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Freeport–McMoRan Equity Research – All
in on Copper: The Metal of the Energy
Transition

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Abstract

This thesis forms a critical component of the comprehensive Freeport-McMoRan Inc Equity Research: *All in on Copper - The Origin of Transition*. The primary objective is to conduct an in-depth analysis of the company and deliver a robust valuation, ultimately guiding investors in assessing their potential returns.

As Freeport-McMoRan operates in the mining sector, the valuation employs a specialized approach. A Discounted Cash Flow model is utilized for developed operations, while a Real Options framework is applied to value undeveloped resources. The research also evaluates the company's key risks and exposures, including political risks, costs, and fluctuations in commodity prices, primarily copper. The latter are further analyzed for their impact on valuation through sensitivity analysis and Monte Carlo simulations.

Our analysis results in a price target of \$43.71. Considering the current stock price of \$42.67 and the anticipated \$2.31 dividend, we forecast a 12-month expected return of 7.9%. Based on these findings, our final recommendation is a "Hold," reflecting our conclusion that the market is effectively pricing Freeport-McMoRan.

Copper, Gold, Real Options Valuation, Monte Carlo Simulation

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This report is part of the Freeport-McMoRan Equity Research report (annexed), developed by José Cardoso and Rafael José and should be read as an integral part of it.

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Introduction

This report forms a critical component of the Equity research on Freeport-McMoRan Inc, a U.S. mining company producing copper as their main business.

The full joint report is structured to provide a holistic evaluation of Freeport-McMoRan, beginning with an introduction and an overview of the company's operations and historical performance. It then analyzes the macroeconomic environment and its influence on the business, including trends in the global economy and commodity markets. The report proceeds with the valuation of Freeport-McMoRan's developed operations, employing a Discounted Cash Flow model, and the valuation of its undeveloped resources using a Real Options Valuation framework. To further enhance the analysis, quantitative methodologies, such as sensitivity analysis and Monte Carlo simulations.

This individual report focuses on a detailed assessment of Freeport-McMoRan's operational landscape and past performance, followed by the valuation of its undeveloped resources using a Real Options Valuation approach. Additionally, this report contains quantitative assessments encompassing sensitivity analysis, Monte Carlo simulations as well as multiples analysis. These methodologies evaluate the impacts of key variables—such as commodity prices on the aggregate valuation. This analysis revealed particular exposure to the performance of copper prices, which are highly correlated with the performance of the company.

Together, these analyses lead to a shared price target of \$43.71. Given the current stock price of \$42.67 and an anticipated dividend of \$2.31, we project a 12-month expected return of 7.9%. The resulting recommendation is a "Hold," as we believe the market is adequately pricing the company at this time.

Company Overview

History

Freeport-McMoRan Inc. (FCX) is a U.S. based company headquartered in Phoenix, Arizona and is known today for being one of the major players in the mining industry, currently standing as the biggest publicly traded copper and molybdenum producer in the world (Figure 1), having produced more than 4 billion pounds of copper, 1.6 million ounces of gold and 732 million pounds of molybdenum in 2023. With its current large portfolio of assets, the company operates several mines distributed around the globe, including the US, South America and Asia.

While displaying a long history of growth and expansions some of its operations can be traced back as far as the 1800s. Since then, several mergers and acquisitions have shaped what Freeport-McMoRan is today. One of the most notable being the 1981 merger between Freeport and McMoRan Oil & Gas where the company started to claim its position as a major powerhouse with interests in oil, gas, sulphur, copper, gold and other minerals.

Also a decisive event was the discovery of the Grasberg copper and gold mine in Indonesia in 1988 which led to the listing of FCX in the New York Stock exchange and initiated several expansion projects remaining one of the most important assets of the company until today. In fact, for the following years the growth in the gold revenue arising from those mines was so significant that FCX changed its name to Freeport-McMoRan Copper & Gold Inc. The other main acquisition that explains the asset composition of what Freeport is today was the 2007 acquisition of Phelps Dodge, which for the first time proclaimed this company to be the largest publicly traded copper producer in the world. This acquisition included some major copper producing mines located in Arizona, Peru and Chile, as well as the molybdenum mines in Colorado.

In 2015 FCX went under a significant change regarding their structure and strategy, which included a new board, having now a focus on enhancing its position as a global leader in copper production. This was translated into measures for the continued growth of their copper producing assets as well as the release of some other unrelated enterprises such as the sale of the great majority of their Oil & Gas segment in 2016.

Business Segments

As of today, Freeport-McMoRan's revenues are derived from the sale of three primary metals: copper, gold, and molybdenum, with the company's main source

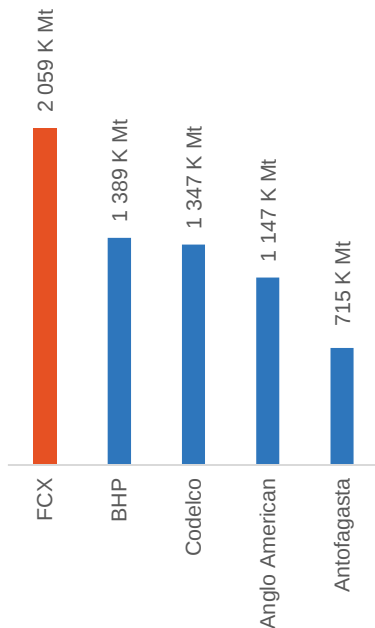


Figure 1. Leading Copper Mining Companies Worldwide in 2023 by Production Output (in 1000 metric tons)
Source: Investing News Network, in Statista.

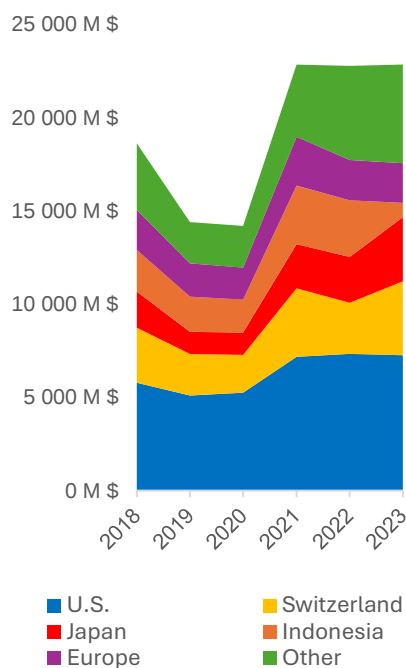


Figure 2. Revenues Attributed to Countries Based on the Location of the Customer, (in million USD)
Source: Freeport-McMoran Inc., Form 10-K U.S. Securities and Exchange Commission.

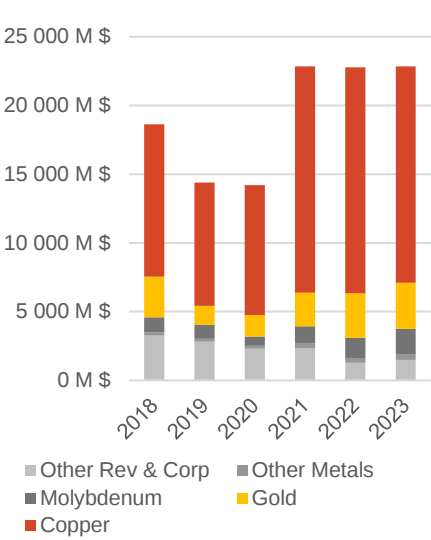


Figure 3. FCX's Total Revenues, (in millions of USD)
 Source: Freeport-McMoran Inc. Form 10-K U.S. Securities and Exchange Commission.

of income as well as principal strategic focus for the foreseeable future being copper, currently sold though the form of copper concentrate, cathode and rods. These revenues are generated from various geographical regions, although the main customers are located in the United States corresponding 32% of total revenues (Figure 2). In 2023, FCX achieved **\$22.85 billion in revenues**, marking the highest amount recorded to date and representing a **22% increase** compared to five years prior, although, this value is very similar to the revenues of 2021 and 2022 (Figure 3), indicating some challenges in achieving significant recent growth in total sales.

Freeport's geographically diverse portfolio of assets operate through four main business units: North America Copper Mines, South America Mining, Indonesia Mining and Molybdenum Mines, where the largest source of revenue is the Indonesia Mining segment, representing **\$8.4 billion** in revenues in 2023 (Figure 4). Apart from the Molybdenum Mines business segment, which is located in North America, each segment comprises all mining operations within the geographic region associated with its respective business unit name. Freeport also operates 3 out of the 5 largest copper mines in the word, by production capacity (Figure 5), and these operations are responsible for **over 75% of Freeport's total copper production** (Figure 6).

It is important to note that the South America Mining and Indonesia Mining segments are **not fully owned by FCX**, in fact they operate the Gasberg Mineral District in Indonesia through its subsidiary PT-FI, which FCX owns 48.76%, with the remaining 51.24% owned by PT Mineral Industri Indonesia (MIND ID) and PT Indonesia Papua Metal Dan Mineral (PTI), both of which owned by the Indonesian Government, with the latter including participation by the Papuan Government. FCX manages PT-FI's mining operations, and its results are consolidated in FCX's financial statements. The South America mines display variable interests regarding Freeport's ownership, where currently they own 55.08% of Cerro Verde in Peru and 51% of El Abra in Chile (Figure 7), while keeping the same accounting standards.

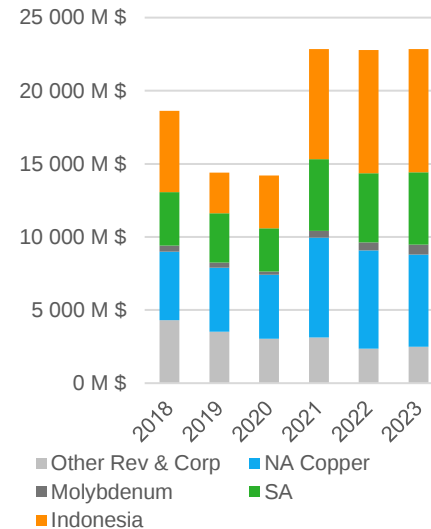


Figure 4. FCX's Revenue by Business Segment, (in million USD).
 Source: Freeport-McMoran Inc. Form 10-K U.S. Securities and Exchange Commission.

North America Copper

The North America Copper segment operates seven open-pit copper mines with some of them also producing molybdenum concentrate, silver and gold as by-products. In addition, the Miami, Arizona mining complex also includes a smelter and a rod mill. The smelter processes copper concentrate primarily from FCX's Arizona copper mines and it produces sulphuric acid as a by-product of smelting, which is used throughout the company's North America **leaching operations**. Furthermore, it also engages in recycling metal waste, effectively extending the useful life of the materials.

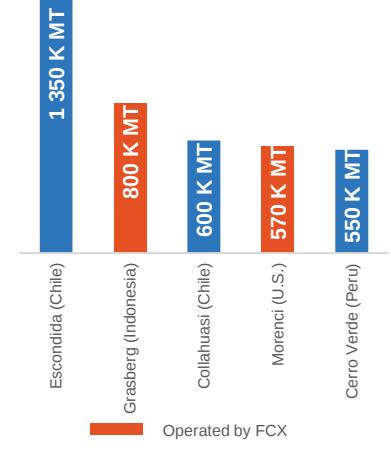


Figure 5. Global Largest Copper Mines 2024, Based on Capacity (in 1,000 metric tonnes)
 Source: ICSG, in Statista

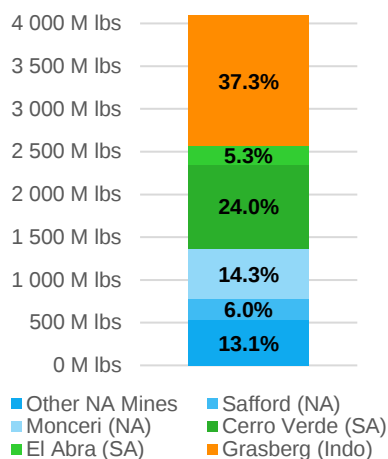


Figure 6. FCX's Total Copper Production by Mine in 2023, (in millions of pounds)

Source: Freeport-McMoran Inc. Form 10-K 2023 U.S. Securities and Exchange Commission.

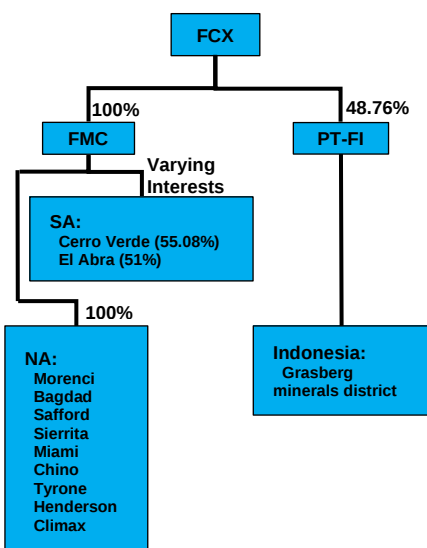


Figure 7. FCX's Ownership Interests on September 30, 2024

Source: Freeport-McMoran Inc. Form 10-K & Form 10-Q U.S. Securities and Exchange Commission.

The rod mill, completed in 1969 was the first of its kind to be located at a mine site, treats cathodes from the Miami mine and FCX's other NA copper mines and produces 7 500-pound and 15 000-pound rod coils (Figure 8). In 2023, this segment generated **\$6.3 billion in revenues**, with \$5.3 billion attributable to copper sales alone and the remaining amount derived from molybdenum as a byproduct. This figure has been registering modest growth (Figure 4), despite the total production volume of both ores remaining relatively unchanged since 2018. This stability in production volume, together with the growth in sales, suggests that the average realized price for both minerals has been increasing over the years.

■ South America Mining

The South American operations encompass the Cerro Verde copper and molybdenum mine in Peru and the El Abra copper mine in Chile, both of which are open-pit mines. The output from these mines is sold as concentrate or cathode, with a portion of the copper concentrate shipped to Atlantic Copper, FCX's wholly owned smelting and refining unit in Huelva, Spain. In terms of revenue, the South American mines contributed **\$4.9 billion**, with \$4.5 billion from copper sales alone and the remainder from silver and molybdenum. A similar trend is observed here, where production volumes have remained stable while revenues have increased, due to price hikes. Additionally, FCX has drilled and modelled a large sulfide resource in El Abra that would support a major mill project, similar to the large-scale concentrator in Cerro Verde. Planning for a submission of an environmental impact statement by the end of 2025 is ongoing, subject to economic evaluations and ongoing shareholder engagement.

■ Indonesia Mining

Through its subsidiary PT-FI, Freeport mines the Grasberg minerals district in Papua, Indonesia. While primarily a producer of copper and gold, it also extracts other metals, such as silver. Since 2020, operations have been conducted exclusively in underground mines, following the closure of the Grasberg open pit the previous year. This mineral deposit is one of the world's largest copper and gold deposits¹, containing the **highest grade of minerals** among all of the company's assets. From 1990 until 2019, the Grasberg minerals district produced a total of **33 billion pounds of copper and 53 million ounces of gold**. PT-FI is also highly active in capital investments in the region, spending **\$1.7 billion** in 2023, reflecting their desire to further increase production, having announced in July 2024 that it had substantially completed construction of its new Manyar smelter in Grensik, and has commenced commissioning operations. The smelter will produce copper cathodes and is expected to fully ramp up by the end of 2024.



Figure 8. Coils of Copper Rod in Ready for Shipment, Miami Rod Mill

Source: Mining History Association (2011), Photo Credits Johnny Johnsson

¹ Freeport-McMoran Inc. (2024). Form 10-K: Annual report for year ending December 31, 2023.

Additionally, there are efforts allocated to the development of the **Kucing Liar mine** which is expected to be completed around 2032 and is estimated to yield an annual production of around 500 million pounds of copper and 500 thousand ounces of gold annually.

As previously mentioned, the Indonesian segment is the highest revenue provider for FCX, despite producing a similar amount of copper as the other operations. This is largely due to significant gold exploration at this mine, which alone generates **\$3.3 billion** in revenue, in addition to the **\$5.8 billion** generated from copper. In terms of production volume, this mine also deviates from the trend observed in other locations. For copper mining, output has been increasing, except for a downturn in 2019 and 2020 caused by the closure of their open-pit exploration, which has since rebounded with the ramp-up of production of the underground mines. Gold, however, displays a clear decrease in production, suffering from the same decline as copper but without recovering to the levels of volume observed five years ago. This fact is attributed to a drop on the average ore grades registered in the mining operations of the segment. Despite the large volume of production, this segment faces constraints regarding the company's ownership. In 2018, as part of a significant transaction, PT-FI acquired all of the common stock of PT Rio Tinto Indonesia, which held the previous Rio Tinto Joint Venture interest in the Grasberg project. Following the transaction, the Indonesian government, through MIND ID (holding 26.24%) and PTI, (holding 25.00%)¹, collectively increased its ownership in PT-FI from 9.36%¹ to 51.24%, by paying \$3.85² billion for a 41.88%, thus valuing PT-FI at \$9.2 billion. This left Freeport-McMoRan with a 48.76% share in PT-FI (Figure 7). Despite the reduction in its ownership stake, FCX, retained the economic benefits of the revenue and cost-sharing arrangements previously established under the Rio Tinto Joint Venture. As a result, FCX's economic interest in PT-FI remained approximately 81% through 2022. Starting in 2023 and beyond, FCX's economic interest aligns with its ownership stake of 48.76%. The transaction also marked the termination of Rio Tinto's joint venture interest, as it was effectively included in the shares acquired by the Indonesian government. Additionally, Freeport faced pressure to secure a 10-year extension of their mining license, which now expires in 2041 that was obtained through agreements to develop the Manyar smelter,. FCX has made it clear that they intend to **file for license extensions** past 2041 and seeks to pursue the continuation of their business operations in Indonesia, even if it involves further

¹ Winanti P.S. & R. Diprose. (2020). *Reordering the extractive political settlement: Resource nationalism, domestic ownership and transnational bargains in Indonesia*.

² Freeport-McMoran Inc., et al. (2018). *PTFI Divestment Agreement*

capital expenditures, currently working on a deal with the government to **transfer an additional 10% of PT-FI¹** in the same year to achieve this extension.

■ Molybdenum Mines

Finally, Freeport operates two molybdenum-exclusive mines in Colorado, U.S.A.: the Climax open-pit mine and the Henderson underground mine. These mines produce high-grade molybdenum concentrate, which is then processed into more complex chemical compounds at the company's own facilities to maximize their value-added. Given that only two mines operate in this segment and molybdenum is not the company's primary focus, sales for this segment are slightly lower than those of other segments. However, sales reached **\$677 million** in 2023, a record for the segment despite not being their highest production year, benefiting from increases in the commodity's price.

Costs & Margins

The company's largest source of costs is attributed to production & delivery, having totalled 59.6% of the revenues in 2023 and reaching a **record of \$13.6 billion** (Table 1) during the same year. These costs encompass mostly labour, energy, which is obtained through diesel, coal and natural gas from third parties, and other commodity-based costs such as sulfuric acid, reagents, liners, tires or explosives. Depreciation, depletion and amortization, which FCX reports as part of cost of sales, also represent a major caption in the cost structure, given their large PP&E portfolio, standing at 9% of revenues, or \$2 billion in absolute terms. Together these costs made up for a gross margin of 31.3%, a figure that represents a slight decrease from previous years, reflecting higher costs of labour, materials and especially energy, all influenced by the inflationary crisis that was felt during 2023. If instead we focus our attention to copper production alone, we can infer an average cost per pound of ore reaching **\$2.30** per pound in 2023, rising from **\$2.18** in the year prior, when averaging the aggregate of all the copper operations in activity (Figure 9). This figure places FCX in the middle of the pack when we compare it to other copper miners, with Anglo American being the company with the smallest production costs, standing at 1,66\$/lb, which can be related to this company's higher ore grades which stand at 0,66%, while FCX's averages 0,37%.

Freeport also reports two cost categories that are endemic to the mining business: Mining Exploration and Research Expenses, which account for 0.4% of revenues, and Environmental Obligations and Shutdown Costs, representing 6.9% of revenues. The latter includes revisions to long-term environmental commitments, which may fluctuate based on legal issues and regulatory changes, as well as

Year	2021	2022	2023
Production and delivery	12 032	13 070	13 627
% of Revenues	52.7%	57.4%	59.6%
DD&A	1 998	2 019	2 068
% of Revenues	8.7%	8.9%	9.0%
SG&A	383	420	479
% of Revenues	1.7%	1.8%	2.1%
Mining exploration	55	115	137
% of Revenues	0.2%	0.4%	0.4%
Environmental obligations	91	121	319
% of Revenues	2.2%	2.7%	6.9%
EBIT	8 286	7 035	6 225
EBIT margin	36.3%	30.9%	27.2%

Table 1. FCX's Cost Structure, (in million USD)

Source: Freeport-McMoran Inc. (2024). Form 10-K 2023 U.S. Securities and Exchange Commission.

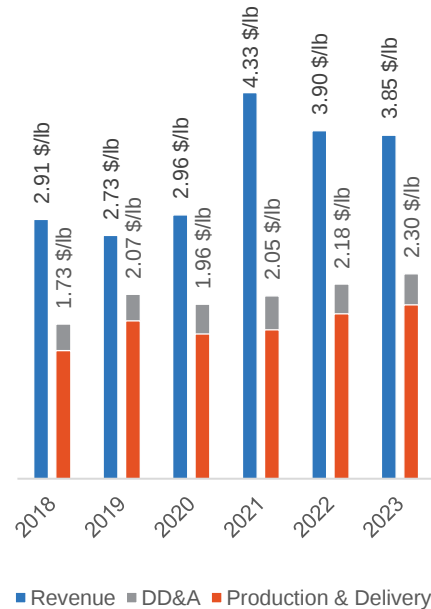


Figure 9. Average Cost and Revenue per Pound of Copper Sold (in USD/lb)

Source: Freeport-McMoran Inc. Form 10-K U.S. Securities and Exchange Commission.

¹ Freeport-McMoran Inc. (2024). Form 10-Q: Quarterly Report for the Period Ended September 30, 2024

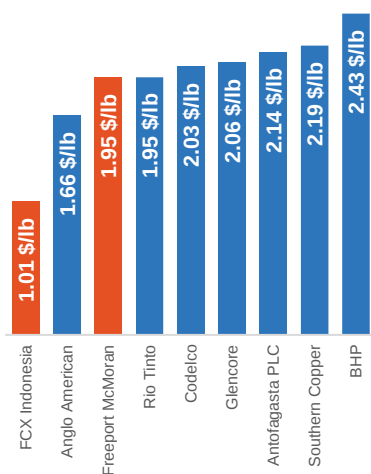


Figure 10. 2023 Copper Production & Delivery Cost per pound by company (in \$/lb)

Source: Company's most recent annual reports, as of December 2024

costs related to care-and-maintenance or litigation involving closed facilities. Additionally, FCX incurred Selling, General, and Administrative (SG&A) expenses totalling 2.1% of revenues in 2023, finally reaching an EBIT margin of 27.2%.

Analysing each segment individually reveals **notable differences in their EBIT margins**. Indonesia stands out with a **significantly higher margin of 56%**, compared to 24.97% in South America and just 18% in North America. This discrepancy is not only attributed to the higher ore grades found in Indonesia, average 1,02% of copper content, which lead to lower extraction costs per unit of metal. Combined with reduced labour expenses, Indonesia achieves the lowest production and delivery costs per pound of copper, at **\$1.01** in 2023, less than half the cost in South America (\$2.34) and North America (\$2.65). Indonesia not only stands as the lowest cost segment inside the company, but also among its peers (Figure 10). In recent years, Indonesia has also broken the trend of rising costs per pound, maintaining relatively stable costs while South America and North America experienced increases of 14% and 34%, respectively, since 2021.

Invested Capital

Freeport, like most companies in the mining sector, is considered a capital-intensive business, as reflected by its high Invested Capital-to-revenue ratio of **141%** as of 2023. This significant figure is largely driven by the company's **\$35.3 billion** in property, plant, and equipment (PP&E), which includes all necessary infrastructure, heavy machinery, reserves, resources, and mining equipment. This portfolio of assets has also been growing and was backed by substantial expenditures through the years. In 2023 alone, FCX registered **\$4.7** billion in Capex, the highest value among its peers for that period (Figure 11). Ongoing investments in mine expansions, more efficient machinery, refining and processing further are the main source for this high capital expenditures. Recent projects illustrating this capital intensity include the development of the Kucing Liar mine, which is expected to take 10 years to complete, starting in 2022, with an annual investment of \$400 million; the commissioning of the Myanmar Industrial Smelter, also requiring around \$400 million per year in capital expenditures; and the development of the underground Grasberg mine, which has involved larger costs of approximately \$1 billion per year. These large and expensive projects highlight the importance of conducting thorough feasibility studies beforehand. Since investments in the mining industry are nearly impossible to reverse and demand significant capital, the accuracy of a company's mining operation forecasts becomes a key risk factor in generating shareholder value.

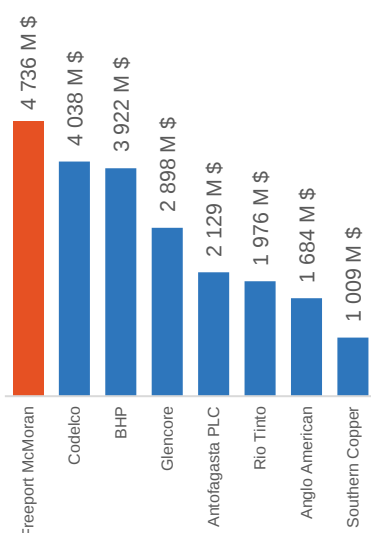


Figure 11. FCX's & Peers Copper Capital Expenditures in 2023, (in millions of USD)

Source: Company's most recent annual reports, as of December 2024

Mineral Reserves & Resources

Reserves

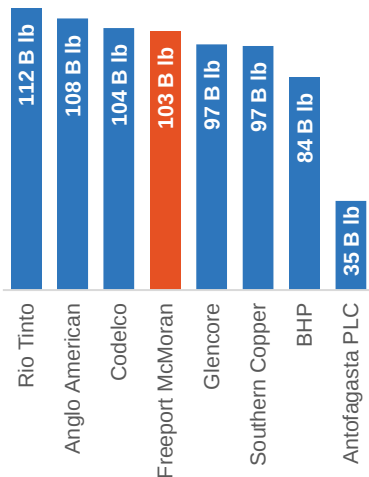


Figure 12. FCX's & Peers Contained Copper in Mineral Reserves, as of 2023 (in billion pounds)¹

Source: Company's most recent annual reports, as of December 2024

¹ The value related to FCX in Figure 12 and value in Table 2 don't match because of ^a and rounding.

	Copper ^a B lb	Gold M oz	Moly B lb
NA	44.70	0.6	2.66
SA	30.5	—	0.68
Indo	29	23.9	—
Total	104.1	24.5	3.34

•Moly – Molybdenum
•B lb – billion pounds
•M lb – million pounds

^a includes 1.8 B lb in Leach and Mill Stockpiles

Table 2. FCX's Consolidated Mineral Reserves as of December 31, 2023¹

Source: Freeport-McMoran Inc. (2024). Form 10-K 2023 U.S. Securities and Exchange Commission

	Copper	Gold	Moly
NA	0.27%	—	0.015%
SA	0.36%	—	0.008%
Indo	1.02%	0.74 g/MT	—

Table 3. FCX's Mineral Reserves Ore Grades as of December 31, 2023

Source: Freeport-McMoran Inc. (2024). Form 10-K 2023 U.S. Securities and Exchange Commission, Author's own calculations

	Copper B lb	Gold M oz	Moly B lb
NA	112.1	5.3	5.4
SA	58.8	2.5	1.55
Indo	48.2	58.4	—
Total	219.1	66.2	6.95

•Moly – Molybdenum
•B lb – billion pounds
•M lb – million pounds

Table 4. FCX's consolidated mineral resources as of December 31, 2023.

Source: FCX's 2023 10-K SEC filing

The longevity and profitability of Freeport-McMoRan's operations are intrinsically linked to the quantity and quality of the ores available in its mines. Reserves, which represent the economically viable portions of the mineral deposits, have the particularity of being physically finite, as such, they dictate the operational lifespan of the mines. As these finite materials are extracted, the company's ability to sustain production and generate revenue diminishes unless new deposits are discovered, or existing reserves are expanded. Therefore, exploration and development activities to extend the operational life and economic viability of the mining assets are a core part of the path of every company in the mining sector. FCX reports the current available mineral reserves by splitting them into proven and probable. Proven reserves refer to economically viable mineral deposits which were discovered through geological studies carried out by their own employees. Probable reserves are estimates for mineral reserves that were not yet discovered through a physical study, however, are highly likely to exist given the conditions of their surroundings. In this regard Freeport disclosed their estimates for the total of their reserves for every mine they currently operate, including the Kucing Liar mine, which is still in development, and is displayed by geographic segment in Table 2. In addition, the average ore grade, which refers to the concentration of the mineral in a sample and is indicative, *ceteris paribus*, of the overall profitability of that ore, is also reported (Table 3). Notably there is a clear discrepancy between the ore grades of the mines in Indonesia and those in the rest of the world, namely in copper concentrations where this figure is more than twice of the other mines, making those operations a vital asset in FCX's portfolio and revealing some reasoning behind the deep interest that the company has shown in continuing them. Given the lower quality of some ore reserves, FCX has adopted a known method to extract value from ores that would otherwise be economically unviable: the **leaching process**. This process consists of placing the ore on a leach pad, a slightly sloping pad, and spraying the ore with acids in order to collect solutions that contain solubilized metal. This way, leaching remains the main method for processing lower grade ores at a low cost. Additionally, FXC has been innovating its leaching initiatives by incorporating new applications, technologies and data analytics. These innovations allow Freeport to increase the production and processing speed of its leaching operations, enabling the company to capitalize on its large leaching stockpiles. Incremental copper production from these activities totalled 144 million pounds for the year ended December 31, 2023.

Resources

FCX's properties not only hold the displayed mineral reserves but also contain considerable amounts of mineral resources (Table 4). These are defined as

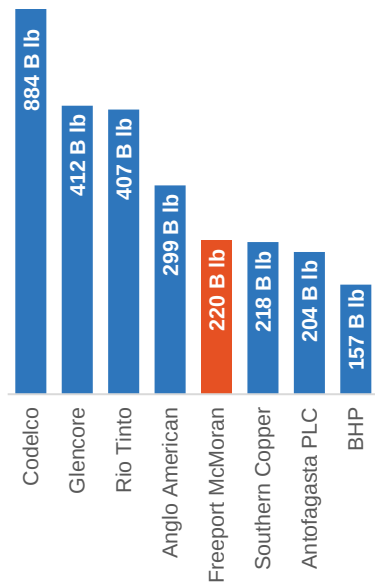


Figure 13. FCX's & Peers Contained Copper in Mineral Resources, as of 2023 (in billion pounds)

Source: Company's most recent annual reports, as of December 2024

concentrations of economically valuable materials, with a form, grade, or quality that indicate **potential for eventual extraction**. They are classified into three categories: measured, indicated, and inferred, based on the level of confidence in the existence of the mineralization. In our case, the key difference between mineral reserves and resources lies in the fact that the former, not only, have already went through sturdy feasibility studies that allowed to confidently determine the economic potential of such reserves, but are also accessible to be extracted, given that most of the appropriate capital expenditures have already taken place, and much of the infrastructure and machinery is ready to be used for this matter. Mineral resources, despite not yet being in active production, are crucial to the company's valuation, as they represent the possible future assets that will shape the operations of the company, especially as the current ones are depleted. Given this fact, special attention will be given to assess the economic potential of these resources.

Valuation Methods

Real Options Valuation

To model the potential decision to develop new operations, we will employ a Real Option Valuation method, drawing from the approach outlined by *Baurens, 2010, Valuation of Metals and Mining Companies*. As it stands, FCX holds considerable amounts of mineral resources on their properties, which although have the potential to be harvested are not yet accessible without investing in the adequate infrastructure. Thus, the optionality we are evaluating aims exactly at the opportunity of, at a future date, investing in new developments, contingent on their economic viability and exploring their resources until depletion. In practice, this decision would involve calculating the expected PV generated by the reserves under evaluation and compare it to the estimated development costs (Capex). If the project would prove profitable, the option would be "exercised", meaning, the investment would go forward, and the resources would be extracted. We will assume that this decision will be made only after the current active operations are fully depleted. At that point, FCX will determine whether to proceed with investing in new operations. For our case, we will consider the possibility of expanding the South American, North American and Indonesian segments separately, based on each segment's own reported mineral resources (Figure 14), effectively computing three different Real Options.

We will apply the Black-Scholes-Merton model for European Call Options, represented by the following formula:

$$C = S_0 N(d_1) - K e^{-rT} N(d_2)$$

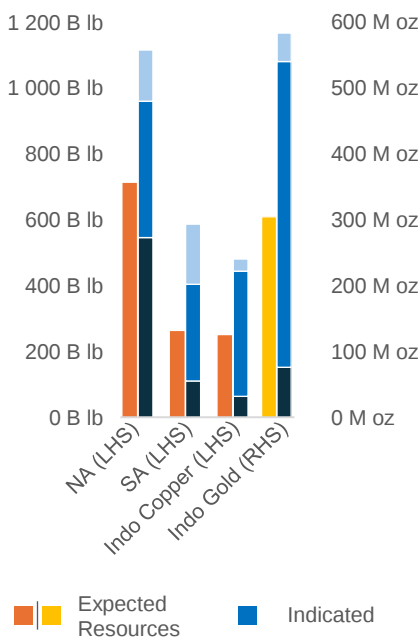


Figure 14. FCX Mineral Resources (LHS - billions of pounds | RHS - millions of ounces)

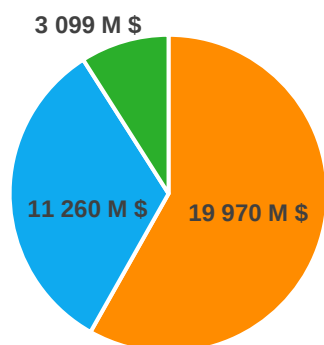
Source: Freeport-McMoran Inc. Form 10-K U.S. Securities and Exchange Commission.

The parameters of the model are then specified such that they accurately model our case in particular. Concretely, we estimate our current underlying price (S_0), as the present value (PV) of the expected cash flows generated by the mining site in question, evaluated using today's prices, i.e. what these reserves would generate if they were operating today. To do so, we compute the NPV of the projected cashflows, estimating production output, cost structure, and discount rate for each segment. Following the recommendation from the aforementioned article, we estimate the expected amount of mineral resources available for extraction through a weighted average of the Measured, Indicated, and Inferred ore quantities, by assigning them probabilities of 90%, 50%, and 10%, respectively. This expected ore value is then distributed over a period of 20 years for the Indonesian and South American segments, and 40 years for the North American segment, thus enabling to infer a yearly extraction rate.

Costs are estimated based on the most recent cost per pound of copper and gold, while we assume the same tax rate of **37.6%** and maintain capital expenditures at level of 5% of revenues, reflecting that most expenditures should be captured in the strike price. We discount these cash flows using the estimated cost of equity, under the assumption that no debt will be issued to finance these expansions, and ultimately derive a PV for each segment.

To compute the **strike prices (K)**, i.e., the expected initial investment, we interpolate the historical Capex from previous operations, sourced from FCX's technical reports, and relate these to the mineral reserves within those operations. The **volatility (σ)** of the underlying is estimated assuming that the NPV of the projects inherits the same volatility as the price of the commodities defining its revenues. As such, for the N.A. and S.A. segments, the annualized volatility of copper is used, based on a 5-year historical estimation. The Indonesian segment's volatility is estimated using the variance of the sum of two non-independent variables¹, by considering gold and copper's price correlation. The **risk-free rate** is based on the yield to maturity (YTM) of 10-year U.S. Treasury bonds. Regarding the **expiration time (T)**, this will be taken as the remaining lifetime of the current active operations, as we are evaluating the possibility of FCX investing in new operations when their current ones are depleted. We summarize the necessary parameters for each sector/ore in the following table:

¹ $Var(X + Y) = Var(X) + Var(Y) + 2 \times Cov(X, Y)$



■ Indonesia ■ North America
■ South America

Figure 15. Real Options Value per Sector (in millions of USD)

Source: Author's own projections

	North America	South America	Indonesia	
	Copper	Copper	Copper	Gold
Expected Resources	71 547 M lbs	26 585 M lbs	25 284 M lbs	30 536 K oz
Extraction Rate / Year	1 789 M lbs	1 329 M lbs	1 264 M lbs	1 527 K oz
Commodity Price	4,16 \$/lb	4,16 \$/lb	4,16 \$/lb	2 392 \$/oz
Unit Costs	2,65 \$/lb	2,72 \$/lb	1,50 \$/lb	741,39 \$/oz
Lifetime of Operation	40 Years	20 Years	20 Years	
Expected NPV (\$)	17 703 M \$	7 023 M \$	27 422 M \$	
Capex (K)	30 948 M \$	15 850 M \$	15 575 M \$	
Volatility (σ)	21,1%	21,1%	14,2%	
Time to Expire (T)	30 Years	23 Years	17 Years	

Table 5. Real Options Valuation Summary Table

Source: Author's own projections

The aggregated value of the three options stands at **\$34.33 billion**, which is split between the sectors as portrayed by Figure 15. It is of importance to note that these values are representative of the total stake in each segment and not of FCX's share in them.

Minority Interests

Given the substantial weight minority interests have in the structure of the company, we employed a **DCF** model to value the current operations of the two sectors not fully owned by FCX, the Indonesian and South American segments. To value mineral resources, we will use the same figures provided on the Real Option Valuation analysis.

While the DCF model is simplified due to limited disclosure by the company, it strives to replicate the assumptions from the aggregate valuation model for these individual segments. We maintained consistency with the main model by using the same EBIT, tax rate, and Capex projections. Additionally, we assumed an identical capital structure, with a 6.4% Net Debt to EV ratio. The WACCs used to discount the cash flows incorporated the same cost of debt and equity as the parent company but were adjusted to reflect the tax rates specific to each segment. The value of the options to expand associated with each segment was considered to compute the total enterprise value with their respective stake. It is important to note that we are assuming that FCX's deal with the Indonesian government to extend their mining license will go through, but with the implication of an addition divestment of 10% in PT-FI, which should be reflected on FCX's share on the Indonesian Option to Expand. Table 6 summarizes the above information by sector. Finally, the values were aggregated and only the stake associated with minority interests were considered, reaching a total value of **\$24.43 billion**.

	Indonesia	South America
FCX's Stake	48,76%	53,52%
Tax Rate	40,6%	45%
WACC	10,35%	10,32%
(+) PV of Cashflows	13 507 M \$	9 826 M \$
(+) Option to Expand	19 970 M \$	3 099 M \$
(-) Net Debt	862 M \$	627 M \$
Equity Value	32 615 M \$	12 297 M \$
Portion not Owned by FCX	18 709 M \$	5 716 M \$
Minority Interests Value	24 425 M \$	

Table 6. Minority Interests Valuation Summary table

Source: Author's own projections

Price Target

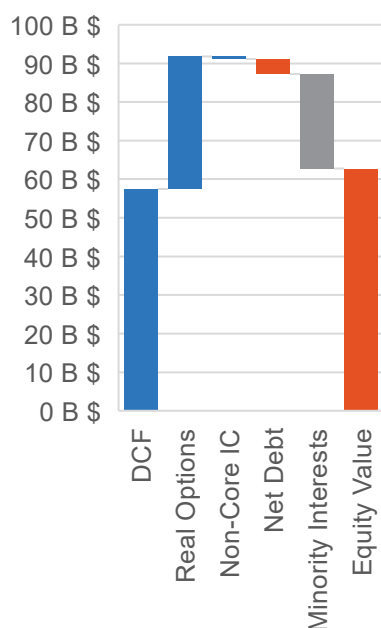


Figure 16. Enterprise to Equity Value Bridge (in billions of USD)
Source: Author's own projections

The company's total enterprise value is calculated by combining three components: the value derived from the DCF model, the estimated value of real options, and the value of non-core invested capital. The latter is projected based on its book value, reflecting residual assets and liabilities not directly tied to the company's core operations. Together, these components yield a total **enterprise value of \$91.14 billion**. From this, we subtract the net debt, which we project to be \$3.9 billion, and remove the \$24.43 billion in minority interests. This calculation results in an **equity value of \$62.81 billion** (Figure 16), which corresponds to a price target of **\$43.71 per share**.

Sensitivity Analysis

To address the uncertainty inherent in some of the key drivers of Freeport's value we will be conducting a sensitivity analysis on some of the inputs that we considered to be the most susceptible to these terms, with the goal of understanding their impact in the final valuation, while revealing potential weaknesses on our model. By varying our corporate tax rate by 8% in each direction, we obtain the following sensitivity analysis on the price per share:

Tax Rate								
29,0%	31,0%	33,0%	35,0%	37,6%	39,0%	41,0%	43,0%	45,0%
\$49,43	\$48,10	\$46,77	\$45,43	\$43,71	\$42,76	\$41,42	\$40,07	\$38,73

Table 7. Share Price Sensitivity Analysis on the Tax Rate

Source: Author's own calculations

The changes applied resulted in a price target range of \$49.43 to \$38.73, this is, changes of around **\$5** inside the defined range. This result reveals a moderate level of responsiveness of our model to this input, which is not ideal given that the tax rate had already been flagged as a potential weakness in our model, due the complexities we faced when estimating it, however we should also note that the tax range provided is wide and, from an historical standpoint we do not attribute a particular high probability for the more extreme figures.

We are also aware of the uncertainty regarding the price of the commodities sold. In this regard our sensitivity analysis will perform a parallel shift in our predicted YoY growth rate for both copper and gold prices, with a deviation ranging from -2% to +2%.

		Copper Price Growth								
		-2,0%	-1,5%	-1,0%	-0,5%	0,0%	0,5%	1,0%	1,5%	2,0%
Gold Price Growth	-2,0%	\$35,53	\$37,29	\$39,18	\$41,21	\$43,40	\$45,75	\$48,29	\$51,02	\$53,98
	-1,5%	\$35,61	\$37,37	\$39,26	\$41,29	\$43,47	\$45,82	\$48,36	\$51,10	\$54,05
	-1,0%	\$35,68	\$37,44	\$39,33	\$41,36	\$43,55	\$45,90	\$48,44	\$51,17	\$54,13
	-0,5%	\$35,76	\$37,52	\$39,41	\$41,44	\$43,63	\$45,98	\$48,52	\$51,25	\$54,21
	0,0%	\$35,85	\$37,61	\$39,50	\$41,53	\$43,71	\$46,06	\$48,60	\$51,34	\$54,29
	0,5%	\$35,93	\$37,69	\$39,58	\$41,61	\$43,80	\$46,15	\$48,69	\$51,42	\$54,38
	1,0%	\$36,02	\$37,78	\$39,67	\$41,70	\$43,89	\$46,24	\$48,78	\$51,51	\$54,47
	1,5%	\$36,11	\$37,87	\$39,76	\$41,79	\$43,98	\$46,33	\$48,87	\$51,60	\$54,56
	2,0%	\$36,21	\$37,97	\$39,86	\$41,89	\$44,07	\$46,43	\$48,96	\$51,70	\$54,65

Table 8. Share Price Sensitivity Analysis on Copper and Gold Growth Rates

Source: Author's own calculations

As initially suspected, the predicted share price is very sensitive to changes in the prices of these two ores, with a substantial emphasis on copper, where the greatest deviations are seen. A natural result, given that the great majority of revenues are directly linked to this commodity. More than pointing out the great deal of importance of having a good perception of the future of these minerals for the purpose of our valuation, this result also reveals how dependent this type of business is on the respective underlying market.

To assess the impact of the WACC we first performed changes in the Return on Debt as well as the return on Equity, as those were the parameters deemed the most influential in this case. It is clearly observable that Re has a much higher impact on the value of the WACC, when compared to the Rd (Table 9).

		Re								
		13,0%	12,4%	11,9%	11,3%	10,8%	10,3%	9,7%	9,2%	8,6%
Rd	6,8%	12,41%	11,91%	11,40%	10,89%	10,39%	9,88%	9,38%	8,87%	8,36%
	6,5%	12,40%	11,89%	11,39%	10,88%	10,38%	9,87%	9,36%	8,86%	8,35%
	6,2%	12,39%	11,88%	11,38%	10,87%	10,37%	9,86%	9,35%	8,85%	8,34%
	5,9%	12,38%	11,87%	11,37%	10,86%	10,35%	9,85%	9,34%	8,84%	8,33%
	5,7%	12,37%	11,86%	11,35%	10,85%	10,34%	9,84%	9,33%	8,83%	8,32%
	5,4%	12,35%	11,85%	11,34%	10,84%	10,33%	9,83%	9,32%	8,81%	8,31%
	5,1%	12,34%	11,84%	11,33%	10,83%	10,32%	9,81%	9,31%	8,80%	8,30%
	4,8%	12,33%	11,83%	11,32%	10,81%	10,31%	9,80%	9,30%	8,79%	8,29%
	4,5%	12,32%	11,82%	11,31%	10,80%	10,30%	9,79%	9,29%	8,78%	8,27%

Table 9. WACC Sensitivity Analysis on Return on Equity and Return on Debt

Source: Author's own calculations

This outcome is derived from the relatively low level of leverage that Freeport has, this way the weight of the Re will be much higher than that of the Debt, resulting in a higher sensitivity.

For each of the WACC's simulated the respective price is displayed as follows.

		Re								
		13,0%	12,4%	11,9%	11,3%	10,8%	10,3%	9,7%	9,2%	8,6%
Rd	6,8%	\$36,06	\$37,74	\$39,54	\$41,48	\$43,57	\$45,83	\$48,27	\$50,92	\$53,79
	6,5%	\$36,09	\$37,76	\$39,57	\$41,51	\$43,60	\$45,87	\$48,31	\$50,96	\$53,84
	6,2%	\$36,11	\$37,79	\$39,60	\$41,54	\$43,64	\$45,90	\$48,35	\$51,01	\$53,89
	5,9%	\$36,14	\$37,82	\$39,63	\$41,58	\$43,68	\$45,94	\$48,39	\$51,05	\$53,94
	5,7%	\$36,17	\$37,85	\$39,66	\$41,61	\$43,71	\$45,98	\$48,44	\$51,10	\$53,99
	5,4%	\$36,19	\$37,88	\$39,69	\$41,64	\$43,75	\$46,02	\$48,48	\$51,14	\$54,03
	5,1%	\$36,22	\$37,91	\$39,72	\$41,68	\$43,78	\$46,06	\$48,52	\$51,19	\$54,08
	4,8%	\$36,25	\$37,94	\$39,75	\$41,71	\$43,82	\$46,10	\$48,56	\$51,23	\$54,13
	4,5%	\$36,27	\$37,97	\$39,79	\$41,74	\$43,85	\$46,13	\$48,60	\$51,28	\$54,18

Table 10. Share Price Sensitivity Analysis on Return on Equity and Return on Debt

Source: Author's own calculations

The shocks applied to the WACC are seen to be very influential in the determination of the share price, a result tightly linked to the nature of the DCF model.

Company	P/EBITDA	P/EBIT	EV/EBITDA	EV/EBIT
BHP	5.1	6.6	5.6	7.2
Anglo American	4.7	7.9	8.6	14.6
Antofagasta	5.6	9.4	8.7	14.6
Glencore	3.2	5.3	5.6	9.4
Rio Tinto	3.1	4.2	5.6	7.7
FCX	7.7	10.2	9.6	12.7

Table 11. FCX and Peer Multiples

Source: Bloomberg L.P., Authors own calculations

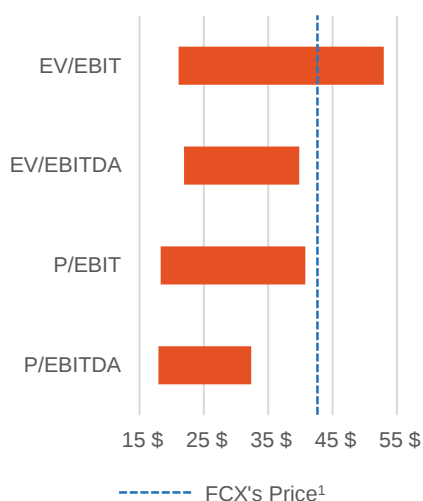


Figure 17. Multiples Football Field Chart

Source: Bloomberg L.P., Authors own calculations

¹Price as of December 10, 2024

Multiples Analysis

Peer Trading Multiples

To ensure a meaningful peer multiple comparison, we selected companies with a similar asset profile, focusing on those with substantial copper mining operations. However, even among these peers, direct comparisons are challenging due to differences in factors such as country risk, mineral portfolio, ore grades, production costs, and resource levels, which can vary significantly between companies and mines. The selected peers are BHP, Anglo American, Antofagasta, Glencore and Rio Tinto.

As seen in Table 11, FCX's multiples are slightly above its peers, seemingly suggesting an overvaluation against other companies, although a deeper investigation carried by analysing each company tells a more complex story. Glencore shows slightly lower multiples across the board due to its higher exposure to trading activities and energy commodities. BHP and Rio Tinto also exhibit robust multiples, attributed to their scale and portfolio diversification, while Anglo American's figures reflect its balanced exposure to both base and precious metals. The closest comparable to FCX should be Antofagasta, whose multiples are also elevated because of its focus on copper production and minimal diversification, concentrating operations in South America.

Transaction Multiples

Considering the significant activity in the M&A market for mining enterprises, we selected a group of past transactions. The scope of our analysis was narrowed to include only transactions meeting the following criteria: conducted after 2022, deal values exceeding \$400 million, operations at production stage, and acquisitions of mines with copper as the main product. Table 12 displays the gathered data.

FCX's implied Market Value to Copper Reserves & Resources of **\$0.20/lb** positions it between the observed M&A transaction multiples. Higher valuations, such as BHP's acquisition of OZ Minerals (\$0.24/lb), reflect assets with superior ore grades and significant strategic importance, which justify higher premiums. In contrast, lower multiples, like \$0.09/lb and \$0.08/lb, are associated with transactions involving a higher proportion of resources to reserves. For instance, Rio Tinto's partial acquisition of Turquoise Hill Resources had a reserves-to-resources ratio of 22%, significantly lower than the 36% observed in the OZ Minerals transaction, emphasizing the role of the mineral composition in determining valuation levels.

Year	Buyer	Seller	Deal Value	Reserves & Resources	Price paid / pound
2022	BHP Group	OZ Minerals	5 942 M \$	24 537 M lb	0.24 \$/lb
2022	Rio Tinto Group	Turquoise Hill Resources	3 241 M \$	34 508 M lb	0.09 \$/lb
2023	MMG	Investor Group	1 875 M \$	24 082 M lb	0.08 \$/lb
2023	Lundtin Mining Corp	ENEOS Holdings	950 M \$	3 898 M lb	0.24 \$/lb
2023	Evolution Mining	CMOC Group	475 M \$	5 097 M lb	0.09 \$/lb
2023	Hubday Minerals	Copper Mountain Mining	445 M \$	5 312 M lb	0.08 \$/lb

Table 12. Copper Mines Merger & Acquisitions Data

Source: S&P Global

Monte Carlo Simulation

Correlation Matrix	Copper	Gold	Moly	Silver
Copper	100%	8%	-3%	17%
Gold	8%	100%	0%	78%
Moly	-3%	0%	100%	1%
Silver	17%	78%	1%	100%

Table 13. Commodities Correlation Matrix

Source: Bloomberg L.P., Authors own calculations

Recognizing the uncertainty surrounding key factors that significantly influence FCX's value, we will conduct a Monte Carlo simulation to better understand the potential range of our price target given the uncertainties affecting the company.

The parameters selected for simulation include the prices of the commodities produced by FCX (copper, gold, molybdenum, and silver) and the WACC. These variables were identified as the most influential factors impacting the company's valuation and are inherently challenging to forecast with precision. For commodity prices, we will simulate the spot value for each forecasted year from 2025 to 2054, assuming a normal distribution. For each metal, the mean is set to the base-case price projection, while the volatility is derived from the 5-year historical estimate, with a lower bound of zero. Additionally, we account for the correlation among the four commodities, using a correlation matrix estimated based on 5 years of historical data, as presented in Table 13. The WACC is also simulated using a normal distribution, with mean (10.34%) and volatility calculated from 10 years of quarterly data¹ (1.78%). This variable is further constrained by a lower bound of 6.77% and an upper bound of 13.53%, reflecting the minimum and maximum historical values during the observation period. From a 10'000-sample simulation computed using the *Argo* excel add-in, we obtain the following distribution:

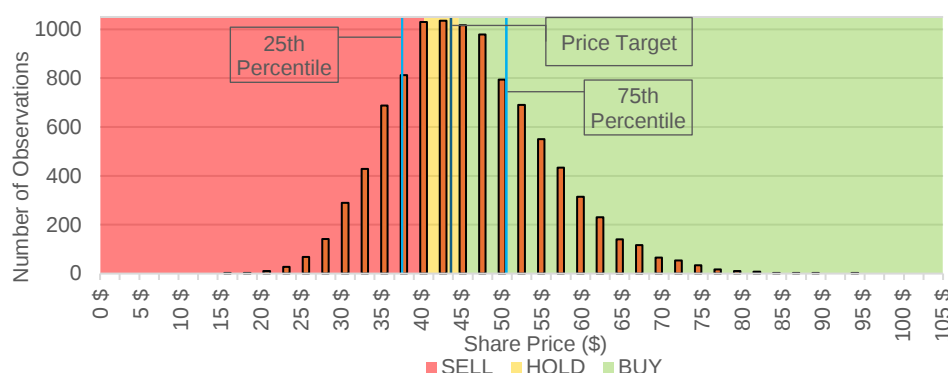


Figure 18. Monte Carlo Simulation Results

Source: Authors own calculations

The simulation yields a mean value of \$44.49 per share, with a standard deviation of \$9.92 (22%). The 25th and 75th percentiles of the distribution imply a fair range of \$37.58 to \$50.61 per share. Based on the established recommendation criteria, we get a 36.34% probability of a Sell recommendation, 17.71% of Hold, and 45.95% of a Buy. The results do indicate a higher likelihood for upside potential, based on FCX's current trading price of \$42.67. However, the analysis reveals significant variability in the outcomes, highlighting once again the notable influence of random factors in shaping FCX's valuation.

¹ Bloomberg L.P.

Final Recommendation

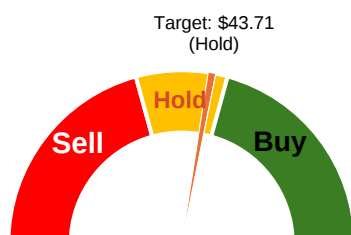


Figure 20.
Recommendation: Hold
Source: Authors own calculations

Investment

As it was deemed the most appropriate model, we will be making use of our *DCF* + *Real Options* model to reach our final price target, standing at **\$43.71** per share as of 2025. Given that the current stock price stands at \$42.67 together with the expected \$2.31 dividend, it should result in an expected return of 7.9% over a 12-month period. This, way our final recommendation is a “**Hold**”, meaning that we consider the market is adequately pricing Freeport.

As a final note we would like to add that FCX currently stands as a solid revenue-generating business with a strong set of assets in its portfolio, although its future will be deeply tied to how the macroeconomic variables we have seen through our analysis develop, in particular the evolution of copper prices, as seen historically (Figure 19). Furthermore, in the long term, FCX’s value will be highly dependent on its ability to renew and acquire new operations, assets and business lines, as well as to negotiate terms and conditions for both current and future segments.

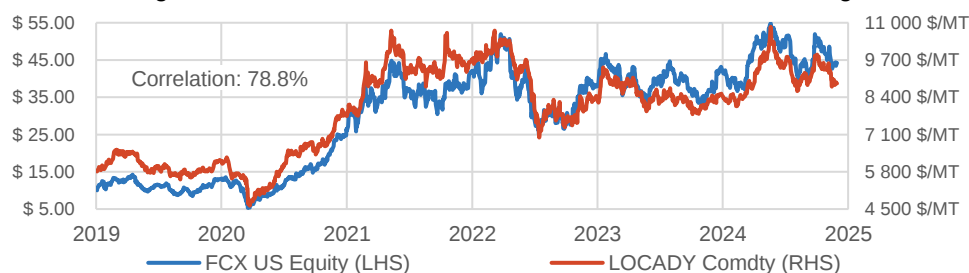


Figure 19. FCX and Copper Historical Prices (01/01/2019 – 29/11/2024)
Source: Authors own calculations