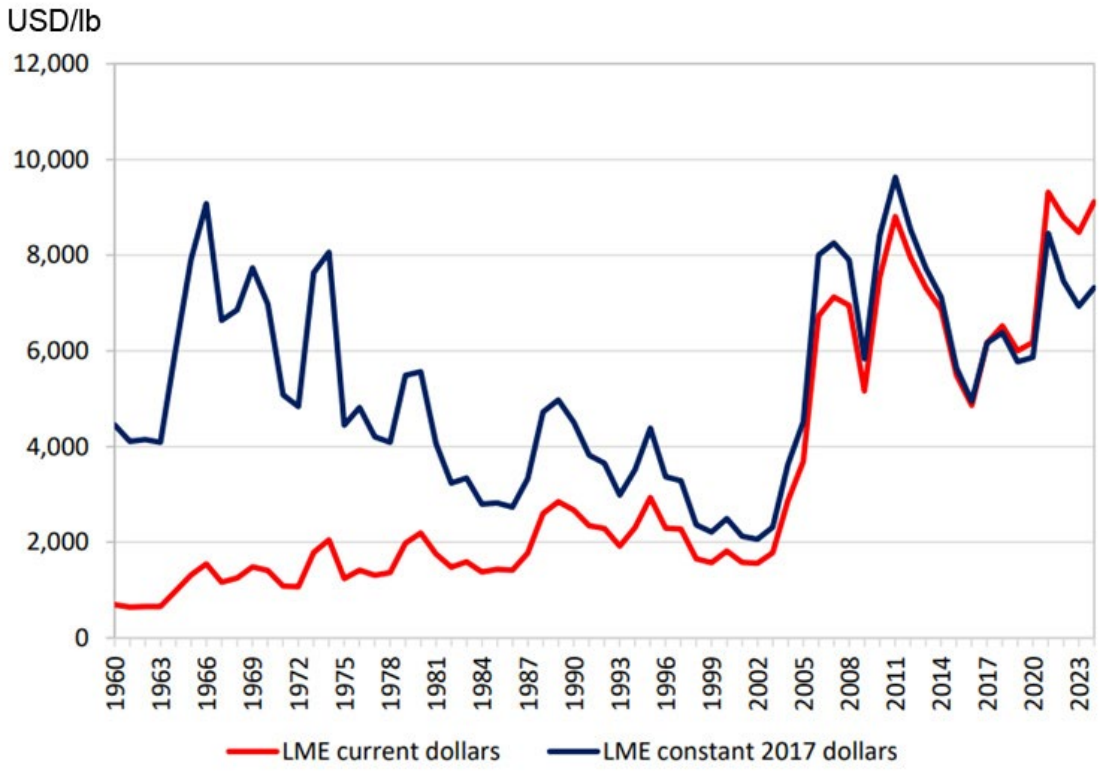
The copper market is mature, with transparent pricing via quoted or index prices, and very limited fixed-price bilateral agreements. For copper, price discovery is a key function of commodity exchanges.

Copper is most actively traded on the London Metal Exchange (LME), the Commodity Exchange Division of the New York Mercantile Exchange (COMEX), and the Shanghai Futures Exchange (SHFE). All three provide the opportunity to trade spot and forward periods, and physical delivery/receipt in their respective warehouse structures is available as an alternative to settle trades. The main commodity exchange that provide facilities to trade copper on the spot market is the LME, as it is the only exchange that trades for specific dates (rather than on a monthly basis).

The product quality, lot size, delivery dates, delivery warehouses, and other elements of the trading process are all specified for their futures or options contracts. Contracts are specific to each transaction.

On the LME, COMEX, and SHFE, prices are set when bid and offer quotes meet, reflecting the market's perception at a particular time of the expected supply and demand of copper for the maturity date of the trade. On the LME, copper is traded in 25-tonne lots and quoted in US dollars per tonne; on COMEX, copper is traded in lots of 25,000 pounds and quoted in US cents per pound; and on the SHFE, copper is traded in lots of 5 tonnes and quoted in Renminbi per tonne. More recently, contracts of smaller lot sizes have been introduced at the exchanges.

Figure 7. Average annual copper prices (LME settlement), 1960–2024*/ USD per tonne



Source: ICSG.

With copper, tax authorities can use the prices reported by commodity exchanges—such as the LME—for transfer pricing purposes, provided there is a corresponding adjustment depending on the product transacted, including any premiums and discounts.

Spot prices have long been based on a considerable volume of transactions, as opposed to other markets, such as for lithium.

Another well-established source of copper pricing comes from third-party, price-reporting agency (PRA)-discovered prices. Copper pricing data is published by price-reporting agencies, such as Argus Media, Fastmarkets, S&P Global Commodity Insights, and Shanghai Metals Market and can be accessible through a subscription. In addition to reporting on copper cathode prices, copper concentrate prices, and copper scrap, it is important to highlight that PRAs often report TC/RCs for copper concentrate and copper cathode premiums. These PRAs are Argus Media, Asian Metal, Fastmarkets, S&P Global Commodity Insights, and Shanghai Metals Market.

PRAs have their own published methodology to develop spot and/or contract prices. The methodology is based on a range of factors, such as actual third-party transactions, bids and offers, and market intelligence—i.e., calls and other communication methods, such as emails to buyers and sellers. The LME uses PRAs' pricing data, such as S&P Global, Argus Media, and Fastmarkets indexes in a number of its cash-settled contracts.

The following section briefly describes copper price indices published by commodity exchanges, and information on copper pricing made available by PRAs.

Copper Price Indexes

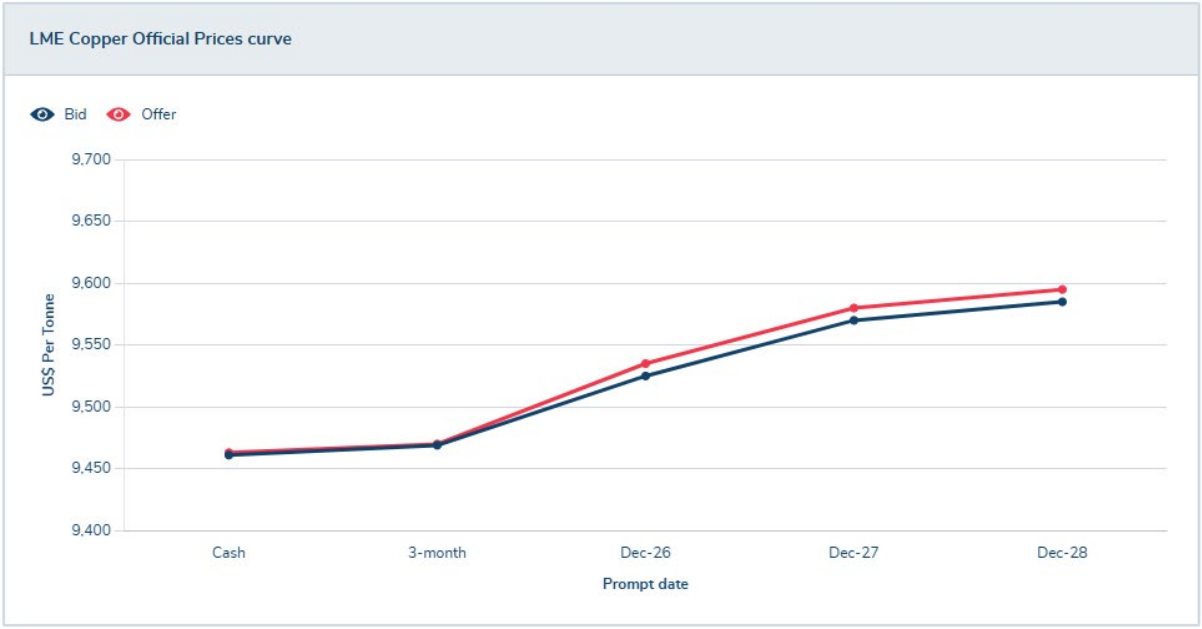
As mentioned, copper prices are reported by the commodity exchanges and the PRAs.

Commodity Exchanges

LME Reports Spot Prices

Price discovery is one of the most important functions of the LME. The prices discovered on the LME are used as the reference price for physical negotiations, including for copper. There are official prices and closing prices. The LME's official prices are based on trading activity, and the closing prices are based on trading activity on the LME select. There are other LME copper prices, including forward prices, prices quoted for delivery dates beyond cash, and the LME Asian Reference Price, calculated using the volume-weighted average of trades on LME select during the most liquid period of Asian trading hours.[10]

Figure 8. LME copper official prices, dated February 25, 2025



Source: LME's website.

Table 7 reflects the special contract rules for copper – Grade A.

[10] LME Copper, London Metal Exchange.

Table 7. Special contract rules for copper - Grade A

Quality	The copper delivered under this contract must be: (a) Refined electrolytic copper conforming to the chemical composition of one of the following standards: (i) BS EN 1978:2022 (cathode grade designation Cu-CATH-1) (ii) GB/T 467-2010 (high purity Copper Cathode (Cu-CATH-1)) (iii) ASTM B115-10 (2021) (cathode Grade 1) (b) In the shape of full plate cathodes (c) Of brands listed in the LME approved list
Size of lot	25 tonnes (2% either more or less)
Warrants	Warrants must be for 25 tonnes (2% either more or less) The copper in each warrant shall consist of one brand which is listed as being good delivery and must be in bundles not exceeding 4 tonnes, securely strapped for safe handling and transport without bundle distortion and breakage Each warrant must state: (a) the name of the brand, (b) the country of origin, (c) the shape, (d) the weight, and (e) the number of bundles making up each lot.
Additional requirements for copper warrants	The LME-listed brand name must be indelibly marked on clips attached to the producer's bundle strapping or marked continuously on the strapping. No opening of producer bundles with producer markings is permitted by a warehouse upon receipt, except under three circumstances.
Major currency	USD
Testing of warranted metal	If the Exchange believes that the conditions at (a) and (b) below are satisfied, the Exchange may instruct an LME-Listed Sampler and Assayer (LSA) to undertake such tests as are necessary to form a reasonable opinion on whether the metal on warrant conforms with these rules. Where the Exchange reasonably believes that the situation requires it, those tests may be conducted without the prior consent of the warrant holder. The LME will bear the costs of such tests. The conditions referred to above are that: (a) there are reasonable grounds to suspect that copper on warrant does not comply with these rules, (b) there is a risk of disruption to the LME's market.

Source: LME Rules and Regulations, as of April 2, 2024.

Commodities Exchange Reports of Future Prices

The CME Group is a derivative marketplace, made up of four exchanges: Chicago Mercantile Exchange (CME), Chicago Board of Trade (CBOT), New York Mercantile Exchange (NYMEX), and the Commodities Exchange (COMEX). COMEX reports different copper derivative products, for example, copper future prices and copper cathode premiums.

Table 8. Sample of copper prices reported by COMEX and Specs

Product name	Contract unit	Price Quotation	Listed contracts	Settlement method
Copper average price option	25,000lbs	USD cents/pound	Monthly contracts listed for 23 consecutive months	Financially settled
Copper Financial Futures	25,000lbs	USD cents/pound	Monthly contracts listed for 23 consecutive months and any Mar, May, Jul, Sep, and Dec for 60 months	Financially settled
Copper Futures	25,000lbs	USD and cents/pound	Monthly contracts listed for 24 consecutive months and any Mar, May, Jul, Sep, and Dec in the nearest 63 months	Deliverable
Copper London TAM	25,000lbs	USD and cents/pound	Monthly contracts listed for 24 consecutive months and any Mar, May, Jul, Sep, and Dec in the nearest 63 months	Deliverable
Copper Option	25,000lbs	USD and cents/pound	Monthly contracts listed for 22 consecutive months and any Jul or Dec in the nearest 60 months	Deliverable
Copper Premium Grade A CIF Shanghai (Metal Bulletin) Futures	25 metric tons	USD and cent/metric ton	Monthly contracts listed for 18 consecutive months	Financially settled

Source: CME Group's COMEX.

Shanghai Futures Exchange Reports of Future Prices

The Shanghai Futures Exchange (SFE) is under the regulation of the China Securities Regulatory Commission (CSRS). It organizes futures trading approved by CSRS. The SFE reports different copper future prices based on copper cathode contract specifications, as described in Table 9.

Table 9. Copper cathode contract specifications

Product	Copper cathode
Contract size	5 metric ton/lot
Price Quotation	Yuan (RMB)/metric ton
Minimum price fluctuation	10 Yuan/metric ton
Range of price limit	Within 3% of the settlement price of the preceding trading day
Listed contracts	Monthly contract for the most recent 12 months
Trading hours	9:00 a.m. to 11:30 a.m., 1:30 p.m. to 3:00 p.m., and other hours specified by the Exchange (Beijing time)
Last trading day	Fifteenth day of the contract month (postponed accordingly if it is a legal holiday in China, and subject to separate adjustment and announcement by the Exchange if it falls during the Spring Festival month or another month specially designated by the Exchange).
Delivery period	Two consecutive business days after the last trading day
Grade and quality specifications	Copper cathode, Grade A copper (Cu-CATH-1) as prescribed in National Standard GB/T 467-2010; or Grade A copper (Cu-CATH-1) as prescribed in BS EN 1978:1998
Delivery venue	SHFE – designed delivery storage facilities
Minimum trade margin	5% of contract value
Settlement type	Physical delivery
Delivery unit	25 metric tons
Appearance and weight per piece	Delivered in the form of ingot. The weight of copper cathode per piece shall not be less than 15kg and its central thickness shall not be less than 5mm

Source: Contract Text, Copper.

Price Reporting Agencies

Price-reporting agencies (PRAs) report copper cathode prices, copper concentrate prices, copper scrap, and TC/RCs for copper concentrate. These are Argus Media, Fastmarkets, S&P Global Commodity Insights, and Shanghai Metals Market.

Argus Media

Argus is an important PRA recognized by a large number of commodity producers. Argus price assessments cover the most active trading regions for each commodity. For copper prices, they cover, for example, Europe, Asia, and the United States. All prices are reported on a spot basis only. For TC/RC for clean copper concentrates, they cover China.

Argus Media produces general price methodology notes applicable to all the minerals and metal prices published by the agency. For copper, the Argus Scrap Markets and Argus Non-Ferrous Markets methodologies are relevant and publicly available.

Argus Non-Ferrous Markets publishes TC/RCs for clean copper concentrate as outright prices of spot treatment and refining for clean copper concentrate meeting certain specifications.[11] Prices are assessed and published weekly. The specifications and details regarding the indexes are available here: Copper prices, charts, and news – Argus Metals.

Fastmarkets

Fastmarkets is a PRA that reports copper cathode prices; copper concentrate and copper blister TC/RCs related to smelters and traders' purchases; and copper scrap prices. It reports copper prices on a CIF, Delivered at Place, Delivered Duty Paid, In Warehouse, and Ex-works basis for production from Asia (including China), the United States, Europe, Taiwan, and Canada (Toronto and Montreal). Fastmarkets publishes a cathode premium based on location. The specifications and details regarding the indexes are available here: Copper prices - historical charts, data, and market news.

S&P Global Commodity Insights[12]

S&P Global Platts reports copper cathode prices, clean copper concentrate TC/RCs, and copper scrap prices. It publishes cathode premiums, depending on location. All prices are evaluated on a daily basis, or Tuesdays on a CIF, Delivered and free alongside ship basis.

S&P Global Platts publishes its general pricing methodology,[13] as well as a price specifications guide for nonferrous metals.[14] It collects information on bids/offers and deals, verifies the information with market participants, normalizes prices when required, and discards non-representative data. It also publishes individual data points that are the basis for their assessment, such as actual transactions and bids and offers, so-called "heards," accessible through free registration. The specifications and details regarding the indexes are available here: Specifications Guide: Global Nonferrous Metals.

Shanghai Metals Market

Shanghai Metals Market (SMM) is a comprehensive online marketplace offering both ferrous and nonferrous metals. Focused on the Asian markets—and the Chinese market in particular—SMM publishes price assessments for copper cathode, copper premium depending on location (e.g., Yangshan, Taiwan, Southeast Asia), and copper concentrate. The specifications and details regarding the indexes are available here: China Copper Spot Price Today, Copper Prices, Charts, Analysis & Forecast, SMM Metals Market.

[11] Argus Media. Argus Non-Ferrous Markets. Accessed 10 January 2025 (argus-non-ferrous-markets (1).pdf)
[12] S&P Global. Commodity Insights. Platts Battery Metals Price Assessment. Accessed 10 January 2025.
[13] S&P Platts. Platts Assessments Methodology Guide. Accessed 10 January 2025.
[14] S&P Platts. Specifications Guide Global Nonferrous Metals. Accessed 10 January 2025.

Comparability Adjustments

Characteristics of the Product

Being a physical product, the characteristics of the mineral in question—either copper concentrates or copper cathodes—are of relevance. As mentioned, the general principle applicable to copper is as follows:

- The quantity of the "payable element," that is, the mineral or metal. Copper concentrate or copper cathode are valued based on the copper content within the mineral or metal, with their value indexed to the refined copper price (99.99% copper), specifically the LME Copper Grade A product. Given the mature nature of the copper market, there is a transparency pricing structure via a quoted price (LME Copper Grade A). For copper concentrate only, the negotiations between the buyer and seller centres around the applicable payable metal percentage (see Table 4 for a breakdown of the standard payable metal percentages).
- As a seller is remunerated for the payable metal within the ore—i.e., the percentage of copper within ore—it's important that appropriate verification via sampling and weighting is conducted and not subject to manipulation. This is relevant for both related and third-party sales, and it's recommended that the exporting country has robust processes to verify the quantity and quality of the copper concentrate that is sold. See OECD-IGF practice note: Monitoring the Value of Mineral Exports: Policy options for governments - Intergovernmental Forum.
- The level of moisture content does not impact pricing as copper concentrate is priced on a dwt basis (no water content). However, it is still important to accurately determine the moisture content of the copper concentrate shipment as shipping costs are based off wet metric tonnes (wmt), and to ensure that the conversion from wmt to dmt is completed accurately.
- Downward adjustments for undesirable physical properties, such as impurities that increase the cost of extracting or refining the payable element. As mentioned, these may be referred to as "penalties" in commercial contracts. Also, an excess of certain impurities can lead to the product being heavily penalized as it becomes undesirable and may need to be blended with other grades of copper concentrate or simply rejected. For example, a copper concentrate ore with 7,000 parts per million (PPM) of arsenic may be penalized heavily relative to a 1,000ppm shipment.
- Upward adjustments for desirable physical properties that have a positive bearing on the costs of smelting. This may also include other valuable by-products (gold, silver, or cobalt) in the concentrate that can be commercially extracted and consumed or marketed. Another example is copper concentrates with very low impurity levels as they can be blended with "dirty" copper concentrates to achieve a constant clean level of material. The copper contract structures tend to reward the quality of the material. The higher percentage of copper within the concentrate (above 30%) will generally receive a higher relative price than a copper concentrate with a lower percentage (below 25%).

Economic Circumstances

When assessing whether a transaction reflects trades between arm's length parties, it is crucial to understand its economic context.

As mentioned, revenues of copper concentrate sales contracts are directly impacted by the prevailing market prices for the payable elements during their relative quotational periods, and the negotiated TC/RC and penalty elements in the contract. The factors influencing copper prices are far more numerous and complex than those influencing market TC/RCs, where non-integrated mine production and custom smelter capacity are the key determinants.

The customer identity is crucial. Smelters are the primary customers—and sole users—of copper concentrates. However, transactions may also involve traders—either independent or related to the seller (within corporate groups)—who source products to eventually sell to smelters for further processing. There is a symbiotic relationship between non-integrated copper mines and custom smelters, given that copper concentrates' only use is to be processed at smelters or refineries to obtain refined copper cathodes. Trading firms serve as a conduit between buyers and sellers who may not be able or ready to participate directly in the market for a number of reasons. It is possible that these businesses lack the necessary resources and expertise, or they are simply too small to do so.

Customers' needs are also pivotal. Smelters would take supply reliability into account to run at maximum capacity and favour buying from miners that have a solid reputation for dependability and consistency. Smelters look for concentrates that are most appropriate for their needs. For instance, depending on the facility's ability to tolerate impurities, smelters can seek a mix of clean and "dirty" concentrates (the smelter may be able to blend dirtier concentrates with clean concentrates without suffering a loss in performance). Traders can perform this function as well, that is, purchase and blend different parcels of copper concentrate with varying properties to achieve a uniform or desirable product.

Short-term sales and purchase agreements are likely to be concluded at terms reflecting prevailing spot TC/RC levels, whereas longer-term agreements can reflect either benchmark terms (depending on when negotiated), indexed TC/RCs, or—more rarely—fixed TC/RCs. The pricing terms of a 150,000dmt per year contract are likely to be quite different to the terms of a 5,000dmt per year contract concluded around the same time. The larger quantity contract would typically reflect prevailing market conditions while the smaller contract seller would be heavily penalized to compensate for the additional costs associated with dealing smaller quantities.

Contractual Terms

As with the sale and purchase of any other mineral, it is important to identify deviations from "standard" contractual terms between independent parties operating at arm's length.

For copper concentrate, value can be shifted between the buyer and seller through deviating from the commercial arm's length terms and conditions. This can create transfer pricing risks in the following contract clauses:

- Quotational period optionality: When a seller allows the buyer to select the applicable quotational period(s) from a number of different options, it creates value for the buyer. That value increases when one or more of the available options can be declared after the prices of those periods have already been determined—so-called back-pricing privileges. The eventual impact on the seller of granting such optionality is unknown, However, the impact on a market-savvy buyer is **never** negative. This QP optionality is rarely seen in independent third-party sales and purchase agreements, and when it is, there is generally a "quid-pro-quo" compensation provided to the counterparty somewhere else in the contract. The taxpayer should be able to justify any QP optionality.
- Payable percentages for copper: By reducing the payable percentages for copper, less revenue is received by the seller. This is why monitoring the value of copper exports is critical for tax authorities.
- Subproducts, such as gold and silver: When the payment is made for the by-products at an inappropriate threshold. As the price of these precious metals continue to increase, their value as a percentage of the total shipment continues to rise. As such, it's important to ensure that the by-products are being paid for and at the current amounts. Refer to Table 4 above for specific details.
- Splitting limits for copper, gold, and silver: Copper concentrate contracts generally call for buyer and seller to exchange assays to determine the final assays of the parcel. If the difference between the buyer and seller's assays falls within the splitting limit, the average of the buyer and seller assays is final. However, if the difference falls outside the splitting limit, an independent umpire lab assay will be required to determine the final assay. A splitting limit that is too wide can lead to abuses. Furthermore, if the buyer and seller are related parties, the assay exchange process may not sufficiently protect tax authorities' interests and it might be necessary to request parcel samples for independent testing. Splitting limits should be present in sales and purchase agreements and within a narrow range to ensure that the final assay used is accurate and reliable. While there are no standard contract terms for splitting limits, anything beyond the figures stated below may not be appropriate:
    - Copper - 0.15% to 0.20%
    - Gold - 0.2 grams/dmt
    - Silver - 5 grams/dmt
- Impurities and penalties: The thresholds for impurities need to be arm's length with appropriate discounts or penalties for when the thresholds are breached (see Table 5).
- Payment terms: Appropriate payment terms are to be used and not shift value between the buyer and seller—for example, through excessive payment terms or no or limited provisional payments.

- Treatment and refining charges: TC/RCs reduce the payments to the seller. TC/RCs should ideally follow published TC/RC benchmarks and reset annually. There might be cases where sellers and buyers agree on TC/RCs made at a flat rate. The tax authority should be able to monitor whether a flat rate is arm's length.
- Freight charges: When the shipping terms of a sales and purchase agreement are on a FOBST basis, and the pricing term utilized is on a delivered basis, there will most likely need to be an adjustment to account for this difference which is referred to as a "netback." The tax authority will need to ensure that the shipping terms selected, and any netback adjustment applied are arm's length. This can be done by ensuring that the factors that influence the shipping costs have been appropriately selected, such as the route, destination, class and size of vessel, commodity, that is, bulk and port charges. International benchmarks of shipping costs are available through providers such as S&P Platts and Baltic Index for the main trading routes and can help determine arm's length costs.

Worked Example

A practical example is applying a reference index price on the main trading route for copper concentrate from Chile to China. This example may not apply to all copper concentrates from Chile, or to copper from other regions. For each specific case, it will be important to assess whether the index is an appropriate benchmark for the copper production under analysis.

Contract Details

Quotational Period		**Calculation**
• Copper	M +3	
• Silver	M +1	
• Gold	M +1	
TC/RCs		
• Treatment charge (USD/dmt)	80	a
• Refining charge (c/lbs)	8	b
• Silver refining charge (USD/troy oz)	0.4	c
• Gold refining charge (USD/troy oz)	5	d
Penalties		
Arsenic penalty (USD/dmt per extra 1,000ppm over 2,000ppm limit)	5	M
Bismuth penalty (USD/dmt per extra 100ppm over 200ppm limit)	25	

Shipment Information

Input	Variable	Calculation
Shipment month	Sep-23	
Shipment quantity (wmt)	10,500	
Shipment moisture (%)	8.50	
Shipment quantity (dmt)	9607.5	K
Copper content (%)	29.45	A
Silver content (g/dmt)	53	B
Gold content (g/dmt)	3.25	C
Arsenic content (ppm)	3,000	D
Bismuth content (ppm)	150	E

Conversions

Input	Variable	Calculation
Silver content (oz/dmt)	1.70	B/I
Gold content (oz/dmt)	0.10	C/I
Recovery rate: copper	97%	F
Recovery rate: silver	90%	G
Recovery rate: gold	94%	H

Units

Grams per ounce	31.10	I
Pounds per tonne	2,204.62	L

Market data

	Sep-23	Oct-23	Nov-23	Dec-23
Copper average LME ($/MT)	9,985	9,930	9,870	9,450
Silver average LBMA ($/troy oz)	28	29	29	29
Gold AM/PM average LBMA ($/troy oz)	2,410	2,350	2,320	2,270

Copper Concentrate Price Determination - Invoice Details

	Calculation	Per dmt	Total
Copper payable	(A/100) * F * 9450	$2,699.53	
Silver payable	1.70 * G * 29	$43.71	
Gold payable	0.10 * H * 2350	$230.82	
Copper TC	a	($80.00)	
Copper RC	b * A * F * (L / 100)	($50.38)	
Silver RC	c*B*G	($0.61)	
Gold RC	d*C*H	($0.49)	
Arsenic penalty	M	($5.00)	
Bismuth penalty		$0.00	
Price of concentrate	J	$2,837.58	
Value of concentrate shipment	J * K		$27,263,971

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Appendix A. Sources of Information for Copper

Provider	Use	Reference
Argus Media	Copper pricing information	Argus Media, n.d.-b
Asian Metals	Copper pricing information	Asian Metal, n.d.
Fastmarkets	Copper pricing information	Fastmarkets, n.d.-a
London Metal Exchange	Copper pricing information	LME, n.d.
COMEX	Copper pricing information	COMEX, n.d.
S&P Global Commodity Insights	Copper pricing information	S&P Global, n.d.-a
Shanghai Metals Market	Copper pricing information	Shanghai Metals Market, n.d.-a
Shanghai Futures Exchange	Copper pricing information	SFE, n.d.
World Copper Factbook 2024	Copper economics information	International Copper Study Group, 2024. Copper Factbook – International Copper Study Group
USGS	Domestic Production and Use	United States Geological Survey, 2024 Mineral Commodity Summaries 2024

Source: Authors.

Note: Websites accessed in March 2025.

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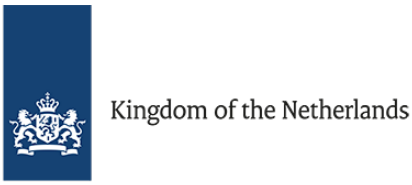

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