

Embrik Aasland
Katharina Fagerhaug Sommerfelt
Martin Berntzen Engevik
Niklas Hartvigsen

Valuation of Glencore plc - Assessing the Relationship Between Ethical Issues and Market Perception

AF3015 Bachelor thesis - Financial Management

Bachelor's thesis in Business Administration
Supervisor: Are Oust
April 2023

Embrik Aasland
Katharina Fagerhaug Sommerfelt
Martin Berntzen Engevik
Niklas Hartvigsen

Valuation of Glencore plc - Assessing the Relationship Between Ethical Issues and Market Perception

AF3015 Bachelor thesis - Financial Management

Bachelor's thesis in Business Administration
Supervisor: Are Oust
April 2023

Norwegian University of Science and Technology
Faculty of Economics and Management
NTNU Business School



Preface

After three years studying business administration at NTNU Business School in Trondheim, we finish by writing a bachelor's thesis. The bachelor thesis is worth 7.5 credits and was finished in April 2023. For the assignment, we have chosen to carry out a valuation, because we are studying financial management within business administration.

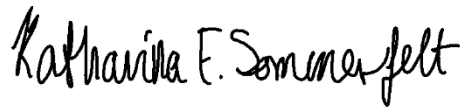
Through the writing of the thesis, we have recognized the extent to which the study's syllabus is applicable and useful for drawing good conclusions and discussing from several theoretical points of view. The authors are responsible for the content presented in this thesis.

We would like to extend a big thank you to our supervisor Are Oust for the valuable help we received throughout the process.

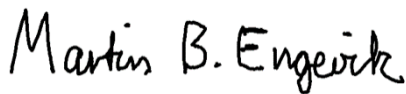
Trondheim, 27.04.2023



Embrik Aasland



Katharina Fagerhaug Sommerfelt



Martin Berntzen Engevik



Niklas Hartvigsen

Sammendrag

Hensikten med denne oppgaven er å gjennomføre en verdsettelse av selskapet Glencore plc gjennom å svare på problemstillingen: Hva er Glencore plc verdt per 24. mars 2023, og hvilken verdsettelsesrabatt er akseptabel ut fra deres uetiske historikk? For å besvare problemstillingen tar vi først utgangspunkt i en selskaps- og bransjebeskrivelse, for deretter å analysere både interne og eksterne faktorer for å undersøke markedssituasjonen rundt Glencore. Eksterne faktorer ble analysert gjennom PESTEL-analyse og Porters fem konkurransekrefter, og interne faktorer gjennom VRIO-rammeverket. Videre har vi beregnet et estimat for selskapets fundamentalverdi ved bruk av en diskontert kontantstrømanalyse, og gjennom en multippelbasert SOTP-analyse.

Den strategiske analysen er tatt i betraktning når vi så gjennomfører regnskapsanalysen av Glencore. Dette er gjort ved å se på årsrapporter fra de siste åtte årene, fra 2015 til og med 2022. I regnskapsanalysen ser vi at Glencore har hatt svært volatile nøkkeltall. Mange av nøkkeltallene økte en del i 2022, men dette er hovedsakelig forårsaket av økte kullpriser. Sammenlignet med konkurrentene har Glencore hatt lavere lønnsomhet de siste fem årene, og de har også hatt dårligere likviditet og soliditet.

Videre bruker vi den strategiske og regnskapsmessige analysen til å komme frem til Glencore's prosjekterte frie kontantstrøm fra 2021 til 2030. Vi kom frem til en verdi på 10,38 % for avkastningskravet for total kapitalen (WACC), og har brukt en vekstfaktor, g , på 2%.

Vi har valgt å vektlegge den multippelbaserte SOTP-analysen og diskontert kontantstrømanalysen 50/50, og kommet frem til et endelig kursmål per aksje pålydende **£6.90**. Sammenlignet med aksjekursen til Glencore plc ved børs slutt 24. mars 2023 på £4.43, gir dette en oppside på 55,3%. Gjennom en sensitivitetsanalyse med vekstfaktor og WACC som verdidrivere, ser vi at selv om endringer i disse faktorene påvirker kursmålet, endrer det ikke vår konklusjon om at det ligger en betydelig oppside i aksjen til Glencore.

Abstract

The purpose of this thesis is to conduct a valuation of the company Glencore plc, and in doing so answering the question: What is Glencore plc worth as of March 24th, 2023, and what discount is acceptable due to their unethical history? To answer this question, we begin with a company and industry description, then we analyze both internal and external factors to survey the market situation around Glencore. External factors were analyzed through PESTEL analysis and Porter's five Forces, and internal factors through the VRIO framework. Furthermore, we have calculated an estimate for the company's intrinsic value using a discounted cash flow analysis, and a multiple-based sum of the parts (SOTP) analysis.

The strategic analysis is considered when we carry out the accounting analysis of Glencore. This has been done by looking at annual reports from the last eight years, from 2015 up to and including 2022. In the accounting analysis, we see that Glencore has had very volatile key figures. Many of the key figures increased in 2022, but this is mainly caused by higher coal prices. Compared to its peers, Glencore has had lower profitability over the past five years, as well as poorer liquidity and solvency.

Furthermore, we use the strategic and accounting analysis to arrive at Glencore's projected free cash flow from 2021 to 2030. When calculating the required return on total capital (WACC) we arrived at a value of 10,38%, and we have used a growth factor, g , of 2%.

We have chosen to weigh the SOTP multiple analysis and the discounted cash flow analysis 50/50 and arrived at a weighted target price per share of **£6.90**. Compared to Glencore plc's closing price on 24 March 2023 of £4.43, this gives the share an upside of 55,3%. Through a sensitivity analysis with growth factor and WACC as value drivers, we see that although changes in these factors affect the target price, it does not change our conclusion that there is significant upside in Glencore's share.

Table of contents

1. Introduction.....	1
1.1 Motivation.....	1
1.2 Research question	1
1.3 Delimitations.....	2
1.4 Structure.....	2
2 Company and industry description.....	2
2.1 The Commodity Market.....	3
2.1.1 The History of the Commodity Market	3
2.1.2 Competitors.....	4
2.2 About Glencore.....	7
2.3 Purpose and Strategy.....	8
2.4 Business Segments, production, and marketing.....	8
2.5 Controversies	10
2.5.1 Bribery and corruption.....	10
2.5.2 Human rights violations.....	11
3. Strategic Analysis.....	11
3.1 External analysis	11
3.1.1 PESTEL	11
3.1.2 Porters five forces	20
3.2 Internal analysis	23
3.2.1 VRIO.....	23
3.3 Summary of the strategic analysis	28
3.3.1 SWOT	28
4. Financial statement analysis	29
4.1 Profitability	29
4.1.1 Return on equity - ROE	29
4.1.2 Return on assets – ROA.....	30
4.1.3 Return on invested capital – ROIC.....	31
4.1.4 Operating cash flow ratio.....	32
4.2 Liquidity.....	33
4.2.1 Current ratio	33
4.2.2 Cash ratio	34
4.3 Financing and solvency.....	35
4.3.1 Debt ratio	35
4.3.2 Debt-to-equity ratio.....	36
4.3.3 Interest coverage ratio.....	37
4.4 Discussion on key figures	39
4.5 Summary	40
5. Free Cash Flow Projections	40
5.1 Forecast period.....	40
5.2 Revenue.....	41
5.2.1 Industrial Revenues.....	41

5.2.2 Marketing revenues.....	45
5.3 Cost of goods sold.....	47
5.3.1 Copper assets	47
5.3.2 Zinc assets.....	49
5.3.3 Nickel assets.....	49
5.3.4 Ferrous alloys and Platinum Group Metals (PGMs)	49
5.3.5 Coal assets.....	50
5.3.6 Oil assets	51
5.3.7 Marketing.....	52
5.4 Other costs.....	52
5.5 Depreciation and amortization (D&A)	53
5.6 Net Working Capital (NWC)	54
5.7 Capital Expenditures (CapEx)	55
5.8 Free Cash Flow	56
6. Weighted average cost of capital - WACC	57
6.1 The cost of equity.....	57
6.1.1 The risk-free rate.....	58
6.1.2 ERP	58
6.1.3 Beta	58
6.1.4 CAPM summary	60
6.2 After tax cost of debt.....	60
6.3 Capital structure	61
6.3.1 Market value of equity	61
6.3.2 Market value of debt	61
7. Valuation	63
7.1 Multiple analysis.....	63
7.1.1 Price multiples	63
7.1.2 Enterprise multiples	65
7.2 Multiple-based sum of the parts (SOTP)	66
7.3 Discounted free cash flow.....	67
7.3.1 Perpetuity growth model.....	68
7.3.2 Enterprise to equity value	68
7.3.3 Per share value	69
7.3.4 Weighted target price.....	69
7.4 Sensitivity analysis.....	70
7.4.1 Bear case	70
7.4.2 Bull case.....	71
7.4.3 Beta	72
7.4.4 Weighted average cost of capital and terminal growth rate.....	72
8. Discussion.....	73
9. Conclusion.....	74
List of sources.....	76

Table list

Table 1: VRIO framework	24
Table 2: VRIO outcome	28
Table 3: SWOT summary	28
Table 4: Glencore plc: Base case production 2021 - 2030	42
Table 5: Glencore plc: Bear case production 2021 - 2030	42
Table 6: Glencore plc: Bull case production 2021 - 2030	43
Table 7: Glencore plc: Base case prices 2021 - 2030	44
Table 8: Glencore plc: Bear case prices 2021 - 2030	44
Table 9: Glencore plc: Bull case prices 2021 - 2030	45
Table 10: Glencore plc: Marketing segment - Revenue forecast 2021 - 2030	46
Table 11: Glencore plc: Copper assets COGS 2021 - 2030	49
Table 12: Glencore plc: Zinc assets COGS 2021 - 2030	49
Table 13: Glencore plc: Nickel assets COGS 2021 - 2030	49
Table 14: Glencore plc: Ferroalloys and PGMs COGS 2021 - 2030	49
Table 15: Glencore plc: Coal assets 2021 - 2030	51
Table 16: Glencore plc: Oil E&P assets 2021 - 2030	51
Table 17: Glencore plc: Oil refining assets 2021 - 2030	52
Table 18: Glencore plc: Marketing: metals and minerals 2021 - 2030	52
Table 19: Glencore plc: Marketing: energy 2021 - 2030	52
Table 20: Glencore plc: SG&A expenses: 2021 - 2030	53
Table 21: Glencore plc: Other expenses: 2021 - 2030	53
Table 22: Glencore plc: Interest expenses: 2021 - 2030	53
Table 23: Glencore plc: Depreciation Industrials 2021 - 2030	54
Table 24: Glencore plc: Depreciation Marketing 2021 - 2030	54
Table 25: Glencore plc: Changes in net working capital 2021 - 2030	55
Table 26: Glencore plc: Capital expenditures Industrials 2021 - 2030	56
Table 27: Glencore plc: Capital expenditures Marketing 2021 - 2030	56
Table 28: Glencore plc: Free cash flow 2021 - 2030	56
Table 29: Glencore plc: Equity risk premium for each continent	58
Table 30: Glencore plc: Regression Statistics and ANOVA table	60
Table 31: Glencore plc: Market value of debt	62
Table 32: Glencore plc: WACC summary	62
Table 33: Glencore plc: Forward multiples P/E - select competitors 2023 - 2025	64
Table 34: Glencore plc: Forward multiples EV/EBITDA - select competitors 2023 - 2025	65
Table 35: Glencore plc: Base case SOTP	66
Table 36: Glencore plc: base case scenario - PV of cash flows	68
Table 37: Glencore plc: Enterprise value	68
Table 38: Glencore plc: Equity value in USD and GBP	69
Table 39: Glencore plc: Per share value	69
Table 40: Glencore plc: Weighted target price	69
Table 41: Glencore plc: Bear case SOTP	70
Table 42: Glencore plc: Bear case weighted equity value	70
Table 43: Glencore plc: Bull case SOTP	71
Table 44: Glencore plc: Bull case weighted equity value	71
Table 45: Glencore plc: Sensitivity analysis – Beta	72
Table 46: Glencore plc: Sensitivity analysis – Terminal growth and Wacc	73

Figure list

Figure 1: Glencore's EBITDA Next Twelve Months – counting from March 24th, 2023	10
Figure 2: Glencore EBITDA by segment 2018 - 2026	12
Figure 3: Real GDP 2011 - 2050	14
Figure 4: Global population 1950 – 2100	15
Figure 5: Development in extreme poverty 1990 - 2030	16
Figure 6: Countries of the world by their position on the ND-GAIN Country Index Vulnerability score.	19
Figure 7: Glencore plc: Historic development of Return on Equity 2015 - 2022.....	30
Figure 8: Glencore plc: Historic development of Return on Assets 2015 - 2022.....	31
Figure 9: Glencore plc: Historic development of Return on Invested Capital 2015 - 2022	32
Figure 10: Glencore plc: Historic development of Operating cash flow margin 2015 - 2022	33
Figure 11: Glencore plc: Historic development of Current Ratio 2015 - 2022	34
Figure 12: Glencore plc: Historic development of Cash Ratio 2015 - 2022.....	35
Figure 13: Glencore plc: Historic development of Debt Ratio 2015 - 2022.....	36
Figure 14: Glencore plc: Historic development of Debt-to-Equity ratio 2015 - 2022.....	37
Figure 15: Glencore plc: Historic development of the Interest coverage ratio 2015 - 2022.....	38
Figure 16: Glencore plc: Historic development of the Operating income (EBIT) 2015 - 2022	38
Figure 17: Glencore plc: Correlation analysis 1	45
Figure 18: Glencore plc: Correlation analysis 2	46
Figure 19: Glencore plc: Non-metallurgic EBITDA and EBITDA Margin 2021 - 2030.....	48
Figure 20: Glencore plc: Metallurgic EBITDA and EBITDA Margin 2021 - 2030.....	48
Figure 21: Regression analysis - Glencore plc return vs FTSE 100 return.....	59
Figure 22: Glencore plc: Glencore bonds YTM	61
Figure 23: Glencore plc: EV/EBITDA 2013-2023	66
Figure 24: Glencore plc: Base case SOTP - illustration	67
Figure 25 Glencore plc: Valuation scenarios (pence).....	72

1. Introduction

1.1 Motivation

The commodity trading and mining business has existed for almost as long as civilization itself. It has played a key role in the flourishing of the human species and will do so for a long time to come. Due to the technological progress we are experiencing and the need for renewable energy options, the future of our world is dependent on the extraction and intelligent usage of, among others, copper, cobalt, aluminum, zinc and nickel.

Copper, aluminum, cobalt and nickel are crucial for future civilizations due to their widespread use in essential areas such as electricity transmission, building construction and infrastructure, renewable and sustainable energy, public health and new technology development.

In learning about these materials and our need for their existence for the past years, we grew interested in understanding the companies that work in this field. It is widely acknowledged that mining companies have had a rough history, which includes slave work, child labor, excessive bribery, corruption and toxic emissions. Many people are ignorant to the extent that this is still happening across the world, and we have identified Glencore plc as a company with plenty of similar allegations. Glencore is both the largest commodity trading company and the largest mining company in the world. Furthermore, cobalt is a critical raw material that is expected to have a high degree of supply risk (European Commission, 2023, p. 35), and Glencore operates “Nikkelverket” in Kristiansand, which makes it so that the company’s operations directly affect Norway as a country.

The combination of the necessity for these minerals, especially cobalt, the immense size of Glencore, the unethical practice they seem to run, and the direct operations that the company has in Norway, is what led us to pick Glencore as the company to evaluate.

1.2 Research question

We have chosen the following research question: *What is Glencore plc worth, and what discount is acceptable due to their unethical practices?* To answer this problem, we will first strategically analyze both the external and internal factors to survey the market situation

around Glencore. Thereafter, we will calculate an estimation of the intrinsic value of the company through the use of a discounted cash flow analysis based on the data from March 24th, 2023, and we will do a relative valuation through a multiples analysis.

1.3 Delimitations

The thesis has one important delimitation. We have only used accounting figures from the period 2015 to 2022, which means that most of our forecasts are based on this period.

1.4 Structure

The thesis starts with a description of the company and the industry which it operates in, namely the commodity market. The descriptive section lays the foundation on which we develop further analysis on the company and the industry. From there, we go through a strategic analysis of the firm's internal and external factors. The external factors are studied using PESTEL and Porters 5 Forces, while the internal factors are studied using a VRIO-analysis. These two are then summarized in a SWOT-analysis, concluding the strategic analysis of Glencore. Afterwards, we do a financial statement analysis, where we look at the financial situation of the company.

The second part of the thesis covers the valuation of the company and the quantitative consideration of their unethical practices. This part starts with forecasting the different parts that go into the creation of a discounted free cash flow analysis, such as revenues, costs, net working capital and depreciation. Then, we calculate the weighted average cash flow for Glencore, before we value Glencore through both a multiple-based sum of the parts (SOTP) analysis and a discounted free cash flow analysis.

2 Company and industry description

Glencore operates as mentioned in the mining industry and the commodity trading industry. To better see the full picture when reading the thesis, it is useful to know the basics and the history of the industries in which they operate, their key competitors and the company itself and its history.

2.1 The Commodity Market

“A commodity market is a marketplace for buying, selling, and trading raw materials or primary products” (Hayes, 2021a, paragraph 1). These markets include a wide range of goods like oil, gas, corn, cotton, iron, gold, and attract many investors worldwide. Commodity markets are subject to large movements, as they are affected by plenty of macroeconomic factors.

It is usual to split commodities into two categories: soft and hard commodities. Soft commodities include products from the agriculture sector and livestock, like wheat, cotton and cattle. Hard commodities range from natural resources that must be mined to those that need to be extracted, such as different metals and oil (Hayes, 2021a, paragraph 2).

Some of the largest commodity markets include Chicago Mercantile Exchange (CME), which was founded in 1898 under the name “the Chicago Butter and Egg board.”. They have since become a global derivatives marketplace (CME Group, 2013). Tokyo Commodity Exchange, Inc. (TOCOM) is Asia’s largest commodity futures exchanges, primarily trading precious metals, oil, rubber and soft commodities. Other large commodity markets include London International Financial Futures and Options Exchange (LIFFE), where soft commodities are traded, and London Metal Exchange (LME), “the world's largest market in standardized forward contracts, future contracts and options on base metals” (Library of Congress, 2022). Metals traded at LME include copper, zinc, nickel, aluminum and cobalt.

2.1.1 The History of the Commodity Market

Since the beginning of humanity, mankind has traded goods and commodities with each other. We began with the exchange of simple agriculture products like corn and meat but have since evolved to include most primary products and raw materials. The Dojima Rice exchange is considered the world's first formally organized commodity exchange market, founded in Japan in 1697 (Fernando, 2021, paragraph 1). Since then, the number of commodity markets has grown enormously, with different markets focusing on different commodities all over the world.

From 1970 till today, the commodity market has undergone significant changes. The growth of globalization has prompted an increase in the trading and investment in commodities, generating significant growth in the size and importance of the commodity market.

Technological advancements have improved the efficiency of mining and processing

operations, thereby reducing costs and increasing production. The growth of emerging economies like India and China has created new demand for commodities, especially regarding the areas of metals and energy. Furthermore, the market has been subject to significant price volatility in recent decades, notably in response to global political and economic events. Growing concerns about the environmental impact of mining and processing have increased regulation and scrutiny of the commodity market.

It is worth mentioning that the ongoing war in Ukraine has impacted the commodity markets considerably. The war has, and is, disrupting production and trade of several commodities, especially those where Ukraine and Russia are key exporters. Russia is a main exporter of commodities like oil, natural gas, wheat, iron, fertilizer, and nickel, and the restrictions imposed by western governments have put great limitations on their export of commodities, strongly affecting commodity prices. Before the war began, the EU imported 35% of their natural gas, 20% of crude oil and 40% of coal from Russia. By the end of March 2022, just after the war began, there was a large increase in commodity prices when looking at the three-month price change. Coal prices increased by almost 75%, and the price for nickel, wheat and natural gas from Europe increased by more than 50% due to decreased export from Russia and Ukraine. (Baffes and Nagle, 2022). It is hard to say how long this situation will last, but when the war ends, it is likely that the commodity prices that surged during the war will normalize over time.

Overall, the commodity market has expanded in size and importance in the last 50 years, driven by globalization, technological advancements, emerging market demand, among other factors. Despite the enormous growth, the market remains subject to significant volatility and an increased influence coming from environmental concerns.

2.1.2 Competitors

As the commodity market has expanded over the last decades, several companies have established their presence as prominent producers and traders of commodities. The following companies are among the largest producers and traders of commodities such as iron ore, copper, coal and others, having significant operations and a strong presence in the global market. They are also among the largest players in the global mining industry, and their size and influence make them significant participants. Furthermore, some of these companies have a strong trading division as well, contributing to their overall presence.

2.1.2.1 Industrial competitors

BHP Group

BHP Group is a large mining company, with headquarters in Melbourne, Australia. Like Glencore, they are involved in several segments of the global market, including iron ore, copper, coal, nickel, oil and gas. BHP operates many mines and has significant processing and distribution capabilities. Their operations are spread across more than 90 locations worldwide. The company has a successful and efficient operation strategy, as well as a strong safety and sustainability policy, making them a strong player in the commodity market (BHP Group, 2023a).

Rio Tinto Group

Rio Tinto is a multinational mining company with headquarters in London, UK. They specialize in a variety of commodities, like iron ore, aluminum, copper, coal, and others. Founded in 1873, they have a longstanding history in the mining industry. Having significant operations across 35 countries and a great presence in the global market, they compete for resources, customers, and investment opportunities (Rio Tinto, 2023).

Vale Limited

Vale Limited is another multinational mining company based in Rio de Janeiro, Brazil. They operate on five continents, and have an integrated chain of production, logistics and energy. Vale specializes in the production of iron ore and nickel and plays a significant part in the market for the previously mentioned metals. They were considered the most valuable company in Latin America in 2021 (Guimarães, 2021), and one of the largest producers of iron ore in the world (Vale Limited, 2023a).

Anglo American plc

Anglo American have their headquarters in London, UK, and is also a multinational mining company operating on five continents. The company is involved in a variety of commodities, including platinum, copper and iron ore. Processing, converting and refining the raw materials is done by the company itself. (Anglo American plc, 2023).

Antofagasta plc

Antofagasta are a Chile-based copper mining group with interests in transport. In 2021 they produced 721.5 thousand metric tons of copper (Antofagasta plc, 2022, p. 2) out of a total

worldwide production of 21.2 million metric tons of copper (Garside, 2023). Their mining operations use 100% renewable energy. Antofagasta's primary focus is on production and sale of their own metals, which also includes molybdenum, silver and gold in addition to copper (Antofagasta plc, 2023).

Boliden AB

Boliden is a Swedish mining and smelting company, with operations in Sweden, Finland, Norway and Ireland. They mainly produce base metals, such as copper, zinc, lead, nickel, gold and silver. The company's mines are in some of the most mineral-rich regions in Europe, giving them access to high-quality ore. Boliden primarily operates in Europe and is known for their use of advanced technology. In addition to this, they have a strong track record of implementing sustainable practices and promoting circular economy principles in their operations (Boliden AB, 2023).

2.1.2.2 Marketing competitors

Trafigura Group Ptd. Ltd.

Trafigura is an international commodity trading company, with divisions in oil, metals, power & renewables and shipping. The company was founded by two former oil traders from Glencore in 1993, with offices and operations in over 60 countries. Trafigura is one of the world's largest independent oil traders and is also heavily involved in the trading of base metals, coal, and iron ore. Trafigura's core business model is similar to that of Glencore, with both companies operating as commodity traders that buy and sell physical commodities in the global market. Trafigura's trading operations span across more than 50 countries, with a strong presence in Asia, Europe, and the Americas. The company employs over 12,000 people worldwide and reported a revenue of \$231.3bn in 2021 (Trafigura Group, 2022).

Vitol

As a global energy business, Vitol's primary function is the distribution of energy and energy-related solutions. Founded in 1966 to trade oil, their business today ranges from crude oil and products to transitional energy solutions and sustainable energy solutions (Vitol, 2022a) As of 2021, Vitol had a turnover of \$279bn. They are present on every continent, operating from over 40 global offices (Vitol, 2022b).

Mercuria

Mercuria is a privately owned global energy and commodities trading company, founded in 2004. Their portfolio now includes petrochemicals, biofuels, environmental products, natural gas and LNG, power, dry bulk commodities, soft commodities, base metals and agricultural products (Mercuria, 2023b). The company has 38 offices in 27 countries, employing more than 1,200 people. Their turnover in 2021 was \$130bn (Mercuria, 2023a).

Gunvor Group

Gunvor Group has become one of the world's leading independent commodities trading houses and was founded in 2000. They currently employ about 1,600 people in more than 20 countries (Gunvor Group, 2023). The company began as a merchant of crude oil and oil products, but has since invested in upstream, midstream and downstream assets to create a platform for international expansion. Their turnover in 2021 was \$135bn (Gunvor Group, 2022).

2.2 About Glencore

Glencore is known as the world's biggest commodity trader as of July of 2022 (Biesheuvel, 2022), and one of the world's top 100 largest companies according to Forbes (Murphy and Contreras, 2022). With headquarters in Baar, Switzerland, Glencore produces and markets more than 90 commodities, operates on six continents, 35 countries, has more than 40 offices and 135 000 employees (Glencore, 2022, p. 2).

In 1974, Glencore was founded under the company name "Marc Rich + Co AG". The founder, Marc Rich, was subject to a management buyout in 1993 and the company name changed to Glencore. Glencore is an abbreviation of "Global Energy Commodity Resources". After that, they went public in May 2011, in a dual listing on London Stock Exchange and Hong Kong Stock Exchange. This was a move to facilitate a merger with Xstrata, a multinational mining company. The merger was completed in 2013. From the founding date until today, Glencore has established themselves as a global industry giant in both production and marketing of a wide variety of commodities and raw materials, such as copper, cobalt, nickel, zinc, thermal coal, oil, and wheat (Glencore, 2022, p. 4-8). Throughout their history, Glencore has been faced with both legal and regulatory challenges, from lawsuits to increased mineral royalty rates. Despite these challenges, Glencore appears to be a robust company. With their reputation for strong financial performance and ability to navigate challenging market conditions, Glencore is a key player in the commodity market.

2.3 Purpose and Strategy

The purpose of Glencore is “Responsibly sourcing the commodities that advance everyday life.” (Glencore, 2022, p. 1). This implies supplying high-quality commodities and resources to meet the growing demand for technology, energy infrastructure and industrial infrastructure in general. The purpose is reflected in their corporate values, stated as “Safety, Integrity, Responsibility, Openness, Simplicity and Entrepreneurialism” (Glencore, 2022, p. 1).

To achieve this purpose, Glencore operates with a clear and focused strategy. Their main strategic objective is “to be a leader in enabling decarbonization of energy usage and help meet continued demand for the metals needed in everyday life while responsibly meeting the energy needs of today” (Glencore, 2022, p. 12). The strategy is centered around three key pillars: operational excellence, strategic investment, and sustainability. The first pillar focuses on optimization of operations and processes to increase efficiency and productivity. The strategic investment pillar targets Glencore’s effort to expand its business through a combination of organic growth and strategic acquisitions. The last pillar is centered around sustainability, which is at the core of Glencore’s strategy. Having learned from previous scandals, they recognize the importance of sustainable mining and production, committing to reduce the environmental impact of their business. The firm’s strategic priorities revolve around responsible production and supply, responsible portfolio management and responsible product use.

2.4 Business Segments, production, and marketing

Glencore is divided into two business segments: industrial business and marketing business. Industrial business activities consist of exploration, acquisition and development, extraction and production, as well as processing and refining of raw materials. The firm’s Marketing business activities are based on sourcing physical commodities from global suppliers, selling and transporting them to global customers. Furthermore, they blend and process products to meet the customer’s specific demands and wishes. Lastly, in the marketing business segment, they also make money through arbitrage opportunities in the prices of commodities (Glencore, 2023f). Glencore’s adjusted EBITDA for the industrial segment for 2022 was US \$27.3, and \$6.8 billion for the marketing segment. At the intersection between the industrial

and the marketing business, Glencore also works with recycling materials and developing carbon solutions.

Generally, Glencore's operations can be split into three main categories: metals and minerals, energy products and agriculture products.

Within the first category, the focus lies on the production and marketing of copper, zinc, lead, nickel, aluminum, and other base metals, as well as ferroalloys and precious metals. Metals and minerals accounts for the majority of Glencore's production, with operations in countries like South America, South Africa, Canada and Australia.

The second category, energy products, includes production and marketing of coal, oil, and oil products. They are one of the largest suppliers of thermal coal used for electricity production, as well as a significant provider of oil and natural gas.

Agriculture products is the last category, and Glencore is also one of the largest global traders of agricultural commodities. Some of the commodities the company markets include grains, cotton, oilseeds, and sugar. Several of their agriculture operations are based in Australia, Canada, and South America.

Opting to maximize efficiency and productivity, the integration between production and marketing activities across the different segments contributes to their competitive advantages.

To visualize the composition of the firm, this figure illustrates the forecasted EBITDA for the next twelve months counting from March 24th 2023, where the size of each asset corresponds to its EBITDA contribution.

Figure 1: Glencore's EBITDA Next Twelve Months – counting from March 24th, 2023



2.5 Controversies

Glencore has a long history of controversies and litigations. This includes charges of bribery, market manipulation and corruption. In later years, the company has also been accused of several violations of human rights.

2.5.1 Bribery and corruption

In May 2022 Glencore settled with the US government after pleading guilty to allegations of bribery and corruption. This was a coordinated case with criminal authorities in Brazil, the United Kingdom and the United States after year-long payments to foreign officials through intermediaries and subsidiaries. By using these third parties and spending more than 100 million dollars, the company obtained several illegal advantages. The company managed to make litigations disappear and avoided mandatory audits. Glencore did also plead guilty to bribing influential officials to secure contracts in Africa and South America (US Department of Justice, 2022).

Another part of the lawsuit included manipulation of oil prices. By bidding on physical oil in two shipping ports in the United States, they purposely drove the oil price down to manipulate the benchmark rate, and consequently the other oil they traded (US Department of Justice, 2022). Without completely efficient markets, they managed to influence the supply and demand dynamics illegally. These convictions have resulted in Glencore taking measures

to enhance compliance by hiring third party monitoring. Whether this will make the company avoid similar cases going forward is yet to be seen.

2.5.2 Human rights violations

Even though the company is yet to be charged with violations of human rights, Glencore has the worst record of human rights accusations in the commodity production and trading business (Business & Human Rights Resource Centre, 2021). In 2019 the company experienced serious allegations after allegedly using child labor in their mines in DRC (ICAR, 2022). Other allegations worth mentioning include dangerous working conditions and pollution of local waters.

3. Strategic Analysis

To acquire a thorough understanding of Glencore's position in their market, their competitive advantage and their probable path to future excess returns, we will carry out strategic analysis of both their external and internal factors. The external factors will be analyzed through a PESTEL-analysis and Porters Five Forces. The internal factors will be analyzed through a VRIO-analysis, and the total picture of the internal and external factors will be summarized in a SWOT- matrix.

3.1 External analysis

3.1.1 PESTEL

The PESTEL analysis is a framework used to strategically analyze the macro-environmental factors that may affect a specific company or industry. The analysis is made up of six distinct factors: Political, Economic, Social, Technological, Environmental, and Legal.

By identifying and understanding these factors, organizations can acquire a comprehensive view of the external factors that can impact the organization in the future, and therefore it helps in the pursuit of managing and responding to these possible challenges (Peterdy, 2023).

3.1.1.1 Political factors

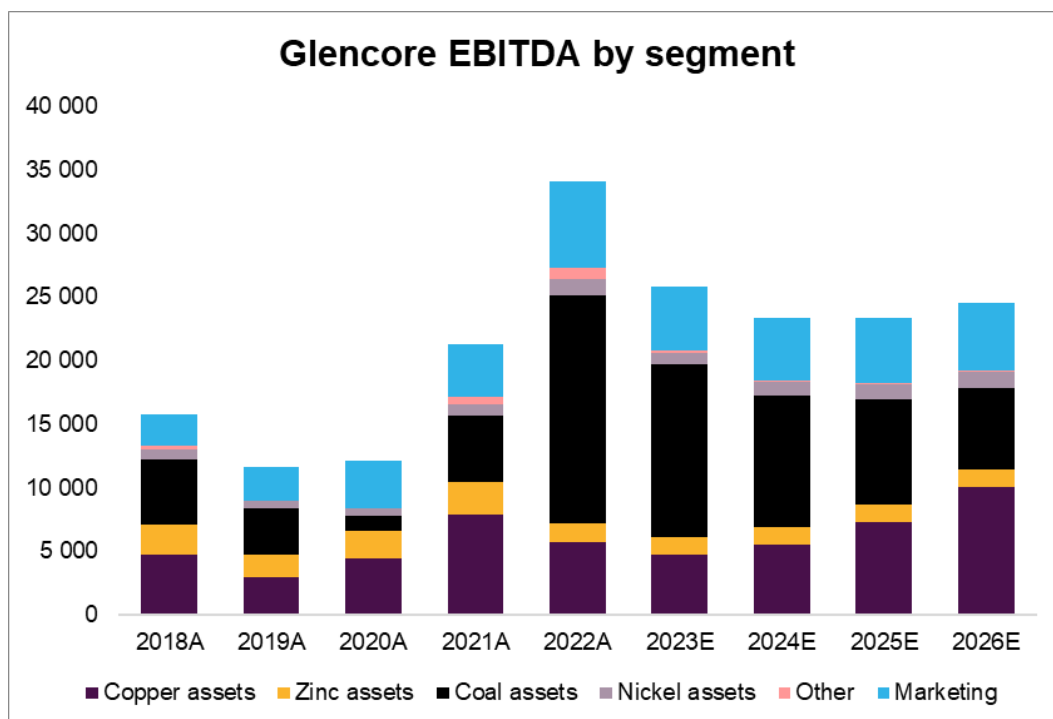
The political factors mainly concern governmental actions and policies. As Glencore is a company represented in over 35 countries and with operations on all continents except Antarctica, they are naturally affected by such actions and policies on a wide scale.

Firstly, Glencore is affected by the political instabilities in the countries in which they operate in. Political turmoil in countries such as the Democratic Republic of Congo, (herein referred to as the DRC), Colombia, Kazakhstan and South Africa can significantly impact the operations and profitability of the business. If some key countries were to undergo a big change in government, this could lead to significant changes in the operation of said country. One example of this would be if the government in the DRC were to increase the piece of the mining pie that it wanted from letting Glencore extract its natural resources. Such a political shift could gravely affect the operational profitability of the company’s efforts in the DRC.

An example of political actions that have affected Glencore, is the coal royalty hike in Queensland 1. July 2022. Queensland, a state in Australia, decided that the citizens of the state should get some of the benefits from the surge in coal prices after the start of the Ukraine war. Therefore, they increased coal royalties, which acts as extra costs in Glencore’s accounts. In the future, there is a risk that Queensland will further increase royalties, or that other countries or states will follow suit (The State of Queensland, 2022).

Political instabilities can also bring opportunities for higher earnings for Glencore. The war in Ukraine has brought up the coal prices, which benefits Glencore. Coals prices went up 229.17 USD/T at 24. February 2022, the day the war started, to 418 USD/T in less than two weeks.

Figure 2: Glencore EBITDA by segment 2018 - 2026



Naturally, as the price of coal increased, so did the earnings that Glencore made from its coal operations. Revenues from the firm's own coal operations increased to \$27,518 million in 2022 from \$11,211 million in 2021 and \$6,536 million in 2020 (Glencore, 2023d, p. 18-19). Therefore, if the war was to end, it may cause the energy-related sanctions to be lifted, which would increase the total supply of oil and gas. Consequently, the price of coal would fall, and so would the earnings derived from coal operations.

Political instabilities also concern chances of civil unrest and conflict. If the people of the DRC or any other country were to rally together to stand against Glencore's operations, then this could also have large impacts on the operation in that area. Due to the polluting nature of the enterprise, it is not something to take lightly. It has happened many times that the local populous have gathered in order to stop operations which they deemed polluting and destructive to the environment.

Lastly, local and national politicians have previously declined Glencore's interest in developing further business in selected areas. An example is in October 2022, when the Australian authorities rejected Glencore's application to expand the Glendell coal mine in New South Wales (Nichols, 2022). Declining further investments can be a hindrance to business growth for the company, and therefore, the local and national politicians and their interests are an important factor for the future growth of the company.

3.1.1.2 Economic factors

Glencore operates in a global market and is therefore subject to a wide range of factors that can affect its operations and economic situation. These factors include changes in global economic growth, commodity prices and interest rates.

The first factor is the change in economic growth. The commodities that Glencore produce and sell are a key player in the production of electronics, infrastructure and machinery. If the economic growth was to change drastically, these outputs would likely be slowed as well. A result of this would be that the demand for Glencore's products, such as copper, coal and zinc, would shrink. Through this, the prices of the materials would fall, and Glencore's economic situation would change for the worse.

Figure 3: Real GDP 2011 - 2050



(The Economist Intelligence Unit, 2015)

Future projections made by The Economist would not indicate that this is the future we are headed for. The compounded annual growth rate for the real gross domestic product of the world is estimated to be around 2% until 2050. The two areas which are expected to grow the most are the Middle East and Africa, and Asia-Pacific. It therefore seems like Glencore is in a good position to help with this economic growth, as most of their key operations are in these two areas. The coal from Australia, and the copper from the DRC are both located well for future growth and can be of significance in building up infrastructure in these areas.

The last economic factor is the sensitivity to interest rates. Through the lens of the company's balance sheet, it is not too sensitive to interest rates. Total borrowings for the company as of December 31, 2022 was \$28,777 million and only \$3,567 million of these are sensitive to interest rates (Glencore, 2023d, p. 78). Furthermore, the company has \$1,923 million in cash and cash equivalents, which facilitates the company's ability to pay its debts (Glencore, 2023d, p. 11). Most of Glencore's borrowings are in capital markets notes that won't be affected by any increase in interest rates. The only possible problem an interest rate increase can cause for Glencore's financing is if they must issue more capital market notes in the future. Then, the interest rate which they must pay their bond investors will be higher, and negatively affect their financial position. But this is not a big concern for the company.

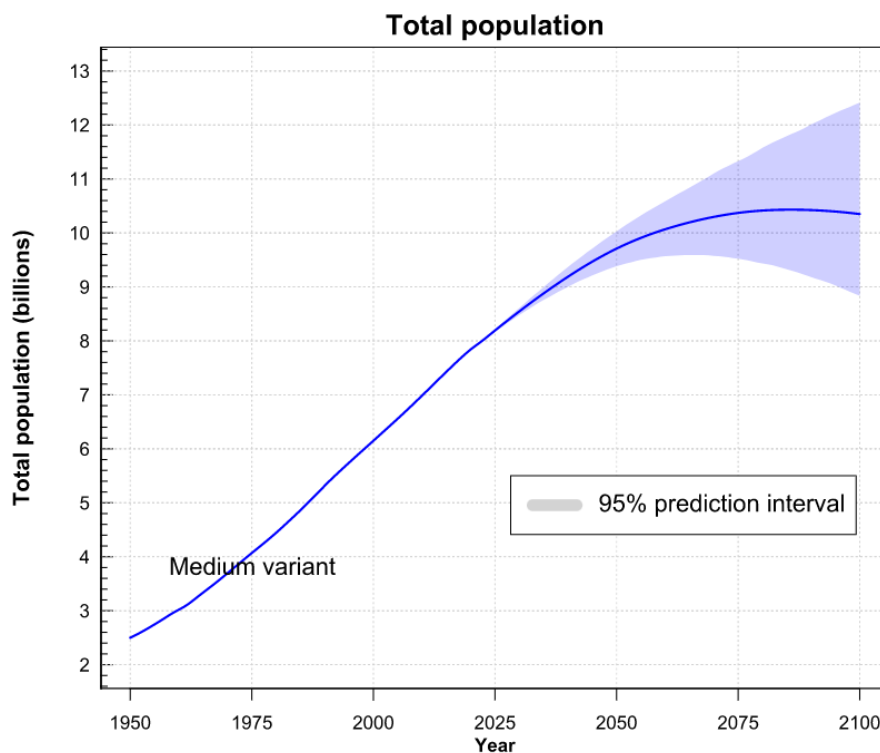
On the other hand, a rise in interest rates could negatively affect Glencore through its effects on the global economy. When the central banks of the world raise their rates, economic

activity slows down, and the same goes for the demand for minerals. Naturally, Glencore would then earn less money, and maybe halt some of their investments in new projects.

3.1.1.3 Social factors

Population growth also creates opportunities for Glencore. As the total population continues to grow in the future, so will the demand for the raw materials that Glencore provides. An increase in the need for energy to cover a growing population can be met through, to some extent, coal production. Furthermore, in the future, there will be a larger emphasis on the use of renewable energy sources, where copper is a key mineral. We will go further into the environmental side of the analysis in the “environmental factors” part.

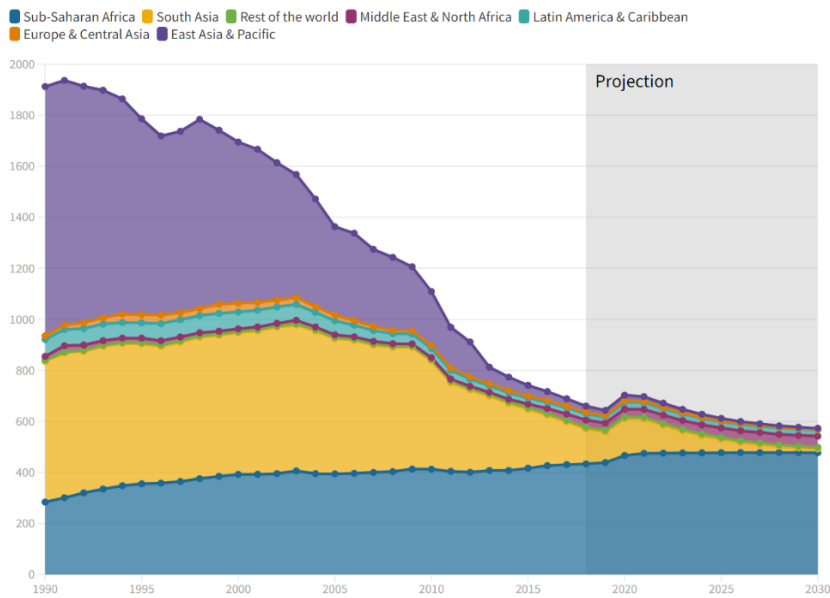
Figure 4: Global population 1950 – 2100



(United Nations, 2022)

Also, the need for energy and infrastructure to support new energy sources will increase as millions of people are lifted out of poverty. Countries such as China, India, Moldova and Vietnam are experiencing a massive lift from poverty, which will require more energy in the future.

Figure 5: Development in extreme poverty 1990 - 2030



Sources: Lakner et al. (2020) (updated), PovcalNet, World Bank (2020)

(World Bank Blogs, 2020)

As the figure above indicates, the number of people living in extreme poverty is projected to decrease from 671.23 million people in 2022 to 573.22 million people in 2030. This means that it is projected that 98.01 million people will be lifted out of extreme poverty in the next eight years, which will further increase the need for clean and renewable energy sources, where copper is extremely useful. Therefore, being able to provide this to these two new groups of consumers is a big area of opportunity for Glencore as a company. Naturally, people from all levels of poverty will be helped in the future, not just those from extreme poverty. The emphasis on extreme poverty is simply due to the data being more available and to make a point of probable future demand.

Another social factor that affects Glencore is views on the worker environment and worker satisfaction. There is a standard that most workers need to meet to be satisfied with their jobs. At Glencore, problems have been arising about the treatment of workers, and they have been striking to fix these issues. One example is in Glencore's Raglan mine in Canada, where 630 workers went on a strike in early 2022. Eric Savard, the president of Steelworkers Local 9449, which represents the striking workers, said: "Glencore has been continually pushing the limits. It even balks at providing a proper lunch hour to workers who are working eleven hours a day, 21 days in a row. Living conditions at the mining camp have deteriorated over the years. The employer systematically quibbles over the living and working conditions of employees who are away (from) their families for long periods of time. It's time for this

company to show greater respect for workers who are generating its profits of tens of millions of dollars each year” (IndustriALL Global Union, 2022). Not only has such claims been made by Canadian workers, but also Glencore workers in Latin-America, especially Peru, where they are claiming that Glencore is committing labor abuse (IndustriALL Global Union, 2020).

3.1.1.4 Technological factors

On the topic of the external technological factors that affect Glencore, the most important are automation and workforce tracking.

Automation is increasing productivity, efficiency and safety in the mining industry. Automated systems such as automated drilling systems, trucks and trains for transportation, ventilation systems, and monitoring systems, help with the productivity of the entire supply chain for minerals. Machines can work around the clock, and the drillings systems can reach deeper in the ground and dig with a higher degree of accuracy. After the minerals have been dug up by machines, they can be transported using automated transportation vehicles. Not only will these systems make the operations more efficient and productive and therefore reduce costs, but the safety of the workers will be better, as they won't need to breathe in the toxic chemicals when digging dangerous tunnels in the ground. Casualties have also occurred due to tunnels collapsing, further illustrating how automation can help (Reuters Staff, 2019).

Wearable workforce tracking devices can play a key role in the use of humans in mining. If companies do not have the financial strength to utilize automation systems, they can still significantly reduce the injury- and fatality risks for their workers through tracking devices. In addition, these devices can be used to increase productivity by finding key workers quickly, and mapping where workers are during their shifts. In this way, not only will communication between workers be more efficient, but workers can be more effectively managed. Lastly, injuries and deaths can be prevented by workers quickly communicating their situations and locations to leaders and other workers, and possible dangerous areas in the mines can be avoided by tracking (Worldsensing, 2018).

3.1.1.5 Environmental factors

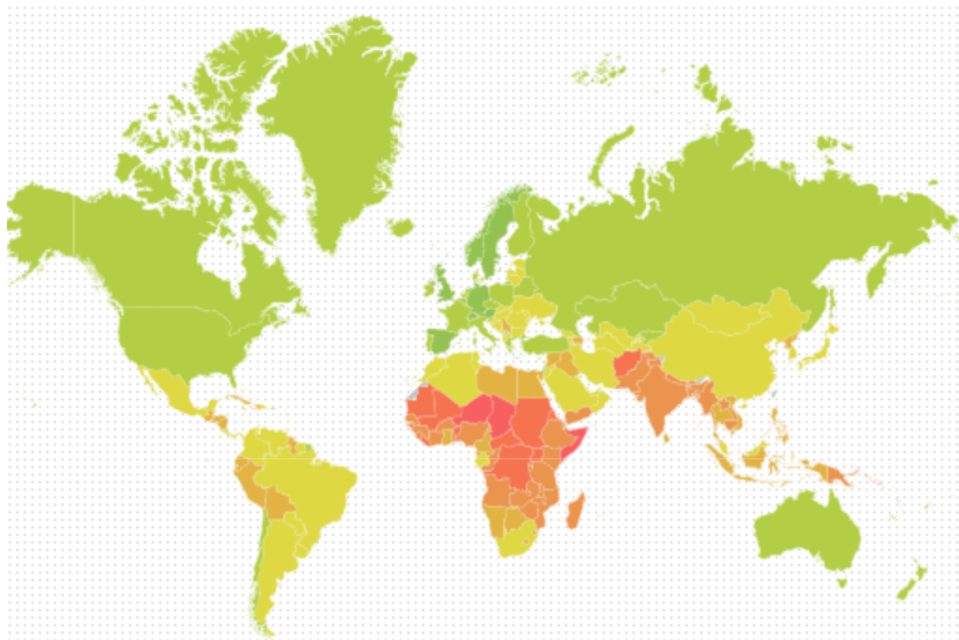
As mentioned earlier, Glencore can offer a lot of help in the transition from brown energy to renewable energy. Through this, the environmental trend of our age is an opportunity for Glencore. Apart from this fact, the environmental factors include how climate change affects Glencore's operations.

A lot of Glencore's operations are in areas subject to climate change risks. These areas include Australia, the DRC and Colombia. Glencore's projects and operations in Australia concerns the mining of coal, copper, lead-zinc and nickel-cobalt, and they are located all over the country. They have operations in four out of five states: New South Wales, Queensland, Western Australia and the Northern Territory, which diversifies the risk of climate change events, but makes it more likely that they will affect operations (Glencore, 2023i).

In the past years, Australia has experienced large floods and record-breaking rain, destroying homes, business projects, infrastructure and crops. All these damages have set Australia back billions of dollars in rebuilding costs and poses a big risk for future business being done in the country. Glencore's operations in Australia largely revolves around coal mining in Queensland and New South Wales, and these are the areas affected the most by the floods. Not only can the heavy floods destroy the physical buildings and projects, but as seen in 2021, the transportation of Glencore's coal through train gets halted during these natural disaster events. As coal is the largest contributor to Glencore's revenues, this is a crucial part to be considered among the macro-environmental factors for the company (The Climate Council, 2022).

Based on the Notre Dame Global Adaptation Initiative index (ND-GAIN index) ranking of 2020, which ranks countries based on "vulnerability to climate change and other global challenges in combination with its readiness to improve resilience" (University of Notre Dame, 2022), the DRC is ranked number 178 out of 182 countries.

Figure 6: Countries of the world by their position on the ND-GAIN Country Index Vulnerability score.



(University of Notre Dame, 2022)

Based on climate change vulnerability part alone, the DRC is only better than Mali, Chad, Somalia, Niger and Sudan, showing how sensitive they are to changes in the climate. As cobalt and copper are essential to the future of batteries and renewable energy, and most of it is mined in the DRC, it is necessary to locate the key climate risks for operations in the DRC. Glencore’s operations are in the southern region of Katanga, near Kolwezi. This is beneficial, since most of the environmental issues in the country happen near the Kongo River, where floods are a problem, and in the northeast, where droughts can be quite severe. Therefore, even though the DRC is sensitive to climate change, the company is not located in the areas subject to the most serious effects (The World Bank Group, 2021).

3.1.1.6 Legal factors

Another factor that could affect Glencore’s business is the magnitude and frequency of corruption and bribery. In November of 2022, Glencore Energy UK Ltd had to pay £281 million after the Serious Fraud Office in the United Kingdom revealed that the company had paid US \$29 million in bribes to get preferential access to oil in African countries.

Furthermore, Glencore had “pleaded guilty in June this year to seven counts of bribery, after an SFO investigation exposed that it had paid bribes to maximise its oil trading profits in five African countries” (The Serious Fraud Office of the United Kingdom, 2022).

If the company must pay bribes and go through the ally of corruption to gain business benefits and better deals, then there certainly is a risk that another company simply will be able to pay more. It then becomes a game of “who can pay more in bribes”, which is a game no business honestly would want to play. This must also be acknowledged as an external factor that the company and its shareholders should consider.

3.1.1.7 Summary of the PESTEL analysis

As can be seen from the analysis, Glencore has many external factors that they must navigate in order to preserve and increase their market share. One of the most important factors seems to be the political and social factors concerning the company's reputation through their treatment of their workers. By mitigating this risk by adopting new technologies such as automated drilling and mining systems, and workforce tracking wearables, they can better their operations' productivity, efficiency and safety, and their relationship to workers, while increasing their social standing. We therefore believe that adopting intelligent and innovative automated systems and other technologies will increase and protect their market share.

3.1.2 Porters five forces

Porters five forces is a strategic framework for identifying and analyzing the competitive landscape of a company. The five forces are all about external factors, and include the threat of new entrants, the bargaining power of customers and of suppliers, the intense rivalry of competitors, and the threat of substitute services or products. The framework was developed by Michael Porter and was first published in *Harvard Business Review* in March of 1979. In the article, Porter wrote: “once the corporate strategist has assessed these forces, he can identify his own company's strengths and weaknesses and act accordingly to put up the best defense against competitive assaults” (Porter, 1979).

3.1.2.1 Potential of new entrants into the industry

Regarding the natural resource industry, a substantial amount of capital is required to make the necessary investments to establish a presence. It is quite difficult to achieve a comparable economy of scale compared to what Glencore has achieved. This makes the entrance barriers high, thereby limiting the threat of new entrants. As a diversified natural resource company

with operations in mining, oil and gas, and agricultural commodities, Glencore has built a significant competitive advantage in the market through its extensive network and expertise within the industry. The products in the natural resource industry are subject to strong differentiation, where the trend is to sell differentiated products rather than standardized products. These factors make the threat of new entrants a weak force within this industry. Furthermore, Glencore has established a great number of long-term relationships with customers, suppliers and governments, making it difficult for new entrants to compete on the same terms. New and strict regulations on natural resource companies that may be imposed by governments pose a significant risk to potential new companies, like environmental regulations. This can make it harder for new entrants to gain a foothold in the industry.

However, the potential for new companies to enter the market is still present. Specifically in the commodity trading sector, which may impact Glencore's market position. Accessing distribution networks is relatively easy for new entrants, making it easy to set up their own distribution channels and to get their products out to retail outlets, due to the limited number of retail outlets selling specific product types. To tackle the threat of new entrants, Glencore may exploit their advantage of the economies of scale, improving their cost advantage to fight off new entrants to the market, as well as a greater focus on innovation to differentiate their products from potential entrants. Overall, we deem the threat of new entrants for Glencore to be moderate.

3.1.2.2 Bargaining power of customers

Glencore's customers include large industrial customers, such as companies in the “automotive, steel, power generation, battery manufacturing and oil sectors.” (Glencore, 2023e). These customers have significant bargaining power due to the large volume of commodities they purchase. In addition, most of Glencore's commodities are interchangeable, which means that buyers can easily switch to other suppliers if they are not satisfied with pricing or quality.

To mitigate the bargaining power of buyers, Glencore engages in long-term contracts with its customers, which provides greater stability in the market (Glencore, 2022, p. 11). The company also diversifies its customer base, which reduces dependence on any single customer. Moreover, Glencore focuses on maintaining quality in its products to enhance customer loyalty and reduce the likelihood of customers switching to competitors. Overall,

the bargaining power of buyers for Glencore is high, and the company must continue to focus on enhancing customer loyalty to mitigate the risk of customer churn.

3.1.2.3 Bargaining power of suppliers

Due to Glencore's large scope of operations worldwide, they deal with many suppliers. From suppliers of minerals and metals to equipment, energy, and service suppliers. The commodity industry is of significant size, and there are many suppliers compared to the number of buyers. Due to this unproportioned relationship, the suppliers have less power over prices, making the bargaining power of suppliers a weak force. The products provided by these suppliers are generally quite standardized, not that differentiated, and are supplied by several companies. The commodity industry is the main income source to the suppliers as well, and the suppliers must provide reasonable pricing to maintain their profit. All these factors contribute to weakening the bargaining power of suppliers.

3.1.2.4 Competition in the industry

The industry Glencore operates in is subject to significant competitive rivalry. There are many companies vying for market share. The competition from other mining companies, commodity trading companies, and energy companies is high. The main industrial competitors to Glencore, as previously mentioned in section 2.1.2, are BHP, Rio Tinto, Vale, Anglo American, Antofagasta and Boliden. These large companies dominate the market, making the industry highly concentrated. It is natural to assume the competition between these companies will be high, as they all have the financial muscles to engage in intensive rivalry, where they all compete on the global markets with great opportunities to gain a bigger market share. As a result, it is vital for Glencore to continuously innovate and improve its operations to remain competitive.

3.1.2.5 Threat of substitutes

The threat of substitutes is moderate for Glencore. Some of their commodities, such as copper, have limited substitutes, which gives the company a competitive advantage. However, other commodities, such as coal and oil and gas, face the threat of substitutes such as renewable energy sources.

To mitigate the threat of substitutes, Glencore focuses on enhancing the quality of its products, which differentiates its products from substitutes. The company also diversifies its operations and invests in renewable energy sources, such as wind and solar power, to reduce dependence on non-renewable resources (Glencore, 2021, p. 17). Moreover, Glencore engages in sustainable practices, such as reducing greenhouse gas emissions, to meet the increasing demand for environmentally friendly products. Overall, the threat of substitutes for Glencore is moderate, and the company must continue to diversify its operations and invest in sustainable practices to remain competitive.

3.2 Internal analysis

3.2.1 VRIO

The VRIO-framework is an internal analysis developed by the American professor Jay B. Barney. The questions asked in a resource-based analysis are mainly connected to the company's internal strengths and weaknesses. They must be viewed in relation to the company's stakeholders, especially customers and competitors. The analysis will establish whether a resource is valuable, its rareness, imitation risk, and organizational competence. Through this, the competitive advantage of the resource can be determined.

1. **Valuable** – Is the resource valuable? Does it give Glencore the possibility to create value and exploit opportunities?
2. **Rare** – Is the resource rare? Can competitors access the same resource easily?
3. **Inimitable**– How difficult is it to imitate or copy the resource?
4. **Organizational competence** – Is Glencore organized in such a way that it can take advantage of the resource and exploit it fully?

The analysis is based on evaluating the different resources, evaluated by the measures mentioned above. This table shows the different outcomes, based on how the resources perform on the different assessment criteria.

Table 1: VRIO framework

Valuable	Rare	Inimitable	Organization	Outcome
<i>No</i>	Yes	Yes	Yes	Competitive disadvantage
Yes	<i>No</i>	Yes	Yes	Competitive parity
Yes	Yes	<i>No</i>	Yes	Temporary competitive advantage
Yes	Yes	Yes	<i>No</i>	Unused competitive advantage
Yes	Yes	Yes	Yes	Sustained competitive advantage

To analyze Glencore’s internal resources, we have singled out four significant resources critical to their business. These resources are Glencore’s physical assets, human capital, financial resources, and localization.

Physical assets

Glencore possesses a significantly diversified portfolio of commodities, consisting of metals and minerals, energy products and agricultural products. Their operations comprise around 60 mining, metallurgical and oil production assets, spread across 35 countries (Glencore, 2022, p. 2). They are the world’s largest zinc producer, one of the world’s largest copper producers and the 4th biggest nickel miner and refiner. Several of the commodities Glencore produce and market, like copper, nickel and cobalt, are essential to the production of renewable technologies such as batteries.

The Paris Agreement sets out a global framework to avoid dangerous climate change, aiming for net zero emissions by 2050. To accomplish this, the amount of renewable energy and technology must rise, increasing the demand for many of the commodities Glencore produces. Their purpose: “Responsibly sourcing the commodities that advance everyday life” illustrates the significant value of their assets. Even though Glencore has valuable assets, they are not the sole producer of any of its commodities. The unique aspect of their assets is the scope of their operations, and the diversification of both the portfolio and the locations. This enables Glencore to quickly react to changes in the market.

In recent years, there has been a trend of higher commodity prices and resource scarcity. Higher sustained commodity prices might increase the risk of material substitution, accelerating efforts to reduce the amount of material needed for a certain application, or

substituting the material for an alternative providing similar performance at a lower cost. The way Glencore is organized enables them to take advantage of their physical assets and react to changes in the market. In total, we deem Glencore's physical assets to be a sustained competitive advantage.

Human capital

Human capital is defined as the economic value of a worker's experience and skills. It is an intangible asset that one cannot find in a company's balance sheet, but nonetheless an important resource to any company. Many perceive human capital to be in relation to economic growth, profitability and productivity (Kenton, 2022). Glencore is a major employer, with 135 000 employees around the world. With such a high number of workers, it is valuable to analyze if the resource is exploited in a proper way and if this leads to any competitive advantage.

Glencore as an organization faces several complex tasks in their day-to-day business, and depending on how well these tasks are performed, the result can affect future revenue. If a mine must stop production due to errors caused by lack of competence or experience, it would negatively affect the revenue from that mine. The same goes for negotiations with suppliers and buyers, cost management and the degree of utilization of operating assets. The commodity market is volatile, and the consequences of poor negotiations may lead to loss of revenue. Competent and experienced employees are therefore an important resource to the company (Glencore, 2023c).

Glencore has a "highly capable, entrepreneurial and engaged workforce that brings a diverse range of experience and perspectives to the organization", according to their own websites. (Glencore, 2023h). Although this statement should be taken with a grain of salt coming from Glencore's own website, which is not an objective source of information. Glencore also engages in talent-development of recent graduates, and they also recognize and uphold all their employee's development opportunities. This is a great foundation for upholding a high level of human capital. Glencore has high human capital inside the management team as well. At the top, Glencore's management is led by Gary Nagle. He has been a part of Glencore since 2000 and holds significant experience in the commodity business as well as leadership experience. The rest of the management team is comprised of mostly non-executive, independent directors. Out of nine members of the board, four are women. A diversified and

experienced management team is better equipped to make the right decisions in a complex market. The experience and knowledge of the management team gained through many years is hard to replicate, but at the same time, employees are free to go somewhere else at any time. It is therefore not an inimitable resource, but we consider it to be both valuable and rare. This makes the human capital resource a temporary competitive advantage.

Financial resources

One of Glencore's key financial resources is the fact that they have a lot of customers, and they stick with Glencore for a long time, which gives them a high degree of financial stability. The average customer relationship between Glencore and its customers is 5-9 years, and none of their customers represent more than 3.2% of revenues in 2022 and 3.6% in 2021. A single customer also did not represent more than 7.1% of total trade receivables in 2022 and 4.7% in 2021 (Glencore, 2023d, p. 103). Having such a widely diversified portfolio of customers gives the firm a financial position that is resilient and durable. If the firm was to have a few large customers, then bankruptcy or default of payment would have a large negative impact on Glencore. Having this risk diversified to many customers mitigates it. Furthermore, developing a relationship with the customer over a 5–9-year timeframe gives Glencore security and faith in its client's ability to pay off their individual payables. It is therefore clear that Glencore's customer relationship and customer diversification are valuable assets.

But these resources are not rare amongst peers. The firm's competitors mentioned have customer relationships between 5-15 years, which is even longer than Glencore's. On the other hand, the maximum trade receivable per customer is harder to find, but BHP's ten largest customers represented 34% of total credit risk (trade receivables) in 2021 (BHP Group, 2023b) and no single customer of Vale contributed more than 10% to receivables or revenues (Vale Limited, 2023b). This is a little bit more than Glencore, but not significantly. Therefore, it can be concluded that this is not a rarity, and it is also quite imitable due to the nature of the industry, which is an industry with a massive number of customers and with a consistent need of minerals and materials, which results in long customer relationships and many customers per supplier.

Localization and ownership

Another key resource for Glencore is the physical localization of their operations. Among the many great localizations of mines for Glencore, is the Mutanda copper and cobalt mining pit in the Lualaba province in the DRC. The Mutanda mine produces a fifth of the world's supply of cobalt and is the largest in the world (Kavanagh, 2022). Owning such physical assets as the Mutanda mine is a large competitive advantage for Glencore and will produce future cash flows that competitors will need several individual mines to match the output of Mutanda. Therefore, such resources are quite rare. The Mutanda mine, and other mines that Glencore owns, are valuable resources for Glencore now and in the future as it will play an important role in the creation of batteries which in turn is essential for the green transition.

Furthermore, such assets are quite rare. Ownership of massive mines in key locations for minerals is quite rare and hard to come by. It takes a long time to create such mines, as one needs to not only find areas with a lot of extractable minerals but also create functioning mining systems to cheaply extract them and transport them to customers. Therefore, such large mines are a somewhat rare and inimitable resource. Glencore's competitors do have large and productive mines, but not to the extent that Glencore has. This ownership is one of the reasons why Glencore is at the top of their industry: they own some of the world's largest mines, and they are hard to come by or recreate. When it comes to the organization around these resources, Glencore is having issues with the management and ethics when running these mines. The Mutanda mine was closed temporarily in November 2019 due to "increasing costs, low cobalt prices, and higher taxes" (IndustriALL, 2021). Glencore has experienced such issues in other mines as well, and the unethical practices by Glencore cause continues problems. Therefore, the organization of these resources does not result in a sustained competitive advantage, but rather a temporary competitive advantage.

Table 2: VRIO outcome

Resource	Valuable	Rare	Inimitable	Organization	Outcome
Physical assets	Yes	Yes	Yes	Yes	Sustained competitive advantage
Human Capital	Yes	Yes	No	Yes	Temporary competitive advantage
Financial resources	Yes	No	No	Yes	Temporary competitive advantage
Localization and ownership	Yes	Yes	Yes	No	Temporary competitive advantage

3.3 Summary of the strategic analysis

3.3.1 SWOT

The SWOT-analysis is a summary of the internal and external analysis we have conducted, highlighting internal strengths and weaknesses, as well as external opportunities and threats. The SWOT-table consists of the most essential strategic factors to Glencore, based on the previous analysis in this chapter.

Table 3: SWOT summary

	Strengths	Weaknesses
Internal Factors	<ul style="list-style-type: none"> - Physical assets and ownership that gives a sustained competitive advantage 	<ul style="list-style-type: none"> - Bad relationship between leadership and workers. - A bad reputation and a history of corruption and law-breaking.
	Opportunities	Threats
External factors	<ul style="list-style-type: none"> - Increase in demand for Glencore’s minerals due to technological innovations, green energy transformations and population growth. - Increase in demand for coal due to sanctions against Russia. 	<ul style="list-style-type: none"> - Pressure from NGOs - Climate change affecting operations - Stricter regulation and government policies

4. Financial statement analysis

The interpretation of the financial statements is an important part of the assessment of a company. We will break down how Glencore has performed in the last eight years regarding profitability, financing, solvency and liquidity. This will include several measures computed by the income statement, balance sheet and cash flow statement. A thorough analysis of statements will provide valuable insight into the historical performance and risk. This is a valuable tool for forecasting the valuation of the company.

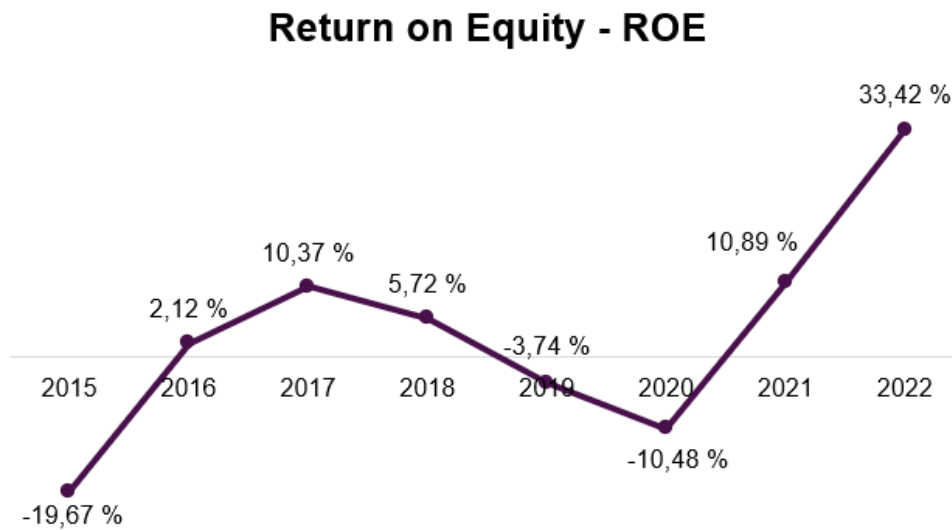
4.1 Profitability

The profitability of a company measures how efficient they make use of its capital. Glencore has a responsibility to deliver value to their shareholders. The return Glencore deliver on their invested capital is an important part of how they are perceived by the investors. We can use different measures or financial metrics to get an insight into this. We will use return on equity, return on assets, return on invested capital and operating cash flow margin.

4.1.1 Return on equity - ROE

Return on equity is a measure based on the equity that the shareholders have invested in the business. By dividing net income by the equity attributable to the shareholders, you find the return on equity. It is important to be aware that even though this is an equity ratio, it is very much dependent on leverage, as a company simply can increase its leverage in pursuit of a higher ROE.

Figure 7: Glencore plc: Historic development of Return on Equity 2015 - 2022



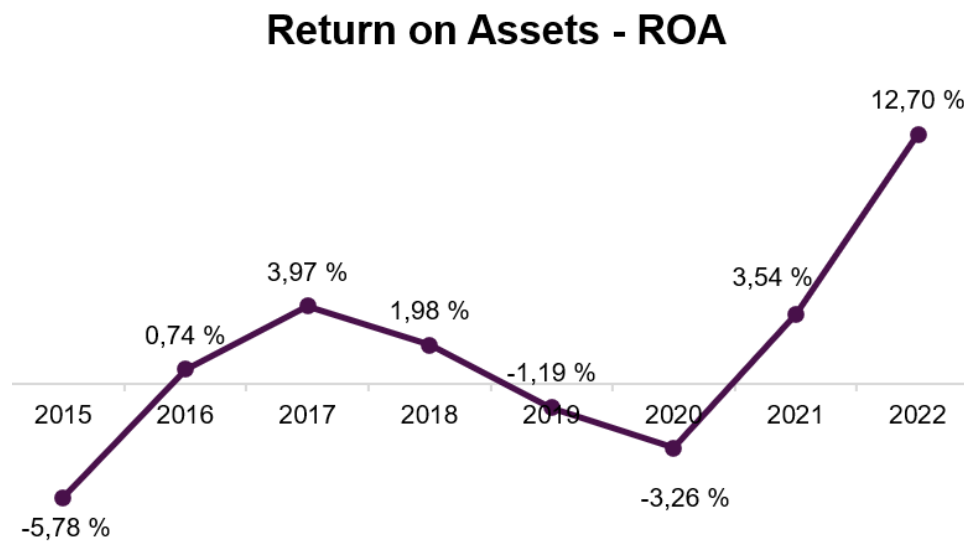
The return on equity for Glencore has increased dramatically since 2015 but has been rather volatile in the period 2015-2022. This increase is not too affected by any change in the shareholder's equity in the company, as it has stayed around \$ 45 billion throughout the analyzed period. It is therefore fair to state that earnings have been volatile in this period, and that the surge in ROE in 2022 is due to the surge in earnings because of higher coal prices. If earnings from the company's coal operations remain at the level of 2022 - which is what the company is estimating for 2023 - the ROE will also remain high.

On average, the return of equity has been only 3.58%, with a high standard deviation. It is safe to say that Glencore's return on equity is volatile and dependent on the prices of some key natural resources.

4.1.2 Return on assets – ROA

Return on assets is a measure that shows how much money the company makes from its assets. This means that the return on assets is the return that the company makes on both its equity and its debt, which makes it a measure of how well the company allocates its resources and how profitable those resources are. The return on assets varies significantly from industry to industry, and companies must therefore be compared to others in the same industry. Comparing across industries will lead to wrong and misleading conclusions.

Figure 8: Glencore plc: Historic development of Return on Assets 2015 - 2022



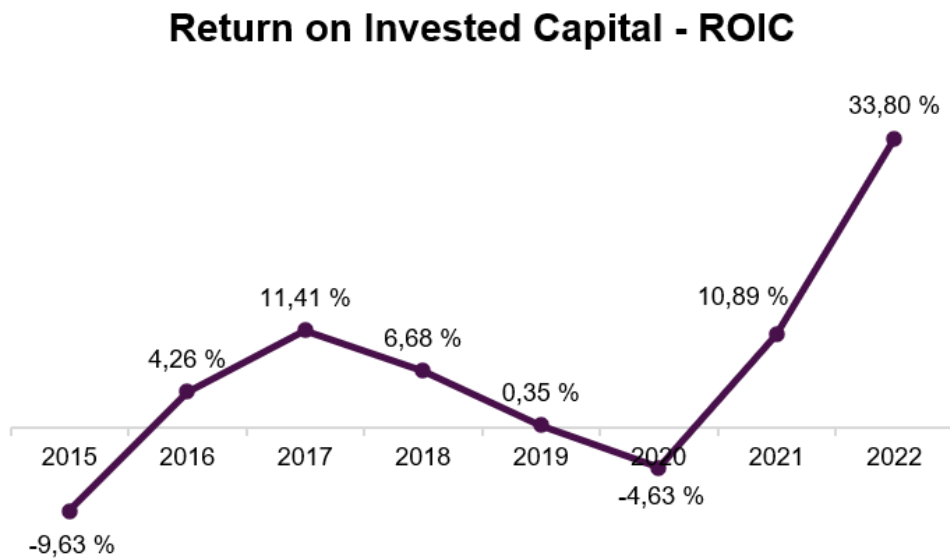
Just like the return on equity, the return on assets has had a similar change and volatility in the period 2015-2022. Naturally, the percentages will be lower, as the denominator in the fraction is significantly larger. In the same fashion as the return on equity, the return on assets has mainly experienced fluctuations due to the change in earnings, and in 2022 due to the increase in coal prices.

The average return on assets for the period is 1.59%, which is quite low. From the fact that the total assets have not changed much in the period, we can deduce that there have not been many major investments made in this timeframe.

4.1.3 Return on invested capital – ROIC

The measure of profitability that has the most credibility and usage among investors is the return on invested capital. ROIC is superior, as it takes the cost of capital into account, which neither ROE nor ROA does. One therefore gets a more comprehensive and thorough understanding of the return made from the true investment. Furthermore, ROIC can be compared to the company's weighted average cost of capital (WACC), to understand whether the investment had a higher return than what the company required as a return. If the ROIC is higher than the WACC, then it can be concluded that the investment created value for the company, and if the WACC is higher than the ROIC, then the company destroyed value.

Figure 9: Glencore plc: Historic development of Return on Invested Capital 2015 - 2022



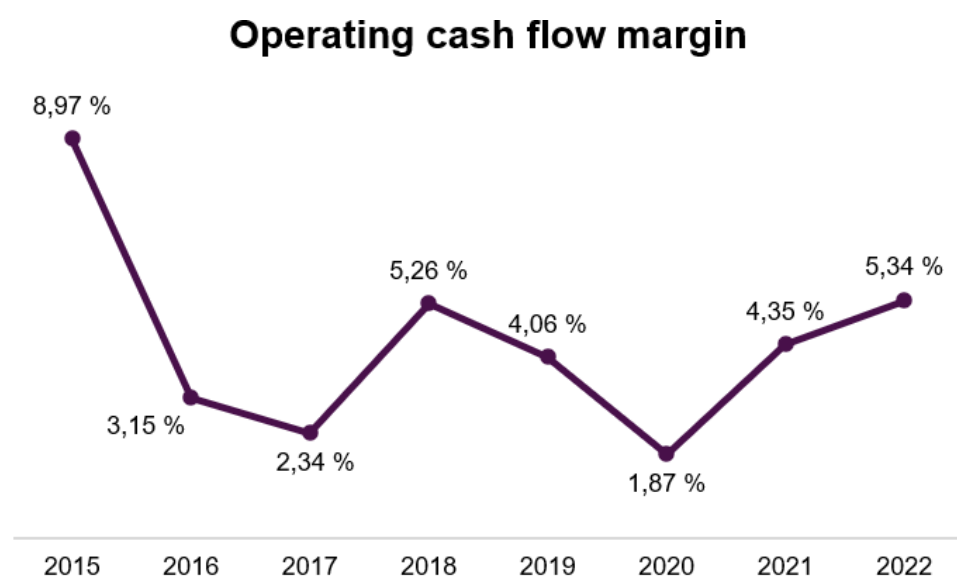
The average return on invested capital for the eight years measured is 6.64%. As shown later in the thesis, we calculate Glencore's weighted average cost of capital is 10.38%, which means that on average, the company has destroyed value through its investments, given that the WACC has been somewhat constant. The situation has nonetheless changed for the positive in 2021 and 2022, with value being created in 2022.

Therefore, we can conclude that Glencore's ability to generate satisfactory returns on its investments is not fulfilled in the period 2015-2022. But as mentioned earlier, the return on invested capital will likely be above the eight-year average for the next few years.

4.1.4 Operating cash flow ratio

A company's operating cash flow ratio shows how much of the firm's sales turn into operating cash flow. The reason why we decided to include a cash flow ratio and not another net income ratio is because the company can take many measures to change and turn the number into a more positive one. On the other hand, cash flows can't be twisted as easily. Therefore, these values are more reliable as a metric for true profitability.

Figure 10: Glencore plc: Historic development of Operating cash flow margin 2015 - 2022



The average operating cash flow margin for the period is 4.42%. The reason why the operating cash flow margin has not seen the same spike in 2022 as the other margins above, is due to the drastic decrease in working capital and the increase in income taxes, while the sales increased from \$203,751 million in 2021 to \$255,984 million in 2022.

It can be concluded that Glencore's operating cash flow margin is rather low when compared across sectors, as the firm's peers have an average operating cash flow in 2022 of 30.58%. The comparison is not perfect, as Glencore has a marketing business which their competitors do not have. We will come back to the comparison between Glencore and its competitors in the discussion part.

4.2 Liquidity

A liquidity analysis will help reveal how Glencore's ability to pay its debts has developed over the past years. In the pursuit of understanding the company's liquidity, we have decided to use current ratio and cash ratio as metrics.

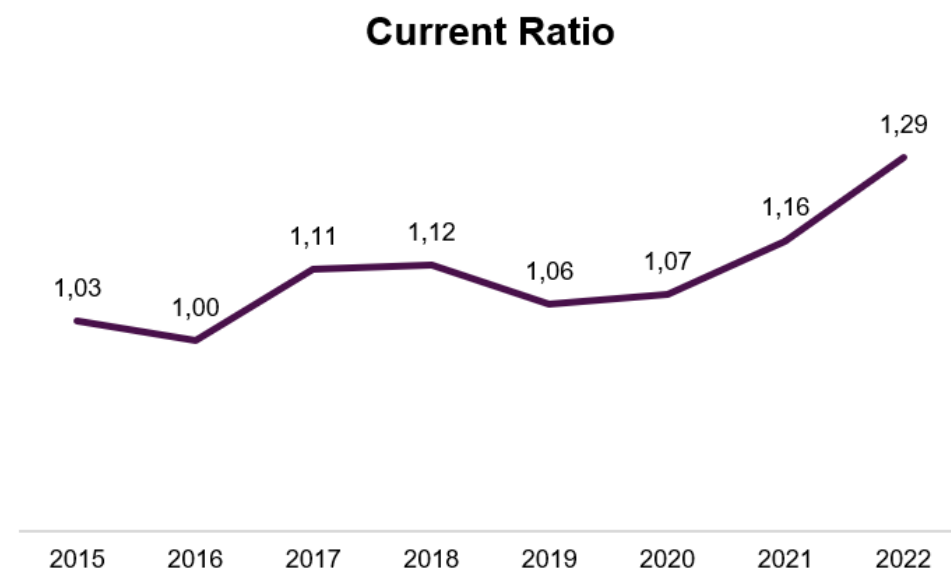
4.2.1 Current ratio

For Glencore, we think that the current ratio is more appropriate than quick ratio, as we believe that Glencore's inventory can quickly be turned into cash. A large portion of the current assets are inventories, like in 2022 when inventories totaled \$33,460 million out of

\$66,783 million in current assets. But as inventories in mining stocks mainly raw materials or semi-finished goods, we assume that these assets could be sold and turned into cash quite quickly. If the inventories could not have been sold easily and turned into cash, then it would have been more appropriate to use a quick ratio.

The current ratio shows a firm's ability to pay off current obligations with its current assets. If a company has a current ratio above 1, it can pay off obligations that mature in under a year quite well, but if the current ratio is below 1, this could mean that the company will have difficulties with covering these short-term obligations. As the current ratio increases, so does the firm's ability to pay off its current obligations and its liquidity is considered better. However, a company with too high of a current ratio may not be efficiently managing its current assets. For every company there is a sweet spot for the current ratio, where they are both safe in covering their current obligations, but also managing their current assets in an optimally efficient manner.

Figure 11: Glencore plc: Historic development of Current Ratio 2015 - 2022

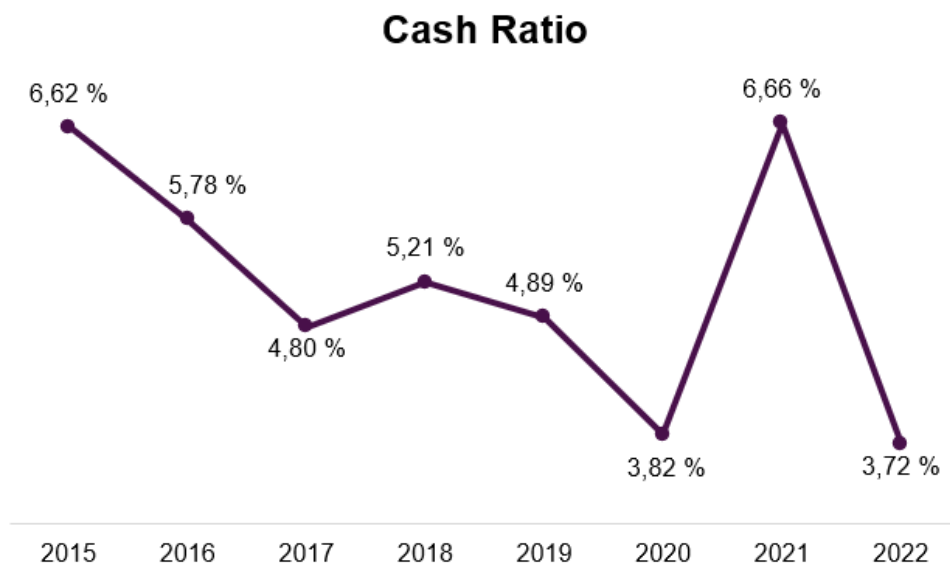


Glencore's current ratio has been 1 or above for the past eight years and indicates therefore an ability to pay off current obligations.

4.2.2 Cash ratio

The cash ratio is a ratio that calculates to what degree the short-term obligations can be payed off solely through cash and cash equivalents.

Figure 12: Glencore plc: Historic development of Cash Ratio 2015 - 2022



As seen from the data above, Glencore's ability to pay off all its short-term obligations with only cash and cash equivalents is rather limited. At most, the company could pay off 6.66% of its short-term obligations with its cash and cash equivalents. The company could therefore benefit from having more cash on hand, but throughout the firm's existence it has shown its ability to pay off short-term debts with the cash it generates. We are therefore not worried about Glencore's liquidity for either the short- or long-term.

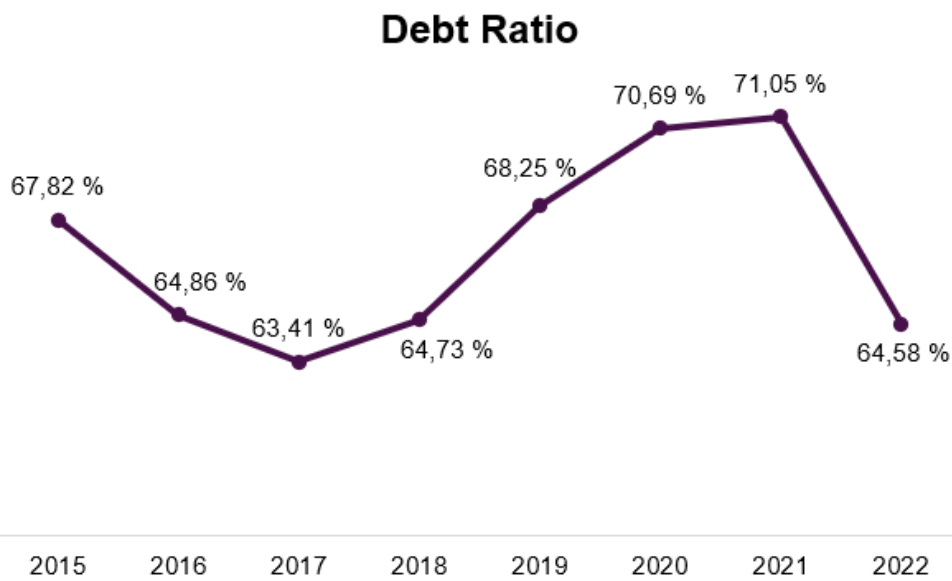
4.3 Financing and solvency

By analyzing the financing and solvency of the company, we get an insight into how they have acquired and used capital in recent years. To get a grasp of the firm's solvency and financing, we have decided to look at the debt ratio, the debt-to-equity ratio and the interest coverage ratio.

4.3.1 Debt ratio

The debt ratio shows how much of the company's assets are financed by debt.

Figure 13: Glencore plc: Historic development of Debt Ratio 2015 - 2022

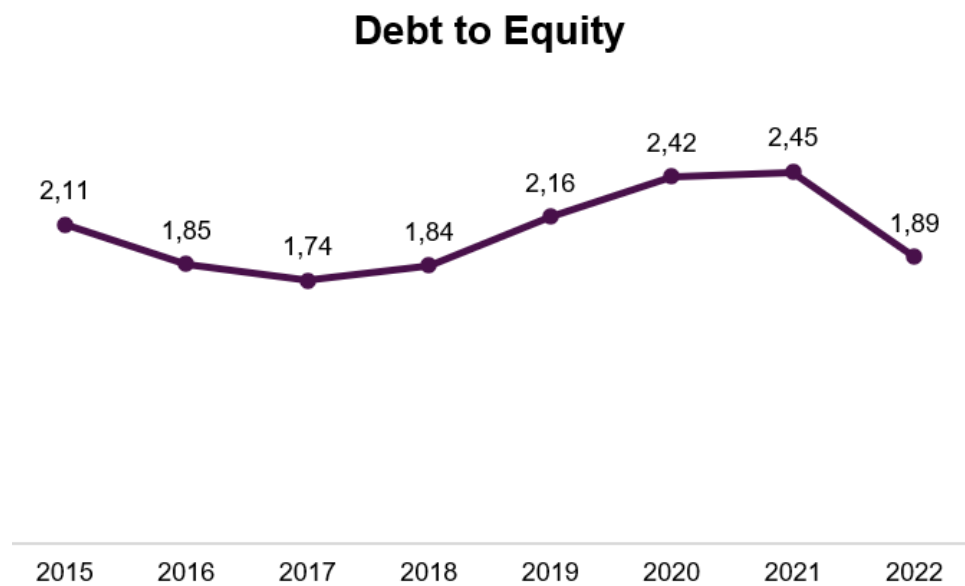


For the past eight years, the average debt ratio has been 66.92%. This simply means that most of Glencore's assets are financed by debt and not equity. As a measure of the company's solvency, it indicates that the debt-load may get overbearing and that they may have issues in the future with getting new loans from banks, or that the interest that they must pay on new loans will be rather high. Furthermore, we see that the debt ratio has been rather stable in the period.

4.3.2 Debt-to-equity ratio

From the debt ratio section, we deduced that the firm's debt level is larger than the equity level. How much larger can be illustrated through a debt-to-equity ratio.

Figure 14: Glencore plc: Historic development of Debt-to-Equity ratio 2015 - 2022

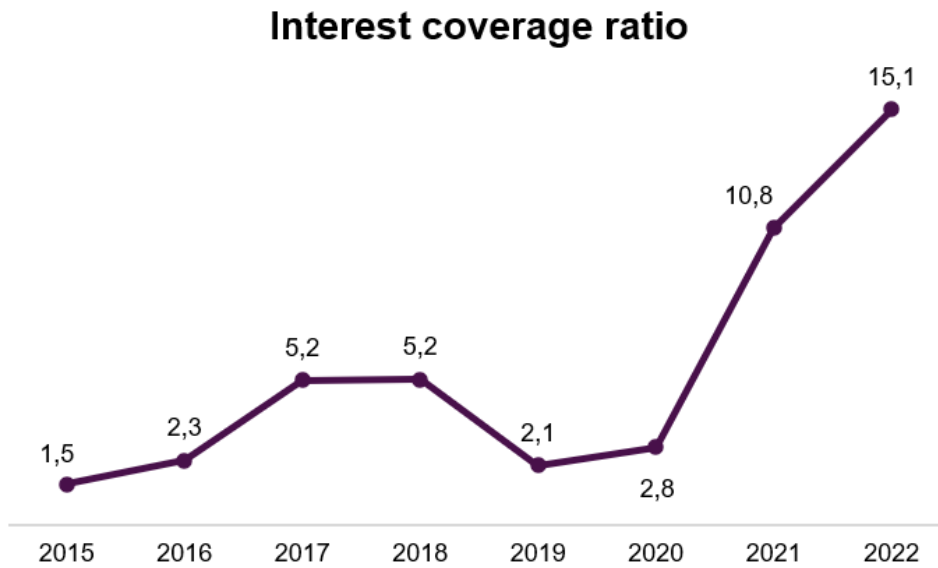


In the period, the average debt to equity ratio was 2.06. This means that on average, the firm's liability level is twice the size of the firm's equity level. As we mention earlier, this can make it harder to get new loans, but as they have survived this high debt situation for quite some time and have been able to pay off interest expenses as they arise, this will not drastically affect the firm unless their ability to pay interest expenses is dramatically decreased. As the need for cobalt increases, and with the current high coal prices, this is not likely to be an issue in the near future.

4.3.3 Interest coverage ratio

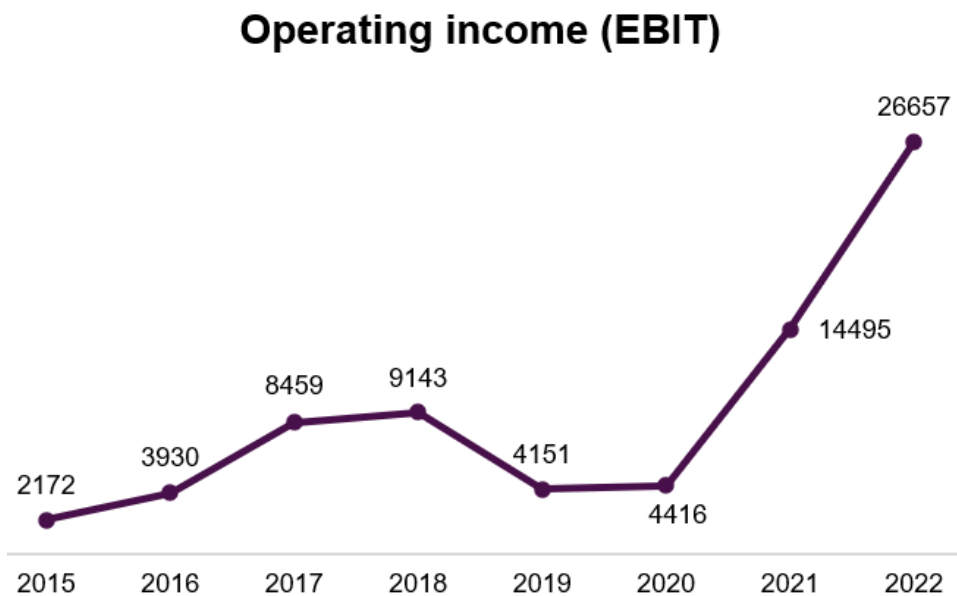
A central part in understanding a company's solvency and ability to stay afloat is its ability to pay interest expenses as they come. Companies go bankrupt due to their inability to pay off their debts when they are due, which means that this metric must have a satisfactory positive value.

Figure 15: Glencore plc: Historic development of the Interest coverage ratio 2015 - 2022



In the period measured, the average interest coverage ratio is 5.6, which means that Glencore's operating income, or EBIT as it is also called, has on average been 5.6 times as large as their interest expense. As a rule of thumb, an interest coverage ratio of less than 1.5 is too low and should be tried fixed. From the data above, we see that Glencore has only been in this range in 2015 but has had no problem afterwards. Therefore, based on this metric, Glencore has a satisfactory ability to pay off debtors' demands, and is not in any way at risk of bankruptcy.

Figure 16: Glencore plc: Historic development of the Operating income (EBIT) 2015 - 2022



We also see that the ratio has strengthened as the years have gone by. The main reason for this is the dramatic increase in operating income in the period, while the interest expense has remained basically unchanged in the same period.

4.4 Discussion on key figures

When discussing the key financial figures and their implications for a firm, it is useful to know how the firm's peers score on the same metrics. We have therefore calculated a mean value for some of the key metrics we have discussed above.

Before we discuss Glencore's economic situation in comparison to their peers, we need to emphasize the fact that no firm is completely the same, and most of Glencore's competitors mine iron and other metals and minerals that Glencore does not mine. This creates a different economic situation, as these materials and minerals have different prices and costs than coal, copper, cobalt and the like. We can't therefore compare with a total degree of certainty and relevancy.

Firstly, Glencore's profitability is not that great when compared to their peers on other metrics except ROIC. It is obvious that recent increases in the price of coal have drastically improved the ROE, ROA and ROIC of the firm, but they do not impress when compared to peers. The average ROA for comparable companies for 2022 was 14.55% while Glencore had 12.7%. Furthermore, Glencore had a pretax ROA of 3.1% over the past five years, while their peers got an average of 15.24% in the same period. Glencore did, however, achieve a higher return on their equity, with their 33.42% ROE compared to the competitors' 28.5%. On a five-year basis, however, the firm achieved an average of 11% compared to 21.72% among the comparable companies. But the most important metric of profitability is the return on invested capital, the ROIC. Glencore achieved 33.8% compared to peers' 25.31%.

Secondly, when looking at peers' current ratio and cash ratio, we see that Glencore is lagging when it comes to liquidity as well. The average current ratio and cash ratio for peers is respectively 2.02 and 66.96% compared to Glencore's 1.29 and 3.72%. Based on these measures, the firm is not as liquid as the competitors, and the firm may need to implement different measures to boost their liquidity.

Lastly, Glencore is more leveraged than their competitors, and therefore their interest coverage ratio is significantly lower than other similar firms. The average debt ratio amongst

their peers is 34.35%, and the average interest coverage ratio is 48.62 compared to Glencore's' 64.58% and 15.1 This leads us to conclude that Glencore's solvency is not as good as their competitors'.

4.5 Summary

The conclusion on the financial statement analysis is that Glencore for the past five years has had worse profitability than their peers for the past five years, but better in 2022 due to higher coal prices. Their liquidity is worse than their peers and so is their solvency. The firm's economic situation can be improved by, among other ways, reducing their costs through implementing new technologies as mentioned in the strategic analysis, which would improve cash flows and in turn lead to better solvency and profitability while strengthening the firm's equity through higher retained earnings, if they chose not to give it to shareholders through dividends or share buybacks.

5. Free Cash Flow Projections

In this thesis we will project cash flows based on a top-down projection structure, i.e., we will commence the projection at the top with prediction of revenues. From there we will move on to projection of operating costs and other relevant items. This will then be utilized to calculate EBITDA, EBIT, and finally free cash flow.

5.1 Forecast period

When computing a discounted cash flow projection, choosing a suitable forecast period for the projected cash flows is important. If one were to have sound future financial information for a company in perpetuity, this would indicate that one could determine a company's true intrinsic value with high certainty. However, forward-looking financial information in real life contains high uncertainty and is often solely limited to the few upcoming years.

Therefore, a lot of assumptions must be made. A forecast period should reflect the number of years where somewhat reasonable assumptions can be made.

Our chosen forecast period is eight years (2023-2030). We deem this a suitable forecast period since these are the years when the European Union's "Fit for 55" climate plan takes

place, affecting the prices of commodities essential in the execution of the “Green Deal”. Anything beyond this period is merely a guess, and we choose to assume a growth rate in perpetuity subsequently.

5.2 Revenue

We choose to forecast Glencore’s revenues based on the bottom-up forecasting method. This is a forecasting method where sales volumes are multiplied with prices to arrive at revenue (Corporate Finance Institute, 2022). We view this as the superior forecasting method given that the company already provides production guidance for the years 2023-2025.

One of the major drawbacks to using a bottom-up forecasting method to forecast revenues is that our prognoses are extremely sensitive to changes in both produced volumes and realized prices. Seeing as the company already reports volume guidance, the potential for our production forecasts being inaccurate is lower. Unlike the production volumes, spot prices are extremely volatile and unpredictable. This weakens the soundness of our analysis and increases the need for a sensitivity analysis that analyses the impact different commodity prices have on the company’s intrinsic value.

Since the company produces a wide scope of commodities under various production assets, creating a revenue forecast is rather complex. Despite this, we create a forecast where we consider each commodity separately.

5.2.1 Industrial Revenues

5.2.1.1 Industrials - Production Assumptions

Since there is a lot of uncertainty related to future production, we create three different production scenarios, a base case scenario, a “bear” case scenario, and a “bull” case scenario. The mentioned scenarios take into account our most grim outlook, our brightest outlook, and a neutral outlook to Glencore’s future production.

5.2.1.1.1 Base case production

Our production assumptions for the years 2023-2025 are derived from Glencore’s official production guidance, and for the years exceeding the guidance years we either base our

production estimates on an average of the preceding years or on the last year of the guidance period.

Table 4: Glencore plc: Base case production 2021 - 2030

		2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Production		Actual		Guidance			Our base case estimates				
Copper	kt	1,195	1,058	1,040	1,060	1,045	1,048	1,048	1,048	1,048	1,048
Cobalt	kt	31	44	38	60	60	60	60	60	60	60
Zinc	kt	1,118	939	950	950	890	930	930	930	930	930
Nickel	kt	102	108	112	123	123	123	123	123	123	123
Ferrochrome	kt	1,468	1,488	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310
Coal	mt	103	110	110	110	110	110	110	110	110	110
Gold	koz	818	752	740	740	740	740	740	740	740	740
Silver	moz	31.5	23.8	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2
Lead	kt	222	192	229	229	229	229	229	229	229	229
Oil E&P	mdbl	5.3	6.1	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9

5.2.1.1.2 Bear case production

The bear case production scenario considers a scenario in which production is missed by 5% in the next three fiscal years. Production in the preceding years is then derived from either an average of the years 2023-2025 or from the production in the last year in the guidance period.

Table 5: Glencore plc: Bear case production 2021 - 2030

		2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Production		Actual		Guidance (miss by 5%)			Our bear case estimates				
Copper	kt	1,195	1,058	988	1,007	993	996	996	996	996	996
Cobalt	kt	31	44	36	57	57	57	57	57	57	57
Zinc	kt	1,118	939	903	903	846	884	884	884	884	884
Nickel	kt	102	108	106	117	117	117	117	117	117	117
Ferrochrome	kt	1,468	1,488	1,245	1,245	1,245	1,245	1,245	1,245	1,245	1,245
Coal	mt	103	110	105	105	105	105	105	105	105	105
Gold	koz	818	752	703	703	703	703	703	703	703	703
Silver	moz	31.5	23.8	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2
Lead	kt	222	192	218	218	218	218	218	218	218	218
Oil E&P	mdbl	5.3	6.1	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7

5.2.1.1.3 Bull case production

The bull case production scenario considers a copper “supercycle” in which copper prices rise beyond \$12,000/t and trigger large scale investments in production facilities. This is a scenario described in 2022 investor presentation, where Glencore Chief Executive Officer, Gary Nagle, says that once they see that the 50 million-tonne copper deficit they forecast is real, they will commence these large-scale investments (Nagle G., 2022, p. 4).

The “bull case”-scenario incorporates an increase in copper prices that sets of a series of brown- and greenfield investments that raises the copper production to 2,000 kt, thereby increasing the production of other relevant byproducts like zinc, cobalt, gold and silver (Nagle G. 2022, p. 13).

Table 6: Glencore plc: Bull case production 2021 - 2030

		2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Production		Actual		Guidance			Our bull case estimates				
Copper	kt	1,195	1,058	1,040	1,060	1,045	2,000	2,000	2,000	2,000	2,000
Cobalt	kt	31	44	38	60	60	90	90	90	90	90
Zinc	kt	1,118	939	950	950	890	1,023	1,023	1,023	1,023	1,023
Nickel	kt	102	108	112	123	123	123	123	123	123	123
Ferrochrome	kt	1,468	1,488	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310
Coal	mt	103	110	110	110	110	110	110	110	110	110
Gold	koz	818	752	740	740	740	888	888	888	888	888
Silver	moz	31.5	23.8	19.2	19.2	19.2	25.9	25.9	25.9	25.9	25.9
Lead	kt	222	192	229	229	229	229	229	229	229	229
Oil E&P	mbbl	5.3	6.1	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9

5.2.1.2 Industrials - Price Assumptions

There exists an abundance of methods that can be used to forecast commodity prices. Our price assumptions are based on future contracts on the various commodities, and our thoughts on different macroeconomic factors that affect the commodities. A future contract is “a legal agreement to buy or sell a particular commodity asset, or security at a predetermined price at a specified time in the future” (Hayes, 2021b).

Using future contracts to forecast commodity prices is often considered flawed. However, a 2004 paper published by the International Monetary Fund (IMF) argues that future prices “can provide reasonable guidance about likely developments in spot prices over the longer term, at least in directional terms” (Bowman and Husain, 2004, p. 13). Due to future prices’ strong directional guidance for commodity price forecasts, we find it reasonable to use future prices in combination with our judgments as basis for the commodity price prediction. As mentioned in the strategic analysis section, the bargaining power of customers is significant due to Glencore’s products’ interchangeability; if the company sells a commodity above the spot price, they will not be able to sell the commodity because the customer can just purchase it from another competitor. Therefore, we base our price estimations on expected market prices and do not assume that the company sells commodities at price discounts or premiums.

5.2.1.2.1 Base case prices

We base our base case prices on a combination of the commodity futures on the 24th of March and on our own judgments. For most of the commodities, we use futures, but for Cobalt and Copper, we estimate higher prices than the futures. This is because these are the commodities we believe will be the most affected by an increased production of electric vehicles.

Table 7: Glencore plc: Base case prices 2021 - 2030

		2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Prices		Actual		Our base case estimates							
Copper	\$/t	9 320	8 805	8 580	8 802	9 621	9 907	9 517	8 918	8 876	9 053
Zinc	\$/t	3 005	3 475	2 975	2 870	2 690	2 635	2 674	2 728	2 783	2 838
Lead	\$/t	2 202	2 147	2 050	2 098	2 088	2 088	2 050	2 050	2 050	2 050
Nickel	\$/t	18 474	25 623	23 350	27 185	27 995	28 915	29 348	29 935	30 534	31 144
Gold	\$/oz	1 799	1 802	2 003	1 947	2 054	2 091	2 131	2 159	2 196	2 240
Silver	\$/oz	25	22	24	24	25	25	26	26	27	27
Cobalt	\$/lb	24	30	17	19	28	42	46	45	42	41
Ferrochrome	¢/lb	113	106	103	101	104	106	108	110	112	114
Coal Newcastle	¢/lb	137	360	208	172	151	136	124	116	104	94
Coking coal	\$/t	221	364	308	282	254	187	165	160	143	129
Oil price	\$/bbl	71	99	71	67	65	63	61	60	60	60

5.2.1.2.2 Bear case prices

For the bear case prices we assume 5% lower commodity prices in 2023 and 10% lower for the years 2024-2030. For cobalt we assume prices slightly higher than the normal cobalt price levels in the years before 2020.

Table 8: Glencore plc: Bear case prices 2021 - 2030

		2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Prices		Actual		Our bear case estimates							
Copper	\$/t	9 320	8 805	8 151	7 922	8 659	8 916	8 565	8 026	7 988	8 148
Zinc	\$/t	3 005	3 475	2 826	2 583	2 421	2 372	2 407	2 455	2 504	2 554
Lead	\$/t	2 202	2 147	1 948	1 888	1 879	1 879	1 845	1 845	1 845	1 845
Nickel	\$/t	18 474	25 623	22 183	24 467	25 196	26 024	26 413	26 941	27 480	28 030
Gold	\$/oz	1 799	1 802	1 903	1 850	1 952	1 986	2 024	2 051	2 086	2 128
Silver	\$/oz	25	22	23	21	22	23	23	24	24	25
Cobalt	\$/lb	24	30	16	17	17	21	21	21	21	21
Ferrochrome	¢/lb	113	106	97	91	93	95	97	99	101	103
Coal Newcastle	¢/lb	137	360	197	154	128	109	99	93	83	75
Coking coal	\$/t	221	364	293	254	216	150	132	128	114	103
Oil price	\$/bbl	71	99	67	62	65	63	61	59	58	56

5.2.1.2.3 Bull case prices

Our bull case price scenario is one where copper prices increase beyond \$12,000/t and Glencore invests in production facilities that can increase output to 2,000 kt copper (Glencore, 2023b, p. 19). Our bull case scenario incorporates cobalt prices that are 5% higher than the base case in 2023 and 20% higher in the preceding years. For all other commodities, we use a price that is 5% higher than the base scenario in 2023 and then 10% for the rest of the years.

Table 9: Glencore plc: Bull case prices 2021 - 2030

		2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Prices	Actual	Our bull case estimates									
Copper	\$/t	9 320	8 805	9 009	10 122	13 469	15 851	15 226	13 377	12 426	11 769
Zinc	\$/t	3 005	3 475	3 124	3 157	2 959	2 899	2 942	3 001	3 061	3 122
Lead	\$/t	2 202	2 147	2 153	2 308	2 297	2 297	2 255	2 255	2 255	2 255
Nickel	\$/t	18 474	25 623	24 518	29 904	30 795	31 807	32 283	32 928	33 587	34 259
Gold	\$/oz	1 799	1 802	2 103	2 142	2 260	2 300	2 344	2 375	2 416	2 464
Silver	\$/oz	25	22	26	26	27	28	28	29	29	30
Cobalt	\$/lb	24	30	18	22	34	50	56	54	50	49
Ferrochrome	¢/lb	113	106	108	112	114	116	118	121	123	126
Coal Newcastle	¢/lb	137	360	218	189	166	150	137	128	115	103
Coking coal	\$/t	221	364	323	310	279	206	182	176	157	142
Oil price	\$/bbl	71	99	74	73	71	69	70	70	70	70

5.2.2 Marketing revenues

While predicting revenues in the industrials segment is relatively straightforward, predicting revenues in the marketing segment is more challenging. Glencore reports marketing volumes sold, but not commission per unit sold or any similar measure. Commodity marketing is somewhat complex, and each trade or deal's structure is often dependent on the situation. The company does not provide any forward-looking guidance either, which makes revenue prediction of this segment somewhat difficult. We decide to base the revenue prediction on other, alternative statistical methods.

Upon creating a regression model comparing both the copper spot price to the metals and minerals segment's revenue for every half year between 2015 and 2022, and the Brent oil price to the energy products segment's revenue, we discover that the relationships between the two are correlated. The relationship between the copper price and metals and minerals marketing revenues has an R-squared value of 0.5659, which indicates that the copper price explains 56.59% of the variance in revenues in the metals and minerals marketing segment. When copper prices rise, the metals and minerals marketing revenues also increase. The same holds true for the relationship between Brent oil spot price and revenue in the energy products marketing division, that has an R-squared of 0.6596 after removing the extreme period of H2 2021 that saw oil prices reach an average of 133 per barrel of oil equivalent.

Figure 17: Glencore plc: Correlation analysis 1

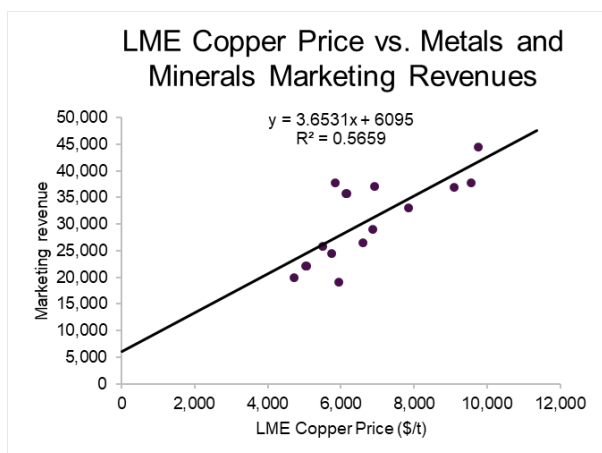
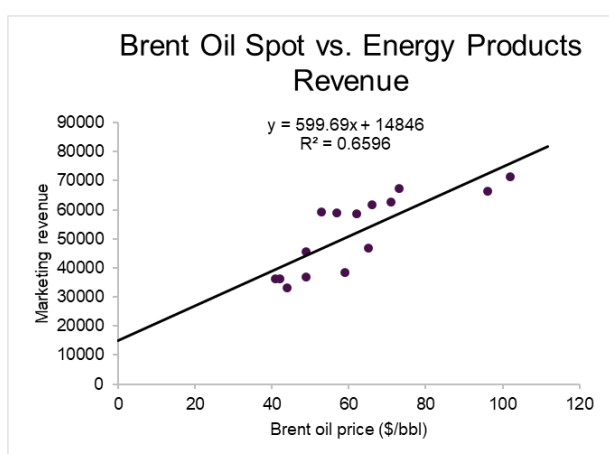


Figure 18: Glencore plc: Correlation analysis 2



Since both the relationships are correlating, we choose to base the future revenues on these regression models. We also include an extra element in the formula to capture the effect of inflation.

- $y_1 = (6,095 + 3.6531 \cdot \text{Copper price}) \cdot \text{Cumulative Inflation (2\%)}$
- $y_2 = (14,846 + 599.69 \cdot \text{Oil price}) \cdot \text{Cumulative Inflation (2\%)}$

Table 10: Glencore plc: Marketing segment - Revenue forecast 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Marketing segment - Revenue forecast										
Metals and Minerals	74 727	77 382	74 877	78 423	86 250	90 197	88 897	85 818	87 192	90 433
Energy Products	107 037	137 720	108 567	107 844	108 433	109 249	110 116	111 491	113 721	115 995
Sum	181 764	215 102	183 444	186 268	194 683	199 446	199 013	197 309	200 913	206 428

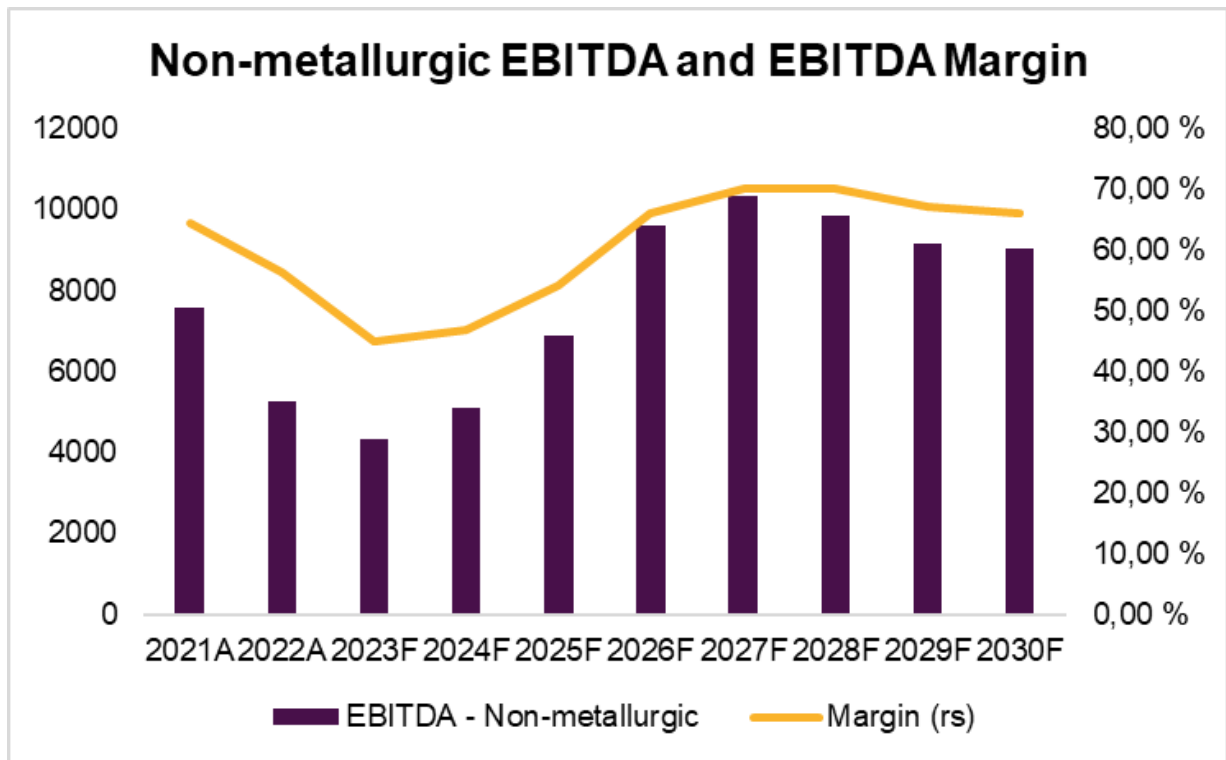
5.3 Cost of goods sold

Due to Glencore's diversity in their commodity portfolio, forecasting the cost of goods sold is no easy task. The cost forecasts are based on a mix of both average EBITDA margins and average unit costs adjusted for expected inflation, in addition to royalties paid in several segments.

5.3.1 Copper assets

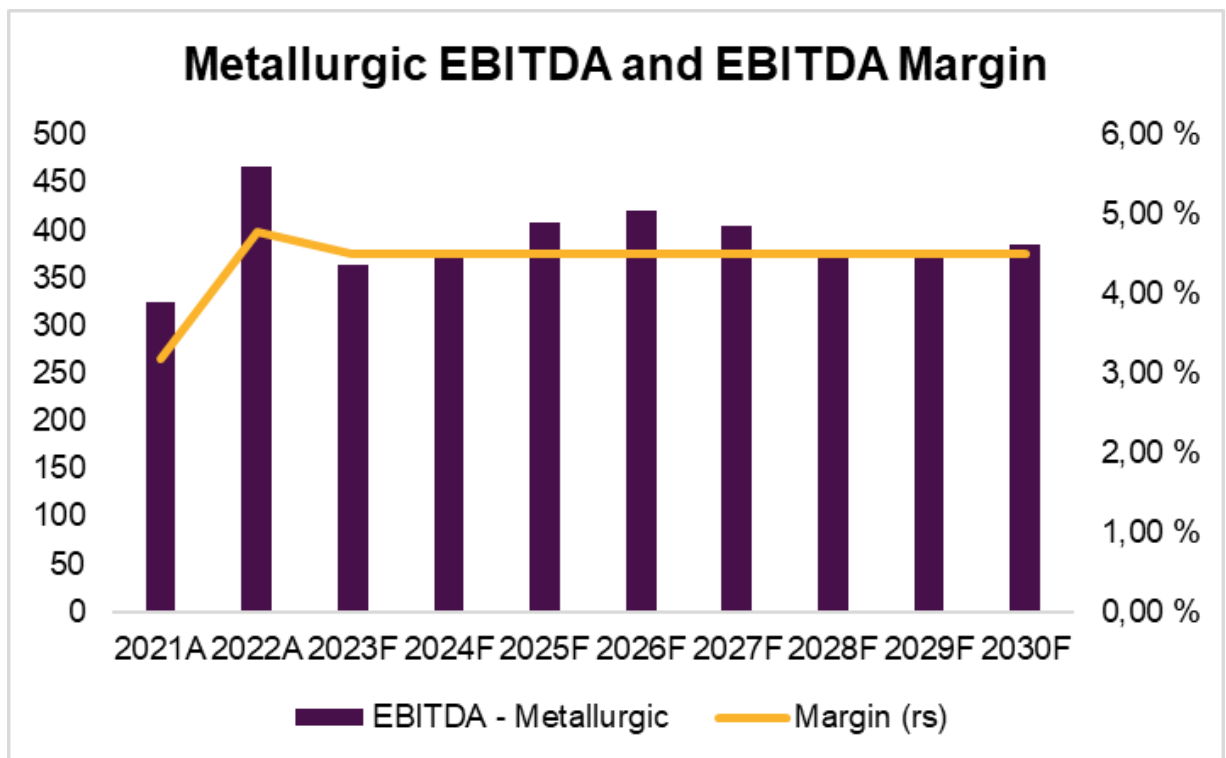
The copper assets segment is split between two different commodity mixes, metallurgical and non-metallurgical metals. The copper assets produce non-metallurgical and metallurgical copper, but also several byproducts from the mining process like cobalt, gold, silver, and zinc. Estimating a definite unit cost is therefore time-consuming and inconvenient. One could estimate an average EBITDA margin from former years, but this would not capture the EBITDA margin increase that occurs when commodity prices increase. For production assets where the commodity prices are relatively stable, we assumed that the EBITDA margins remain constant. We expect stable prices for all commodities that are mined under the copper production assets, except for cobalt. To incorporate the changes in cobalt prices and get an accurate EBITDA margin, every percentage increase in price from a predetermined baseline of \$45,000/t is multiplied with the cobalt revenue when cobalt prices are \$45,000/t and added to the average historical EBITDA margin of 45.02%.

Figure 19: Glencore plc: Non-metallurgic EBITDA and EBITDA Margin 2021 - 2030



For the metallurgic copper we use the historical EBITDA margin of 4.51%.

Figure 20: Glencore plc: Metallurgic EBITDA and EBITDA Margin 2021 - 2030



After calculating the EBITDA, we can compute the cost of goods sold.

Table 11: Glencore plc: Copper assets COGS 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Copper assets COGS										
COGS - Non-metallurgic	4 193	4 076	5 282	5 798	5 824	4 957	4 422	4 216	4 468	4 642
COGS - Metallurgic	9 861	9 302	7 719	7 919	8 656	8 913	8 562	8 024	7 986	8 145
Sum - Cost of goods sold	14 054	13 378	13 001	13 717	14 480	13 871	12 984	12 240	12 453	12 787

5.3.2 Zinc assets

Since all price assumptions for the various commodities under the zinc production assets have stable price outlooks, we assume an EBITDA margin like the historical average of 21.02% for non-metallurgical metals and 3.99% for the metallurgical metals.

Table 12: Glencore plc: Zinc assets COGS 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Zinc assets COGS										
COGS - Non-metallurgic	7 775	7 954	4 873	4 805	4 725	4 820	4 828	4 827	4 887	4 973
COGS - Metallurgic	3 964	4 133	2 645	2 577	2 441	2 400	2 421	2 461	2 501	2 543
Sum - Cost of goods sold	11 739	12 087	7 517	7 382	7 166	7 219	7 249	7 288	7 388	7 516

5.3.3 Nickel assets

Similar to that of the zinc assets, all the commodities produced under the nickel production assets have a stable price outlook, and we therefore assume the historical EBITDA margin of 27.87% to persist.

Table 13: Glencore plc: Nickel assets COGS 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Nickel assets COGS										
Sum - Cost of goods sold	1 948	2 630	2 225	2 834	3 018	3 234	3 309	3 337	3 356	3 405

5.3.4 Ferroalloys and Platinum Group Metals (PGMs)

The metals included in the ferroalloys and platinum group metals segment have a stable price outlook and we implement a historical EBITDA average to calculate the future cost of goods sold.

Table 14: Glencore plc: Ferroalloys and PGMs COGS 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Ferroalloys and PGMs COGS										
Sum - Cost of goods sold	1 684	1 677	1 725	1 715	1 747	1 782	1 818	1 854	1 891	1 929

5.3.5 Coal assets

In both Australia and South Africa, where Glencore mines most of their coal, there are laws put in place to ensure that the countries' inhabitants receive a fair share of the countries' natural resources. Any mining company operating in these areas must pay a percentage share of their revenue or EBIT as royalties.

In Australia, there are different royalty payment structures within the various states of the country. For instance, in New South Wales there is a revenue-based royalty where every miner must pay a fixed percentage depending on their method of coal extraction (New South Wales Government, 2022). For open mines, underground mines, and deep underground mines, the mining companies must pay a fixed percentage of respectively 8, 7, or 6 percent of their revenues in royalty fees. In Queensland, there is a progressive coal royalty rate that varies with the miners' realized coal prices (Queensland Government, 2023). Up to coal prices of \$100, miners must pay a royalty of 7%. For coal sold between \$100 and \$150 there is an additional royalty fee of 12.5%, for coal sold between \$150 and \$175 there is an additional royalty fee of 15%, between \$175 and \$225 an additional royalty fee of 20%, between \$225 and \$300 an additional royalty fee of 30%, and when coal prices are above 300, the marginal royalty fee is 40%.

In South America, the royalty rate for unrefined coal can be computed by dividing the EBIT by the total revenue times 9, and then adding .5% (South African Revenue Service, 2021, p. 17).

To find historical cost per kilogram coal produced, we have to calculate historical royalty rates, and then we divide the total costs excluding royalties by the volume of coal produced. For Australian-produced coal, we use the average unit cost of the last two fiscal years and then multiply this by what we expect the inflation rate to be. For coal produced in South America, we use the last fiscal year average unit cost and then multiply this by the expected inflation. Lastly, for coal produced in Colombia, we use the inflation-adjusted average of the cost per kg coal produced from 2021. The unit cost for 2022 deviates substantially from the average cost, possibly due to the weather challenges and community blockade, mentioned in the 2022 Preliminary Report (Glencore, 2023d, p. 24).

Table 15: Glencore plc: Coal assets 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Coal assets										
Australia - Coking coal:										
Royalties	211	291	656	545	440	239	191	181	152	131
Cost of production	805	818	805	827	837	846	854	863	872	880
Unit cost	59	64	65	67	68	69	69	70	71	71
Royalty percentage	10,69 %	11,80 %	17,27 %	15,64 %	14,05 %	10,37 %	9,39 %	9,20 %	8,65 %	8,23 %
Sum costs	1 016	1 109	1 461	1 372	1 278	1 085	1 046	1 044	1 024	1 011
Australia - Thermal coal:										
Royalties	512	1 492	1 229	859	722	644	593	538	481	432
Cost of production	3 194	3 988	3 835	3 940	3 989	4 029	4 069	4 110	4 151	4 193
Unit cost	52	65	62	64	65	66	66	67	67	68
Royalty percentage	7,33 %	8,83 %	9,62 %	8,15 %	7,79 %	7,67 %	7,75 %	7,51 %	7,51 %	7,47 %
Sum costs	3 706	5 480	5 064	4 799	4 711	4 673	4 662	4 648	4 633	4 625
South Africa - Thermal coal:										
Royalties	29	147	227	137	86	50	19	12	11	10
Cost of production	896	965	1 343	1 379	1 397	1 411	1 425	1 439	1 453	1 468
Unit cost	45	59	63	64	65	66	66	67	68	68
Royalty percentage	1,97 %	5,29 %	5,31 %	3,88 %	2,78 %	1,77 %	0,73 %	0,50 %	0,50 %	0,50 %
Sum costs	925	1 112	1 570	1 517	1 483	1 460	1 444	1 451	1 464	1 478
Colombia - Thermal coal:										
Cost of production	320	1 784	648	666	674	681	688	695	702	709
Unit cost	41	91	44	45	46	46	47	47	48	48
Sum costs	320	1 784	648	666	674	681	688	695	702	709
Other (buy-in) eliminations	865	1 961	993	910	863	830	802	784	756	733
Sum - cost of goods sold	6 850	11 559	9 737	9 264	9 009	8 730	8 641	8 622	8 579	8 556

5.3.6 Oil assets

Glencore's oil assets can be divided into E&P and refining assets. Since these are different activities, we must divide them, and compute the cost of goods sold by segment. E&P, or exploration and production, is the upstream part of oil activities, and to compute the costs, we have chosen to calculate an historical average per oil equivalent produced. According to our calculation this is \$32.6 per barrel of oil equivalent.

Table 16: Glencore plc: Oil E&P assets 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Oil E&P assets										
Sum - Cost of goods sold	65	223	127	127	127	127	127	127	127	127
p/boe	12,32	36,37	32,56	32,56	32,56	32,56	32,56	32,56	32,56	32,56

The refining assets make money by transforming crude oil into suitable products for other consumers. To calculate the sum of the cost of goods sold we have simply, as for some of the other commodities, assumed a historical EBITDA margin. Which for the refining assets equal 1.13 %. This segment is in other words a low margin part of Glencore's core business units.

Table 17: Glencore plc: Oil refining assets 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Oil refining assets										
Sum - Cost of goods sold	6 751	8 961	6 203	5 852	5 666	5 508	5 358	5 265	5 265	5 265
EBITDA margin	2,15 %	-1,25 %	1,13 %	1,13 %	1,13 %	1,13 %	1,13 %	1,13 %	1,13 %	1,13 %

5.3.7 Marketing

The marketing business is divided into metals and minerals as well as energy. To calculate the cost of goods sold in this segment we have used a combination of historical EBIT-margin, in addition to a forecast for the depreciation (in section 5.5) to arrive at the correct EBITDA-margin. When we have this, we can simply find the cost of goods sold by subtracting EBITDA from the revenues. This gives us the following tables below.

Table 18: Glencore plc: Marketing: metals and minerals 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Metals and minerals										
Sum - Cost of goods sold	72 139	75 688	72 658	76 127	83 732	87 557	86 289	83 291	84 618	87 757
EBITDA Margin	3,46 %	2,19 %	2,96 %	2,93 %	2,92 %	2,93 %	2,93 %	2,94 %	2,95 %	2,96 %
EBIT Margin	3,34 %	2,12 %	2,87 %	2,87 %	2,87 %	2,87 %	2,87 %	2,87 %	2,87 %	2,87 %
% of PP&E	9,78 %	5,87 %	11,98 %	9,56 %	6,81 %	7,38 %	7,29 %	7,29 %	7,29 %	7,29 %

Table 19: Glencore plc: Marketing: energy 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Energy										
Sum - Cost of goods sold	105 208	132 162	105 426	104 948	105 536	106 300	107 120	108 431	110 570	112 749
EBITDA	1,71 %	4,04 %	2,89 %	2,69 %	2,67 %	2,70 %	2,72 %	2,74 %	2,77 %	2,80 %
D&A	1,30 %	3,78 %	2,52 %	2,52 %	2,52 %	2,52 %	2,52 %	2,52 %	2,52 %	2,52 %
EBIT	45,16 %	39,02 %	72,25 %	39,73 %	28,31 %	30,66 %	30,28 %	30,30 %	30,32 %	30,31 %

5.4 Other costs

In other costs we include the expenses that are not a part of the cost of goods sold, but still a part of the operating expenses. This includes selling and administrative expenses, interest expenses and other expenses. When doing an enterprise valuation, the forecast of interest expenses is strictly speaking not necessary, because we calculate the unlevered free cash flow. However, we would like to calculate forward multiples, such as price to earnings. Multiples based on earnings require the deduction of interest expenses.

The selling- and administrative expenses, as well as the other expenses are calculated as a historical percentage of sales. To forecast the interest expenses, we use the interest rate multiplied by the borrowings for the year.

Table 20: Glencore plc: SG&A expenses: 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
SG&A										
Sum - Expenses	2 115	2 430	1 864	1 870	1 934	1 972	1 956	1 928	1 943	1 979
SG&A % of sales	1,04 %	0,95 %	0,82 %	0,82 %	0,82 %	0,82 %	0,82 %	0,82 %	0,82 %	0,82 %

Table 21: Glencore plc: Other expenses: 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Other										
Sum - Expenses	2 133	1 276	1 232	1 236	1 279	1 303	1 293	1 274	1 284	1 308
Other expenses % of sales	1,05 %	0,50 %	0,54 %	0,54 %	0,54 %	0,54 %	0,54 %	0,54 %	0,54 %	0,54 %

Table 22: Glencore plc: Interest expenses: 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Interest										
Sum - Expenses	1 348	1 771	1 927	1 924	1 921	1 516	1 286	1 167	1 138	1 077

5.5 Depreciation and amortization (D&A)

For the depreciation and amortization, we choose to base the forecast on a historical percentage of property, plant and equipment. We believe that the company will have a similar depreciation schedule as they move forward. Again, we divide the company's operations into industrial activities and marketing, and furthermore into different asset groups.

For the industrial activities, we first calculate the aggregated depreciation as a percentage of property plant and equipment. Then we divide the D&A to its different assets. To find the appropriate distribution, we look at how it's typically been historically, and assume a similar distribution.

Table 23: Glencore plc: Depreciation Industrials 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Depreciation										
Copper Assets	1 901	2 257	2 002	1 988	1 977	1 987	2 059	2 129	2 166	2 169
% of D&A	30,17 %	32,29 %	34 %	34 %	34 %	34 %	34 %	34 %	34 %	34 %
Zinc Assets	1 366	1 424	1 105	1 098	1 092	1 097	1 137	1 175	1 196	1 197
% of D&A	21,68 %	20,37 %	19 %	19 %	19 %	19 %	19 %	19 %	19 %	19 %
Nickel Assets	506	394	458	455	453	455	472	488	496	497
% of D&A	8,03 %	5,64 %	8 %	8 %	8 %	8 %	8 %	8 %	8 %	8 %
Aluminium/Alumina	1	1	3	3	3	3	3	3	3	3
% of D&A	0,02 %	0,01 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Ferroalloys & PGMs	115	116	108	107	107	107	111	115	117	117
% of D&A	1,83 %	1,66 %	2 %	2 %	2 %	2 %	2 %	2 %	2 %	2 %
Iron Ore	0	0	0	0	0	0	0	0	0	0
% of D&A	0,00 %	0,00 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Coal assets	2 165	2 537	1 926	1 913	1 902	1 912	1 981	2 048	2 084	2 086
% of D&A	34,37 %	36,29 %	33 %	33 %	33 %	33 %	33 %	33 %	33 %	33 %
E&P assets	110	128	147	146	145	146	151	156	159	159
% of D&A	1,75 %	1,83 %	3 %	3 %	3 %	3 %	3 %	3 %	3 %	3 %
Oil Refining assets	76	75	41	41	41	41	42	44	45	45
% of D&A	1,21 %	1,07 %	1 %	1 %	1 %	1 %	1 %	1 %	1 %	1 %
Corporate and Other	60	58	48	47	47	47	49	51	52	52
% of D&A	0,95 %	0,83 %	1 %	1 %	1 %	1 %	1 %	1 %	1 %	1 %
Industrial Activities	6 300	6 990	5 867	5 828	5 795	5 825	6 035	6 239	6 350	6 357
% of PP&E	0	0	0	0	0	0	0	0	0	0

We have a similar approach for marketing assets. However, this is a segment that has had large variation year over year in depreciation. We use the guidance for 2023 and 2024 and a historical average for the years to come. This amounts to 30% for the energy assets and 7% for the metals and minerals.

Table 24: Glencore plc: Depreciation Marketing 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Energy										
Sum - Depreciation	434	359	400	201	258	294	340	393	455	526
Depreciation % of PP&E	45 %	39 %	54 %	27 %	30 %	30 %	30 %	30 %	30 %	30 %
Metals and minerals										
Sum - Depreciation	94	54	66	42	38	46	52	59	67	77
Depreciation % of PP&E	10 %	6 %	12 %	10 %	7 %	7 %	7 %	7 %	7 %	7 %

5.6 Net Working Capital (NWC)

The net working capital of a firm is calculated by subtracting the current liabilities, without the current debt, from the current assets, without the cash and cash equivalents. A change in net working capital therefore shows a change in cash. An increase in NWC means that operating assets have increased, while operating liabilities have not increased or not increased as much. This equals a decrease in cash, and a decreased NWC equals an increase in cash. Nonetheless, an increased NWC will positively affect the liquidity risk of the company.

When calculating the changes in NWC, one must first calculate the values for different current assets in the future. Firstly, we estimate inventories by calculating the average number of days before the inventory is sold and calculating it in relation to the cost of goods sold. We find that the average number of days for 2021 was 111 and we assume that this will continue until 2029. From there, we simply hold the relationship between historic inventories for the two segments – marketing and industrial – constant and assume that this holds true for the foreseeable future.

Secondly, we estimate the account receivables by finding the average number of days from the credit sale until they get paid, and then predicting the account receivables in the future on the basis of the company's revenue. We estimate the number of days to be 74 and assume that this holds true until 2029.

Lastly, on the current liabilities side, we estimate the accounts payable in the future. In the same way with inventories and account receivables, we calculate the average number of days from Glencore buys something on credit till they pay for it. We find that the average number of days was 99 and used this with the cost of goods sold to find the accounts payable.

Table 25: Glencore plc: Changes in net working capital 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Changes in net working capital										
Increase in accounts receivable	-5 888	-4 942	-1 795	493	910	328	-242	-870	-705	-571
Increase in inventories	-5 660	-5 035	-3 031	910	1 187	323	-226	-706	-572	-463
Increase/(decrease) in accounts payable	6 423	-3 292	-2 693	808	1 055	287	-201	-627	-508	-411
Total working capital changes	-5 125	-13 269	-7 519	2 211	3 152	937	-668	-2 202	-1 784	-1 445

5.7 Capital Expenditures (CapEx)

To maintain its business for the years to come, Glencore must invest in different assets. We call this capital expenditures, or “CapEx” for short. We divide the capital expenditures into sustaining and expansionary capex. The company has a clear guidance for capital expenditures for their different asset groups until 2025. For the rest of the forecast period, we assume a historical percentage of property plant and equipment.

If we look at the aggregated numbers for the industrial activities this adds up to 7.4 % for the sustaining activities, and 2 % for the expansionary activities.

Table 26: Glencore plc: Capital expenditures Industrials 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Capital expenditures										
Total sustaining CapEx - Industrials	3 546	4 026	4 500	4 500	4 500	5 643	5 848	5 598	5 143	4 647
Total expansionary CapEx - Industrials	877	781	1 100	1 100	1 100	1 555	1 611	1 542	1 417	1 280
Total CapEx - Industrials	4 423	4 807	5 600	5 600	5 600	7 198	7 459	7 141	6 559	5 927

The company do not divide their capital expenditures from their marketing assets into sustaining and expansionary in their reports. They do, however, have a guidance for the next year, which we have set as a target for the next years as shown in the table below.

Table 27: Glencore plc: Capital expenditures Marketing 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Marketing										
Total CapEx	801	299	100	100	100	100	100	100	100	100

5.8 Free Cash Flow

When we measure profitability, we often use the income statement as a benchmark. There are, however, some items that the income statement fails to address. By complementing the income statement with a calculation of the free cash flow, you get a broader understanding of how much cash is available to the equity and debt investors of a company. The formula for free cash flow is the following:

$$FCF = EBIT * (1 - T_c) + Depreciation - CapEx - \Delta NWC$$

After subtracting tax from the EBIT, we consider that the depreciation is a non-cash cost, and that it will not have a cash flow impact, other than the positive tax-shield effect. Furthermore, capital expenditure is crucial for the business, and their ability to keep on their operations. Lastly, the increase in net working capital will tell us how much the business needs to tie up in operations in the shorter term.

Table 28: Glencore plc: Free cash flow 2021 - 2030

	2021A	2022A	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Free cash flow										
Revenue	203 751	255 984	227 487	228 249	236 080	240 648	238 776	235 304	237 084	241 562
Operating Costs	-182 428	-221 924	-203 071	-206 364	-214 322	-217 846	-216 546	-214 352	-218 019	-223 543
D&A	-6 828	-7 403	-6 304	-6 015	-5 964	-6 033	-6 273	-6 513	-6 665	-6 720
Adjusted EBIT	14 495	26 657	18 112	15 871	15 794	16 769	15 958	14 439	12 400	11 300
Taxes	-3 026	-6 368	-5 223	-4 487	-4 550	-5 033	-4 815	-4 359	-3 701	-3 375
Unlevered net income	11 469	20 289	12 889	11 384	11 244	11 735	11 142	10 080	8 699	7 925
+ D&A	6 335	6 987	6 304		5 964	6 033	6 273	6 513	6 665	6 720
- Increase in NWC	-5 125	-13 269	-7 519	2 211	3 152	937	-668	-2 202	-1 784	-1 445
- CapEx	4 708	4 690	5 700	5 700	5 924	7 496	7 816	7 544	7 018	6 449
Unlevered free cash flow	18 221	35 855	21 013	9 488	8 132	9 335	10 268	11 252	10 130	9 641

Looking at the table above we see a clear trend for the years to come. Much of the company's value is created in the shorter term, as the unlevered net income is greater for the year of 2023 compared to the rest of the forecast period. The unlevered free cash flow is also substantially greater in 2023, due to a release of net working capital.

6. Weighted average cost of capital - WACC

When valuing a company using its future cash flows, we need to consider that money received tomorrow is worth less than money received today. To reflect this, an important part of the valuation is estimating the cost of capital. This is what the investor of the company would expect to earn when investing in businesses with similar risk. We call this the weighted average cost of capital - as we need to consider both the equity and debt holders of the company. The main components of the weighted average cost of capital are the cost of equity, cost of debt and the capital structure.

$$WACC = \frac{E}{V} * k_e + \frac{D}{V} * k_d(1 - T_c)$$

Where:

E	Market value of equity
D	Market value of debt
V	Enterprise value
k_e	Cost of equity
$k_d(1 - T_c)$	After tax cost of debt

6.1 The cost of equity

Like most practitioners we choose the CAPM model to calculate the cost of equity. The capital asset pricing model consists of the market return adjusted for specific company risk. We need to compute the following:

$$CAPM = R_f + ERP * \beta$$

Where:

R_f	The risk-free rate
-------	--------------------

ERP	Equity risk premium
β	Beta

6.1.1 The risk-free rate

The risk-free rate should represent an investment with zero default risk. In theory there are no investments with zero default risk, but we can find bonds with as little default risk that it gets negligible. When estimating the risk-free rate, we must bear in mind where the investors come from. Glencore's main shareholders are insiders, institutions and general investors. The company is listed on the London stock exchange and therefore many of the investors are based in the United Kingdom. Furthermore, Ivan Glasenberg, the former CEO of Glencore is the main shareholder, which means that the investors are spread across Europe. Therefore, we use the European Central bank's calculations for the European area. They calculate this measure by looking at government bonds with triple A credit ratings in Europe. This calculation amounts to a yield of 2.32 % (ECB, 2023). A drawback from using the CAPM model is that we assume that the risk-free rate remains constant over the forecast period, which may not be the case.

6.1.2 ERP

When you are invested in equities, you take on a substantially higher risk than bonds. The equity risk premium is a quantitative measure of how much more risk you will be exposed to by being invested in the market. In our estimation of the equity risk premium, we use NYU Stern professor Aswath Damodaran's measures (Damodaran, 2022, page 57). However, we use an operation-based computation, where we weigh the different risk premiums in the different continents that Glencore does business in. (Damodaran, 2022, page 59)

Table 29: Glencore plc: Equity risk premium for each continent

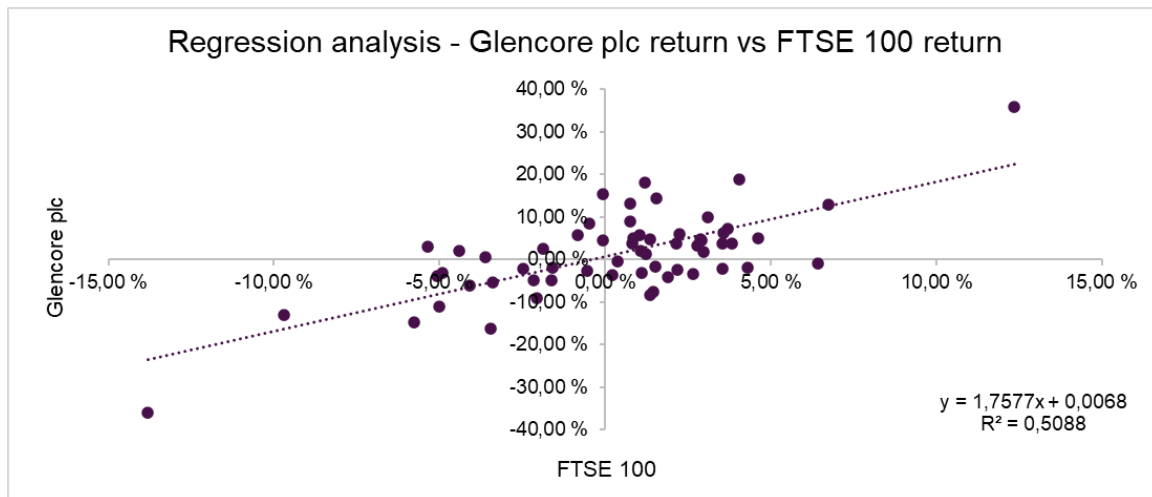
Continent	Average exposure	Continent ERP	Weight
America	18 %	8 %	1,45 %
Europe	33 %	6 %	1,95 %
Africa	3 %	15 %	0,44 %
Asia	40 %	6 %	2,53 %
Oceania	5 %	4 %	0,21 %
Total			6,57 %

6.1.3 Beta

Once we have an estimation for both the risk-free rate and the risk premium, we estimate how sensitive Glencore is to the general market portfolio. This can be done mathematically by

doing an OLS regression with the company and a suitable market index. This is an approximation because we cannot observe the whole market portfolio. Our estimation is based on 60 datapoints of monthly returns for the last five years. We use this period since our forecast is based on strategic and financial statement analysis for the last five years. The slope of the regression line or the beta of the company equals 1.76.

Figure 21: Regression analysis - Glencore plc return vs FTSE 100 return



Using the beta as a proxy for risk can be problematic as it is a backward looking metric and can be influenced by events that will not be repeated. At first glance the beta looks quite high. However, Glencore has some leverage that affects the company’s earnings sensitivity. If we divide the beta by the debt-to-equity ratio we arrive at an unlevered beta of 1.15. This seems reasonable for a mining company, just above the industrial average range 0.9-1.0 (McKinsey, 2020, p. 321).

Mathematical computation is also something to keep an eye on while calculating the beta. If you look at the output of the regression, it clearly has a substantial standard deviation. With a confidence interval stretching from 1.3 to 2.2 we cannot be confident that we have found the “true” beta for the company. We handle this uncertainty by adding a sensitivity analysis after the valuation.

Table 30: Glencore plc: Regression Statistics and ANOVA table

Regression Statistics	
Multiple R	0,713325977
R Square	0,508833949
Adjusted R Square	0,500365569
Standard Error	0,07038604
Observations	60

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	0,297679414	0,297679414	60,08633746	1,59939E-10
Residual	58	0,287343292	0,004954195		
Total	59	0,585022705			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	0,006832545	0,009108736	0,75010903	0,456221191	-0,011400571	0,025065662	-0,011400571	0,025065662
X Variable 1	1,757675396	0,226751833	7,751537748	1,59939E-10	1,303782286	2,211568505	1,303782286	2,211568505

6.1.4 CAPM summary

Taking each element into account we arrive at a cost of equity of 13.88 %.

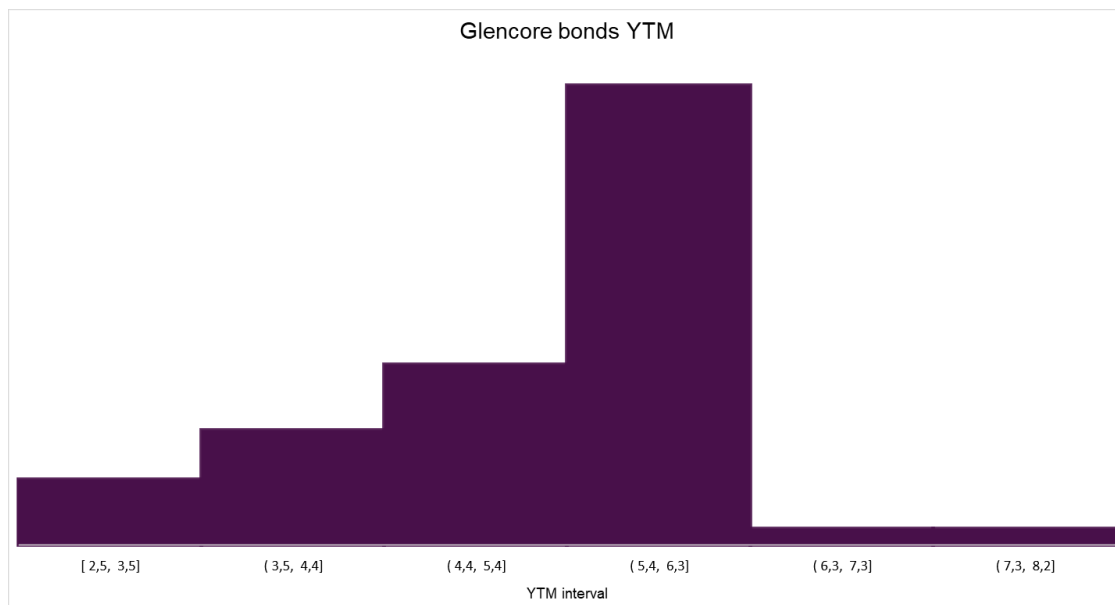
Rf	2,32 %
Equity risk premium	6,57 %
Beta	1,76
Cost of equity	13,88 %

6.2 After tax cost of debt

To estimate the cost of debt we choose to calculate the yield to maturity on the company's long-term bonds (Mckinsey, 2020, page 328). As this is a promised yield to the investors it is only an approximation to the cost of debt since there exists some form of default risk.

However, the company's bond rating is BBB+ (Glencore, 2023g), so we conclude that the default risk does not make a dramatic difference between the promised and expected yield.

Figure 22: Glencore plc: Glencore bonds YTM



This histogram illustrates the range of yield on Glencore’s different bonds. We calculate the weighted average based on the market value of the bonds the company has issued. By doing this we get a yield to maturity, or a cost of debt of 5.35 %.

Glencore’s debt is tax deductible, and we need to incorporate this in the cost of debt. Glencore applicable tax rate is 30 %. We arrive at the current after-tax cost of debt by multiplying the weighted yield to maturity by (1-tax).

6.3 Capital structure

After computing the cost of equity and the cost of debt, we adjust the current capital structure. We measure both the equity and debt in market values.

6.3.1 Market value of equity

To find the market value of equity we simply multiply the number of outstanding shares by the current stock price. As of the 24th of March 2023, this amounts to a market capitalization of \$56.9 billion.

6.3.2 Market value of debt

The calculation of the market value of the debt is a bit more complicated. The company specifies its borrowings in book values. However, we want to know how much the market would have paid for the entire debt. A way to obtain this is to take the book value and treat the entire debt as a bond (Damodaran, 2023a). By using the interest expense, the cost of debt,

and the weighted average maturity, we arrive at the correct market value by using this formula:

$$I * \left(\frac{1 - \frac{1}{(1 + k_d)^T}}{k_d} \right) + \frac{BV}{(1 + k_d)^T}$$

Where:

I	Interest expense
k_d	After tax cost of debt
T	Weighted average maturity
BV	Book value of debt

Table 31: Glencore plc: Market value of debt

Cost of debt	5,35 %
Weighted avg maturity	6,187019774
Interest expense	1 771 000 000
Total debt	28 777 000 000
Market value of debt	29 974 357 279

WACC – summary

By weighing the cost of debt and cost of equity with its contribution to the capital structure the weighted average cost of capital is 10.38%.

Table 32: Glencore plc: WACC summary

WACC	10,38 %
Rf	2,32 %
Equity risk premium	6,57 %
Adjusted beta	1,76
Cost of equity	13,88 %
Tax	30,00 %
Rd	5,35 %
Cost of debt after tax	3,74 %
Market value of debt	29 974 357 279
Market value of equity	56 905 761 530
E/V	65,50 %
D/V	34,50 %

7. Valuation

After a thorough analysis of the company's ability to be profitable, we begin to look at the company's valuation. In our analysis we look at both the relative and absolute valuation of the company, by carrying out three different types of valuation. For the relative valuation we look at the company's multiples in relation to comparable companies. For the absolute valuation we do both a discounted cash flow analysis and a multiple based sum of the parts. Taking different scenarios into account we start with our base case estimates and wrap up with the bull and bear case.

7.1 Multiple analysis

A multiple analysis can be useful to carry out to provide insight on how "expensive" a company is by both looking at comparable companies. We wish to see how the market values assets of comparable nature. There are several multiples you can use to get an idea of this, that both have their strengths and weaknesses. While multiple analysis seems simple, there are several aspects that an investor needs to be aware of to not make decisions based on the wrong basis. Theoretically, valuation is done by looking into the future, so we look at the forward multiples of the company.

7.1.1 Price multiples

The price multiples are used to see how much we pay for each financial metric we get. The equity investor has a claim to the earnings of a company, and therefore a much-used price multiple is price to earnings (P/E). A comparison of historical P/E can be a good measure, as we get an insight into how much we get in earnings for each dollar invested. We compute the P/E ratio for Glencore and other mining companies for the next couple of years.

Table 33: Glencore plc: Forward multiples P/E - select competitors 2023 - 2025

	Market Cap (\$m) Last Close	23F	P/E 24F	25F
Forward multiples - Select competitors				
Glencore PLC	56 906	5,67	6,33	6,07
		6,03	6,78	7,57
Metals and mining peers:				
Anglo American PLC	33 948	7,41	7,92	8,17
Rio Tinto PLC	88 918	8,68	9,23	8,43
Antofagasta PLC	14 955	24,56	20,82	21,69
BHP Group Ltd	147 743	9,62	9,86	11,54
Vale SA	67 409	5,21	5,63	5,29
Boliden AB	10 384	10,07	10,29	9,95
South32 Ltd	12 584	8,11	7,31	6,85
Metals and mining - Mean		10,52	10,15	10,27
Metals and mining - Median		8,68	9,23	8,43
Marketing peers:				
Bunge Ltd	14 083	7,97	8,53	8,17
Archer-Daniels-Midland Co	41 863	11,16	11,51	11,31
Valero Energy Corp	47 547	5,51	7,89	9,72
Marketing - Mean		8,21	9,31	9,73
Marketing - Median		7,97	8,53	9,72

The table represents our estimates and analyst consensus in yellow and white, respectively. At first glance, Glencore's forward multiples seem cheap. They trade in the low end of the price to earnings ratio, being considerably below the median and average. Nevertheless, it is not a surprise that the company is trading on a discount compared to peers based on several factors. The coal business is an important part of the contribution to Glencore's earnings. This segment may not have the growth potential going forward as the other assets. Hence, the investors value other companies at a higher P/E ratio. Some investors may also be worried that the company will continue to have trouble with litigations in the future, taking the company's history into account. Still, we believe that the company looks cheap based on the price to earnings ratio.

We also need to be aware that when we look at comparable companies the P/E does not take the company's capital structure into consideration. A company with much debt may look cheap based on price to earnings, but not while taking the debt into account. Therefore, we supplement with enterprise multiples. Glencore has a considerable amount of debt, which may result in a different view of the comparable valuation.

7. 1. 2 Enterprise multiples

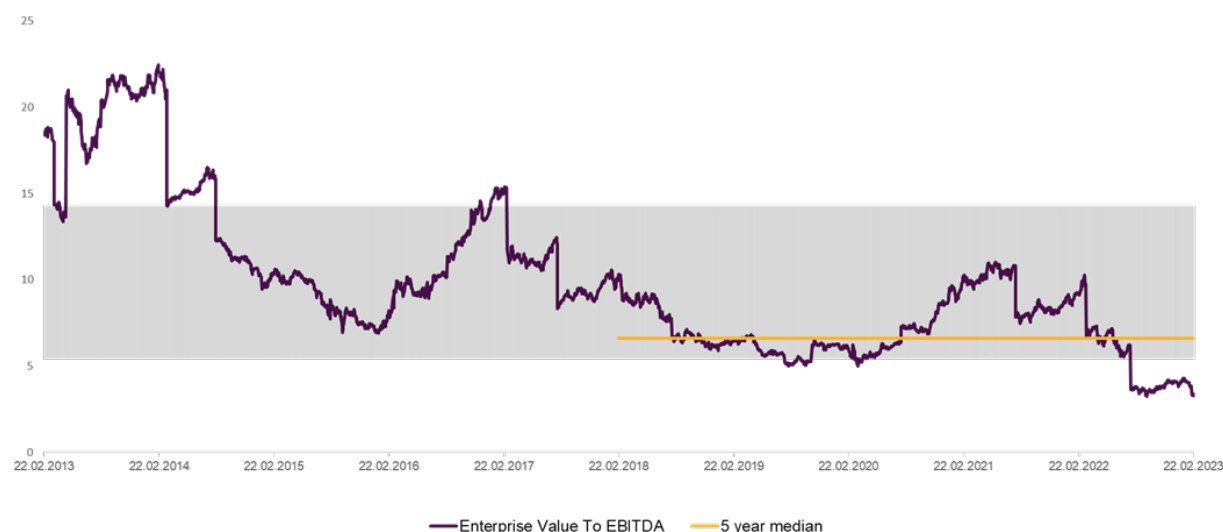
The enterprise value is the combination of the company's equity and debt. In other words, a combination of market capitalization and the market value of debt. For comparable companies, this gives a better insight since it takes debt into account. A question, however, is which denominator we should use. In our analysis we use EBITDA, as these are financial metrics that are available to all investors, not just the equity holders.

Table 34: Glencore plc: Forward multiples EV/EBITDA - select competitors 2023 - 2025

	EV/EBITDA		
	23F	24F	25F
Forward multiples - Select competitors			
Glencore PLC	3,80	4,24	4,26
	3,83	4,22	4,58
Metals and mining peers:			
Anglo American PLC	3,99	4,15	4,22
Rio Tinto PLC	4,84	4,93	4,90
Antofagasta PLC	7,03	6,31	5,97
BHP Group Ltd	5,14	5,16	5,71
Vale SA	3,52	3,72	3,71
Boliden AB	5,27	5,33	5,06
South32 Ltd	4,23	4,03	3,98
Metals and mining - Mean	4,86	4,80	4,79
Metals and mining - Median	4,84	4,93	4,90
Marketing peers:			
Bunge Ltd	5,82	6,26	6,31
Archer-Daniels-Midland Co	8,61	9,01	9,28
Valero Energy Corp	3,91	5,29	6,27
Marketing - Mean	6,11	6,85	7,28
Marketing - Median	5,82	6,26	6,31

The company does still look cheap when taking the debt into account. We can also supplement the table with a chart of historical valuation. While Glencore delivered a record high EBITDA due to the soaring coal demand because of the Ukraine war, investors are pricing its EBITDA on an all-time low compared to enterprise value.

Figure 23: Glencore plc: EV/EBITDA 2013-2023



7.2 Multiple-based sum of the parts (SOTP)

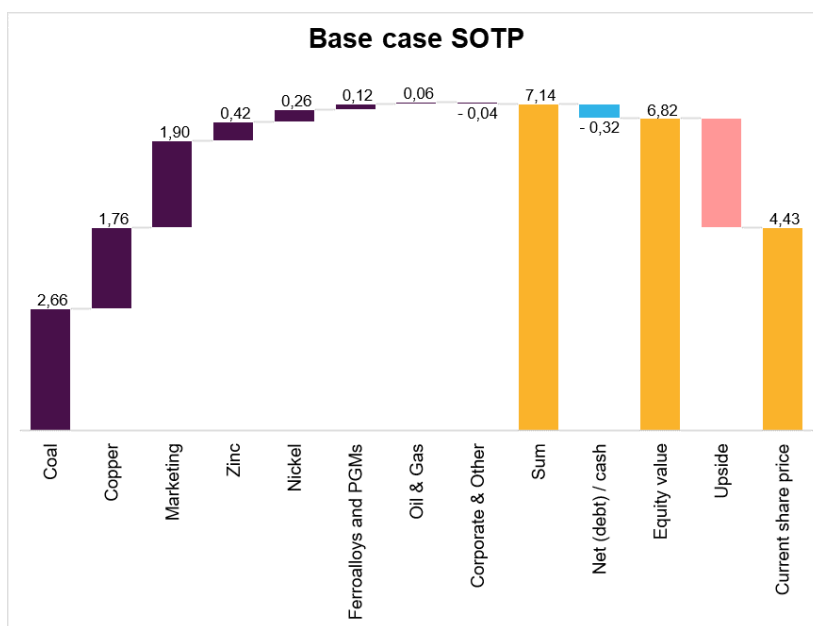
A sum of the parts (SOTP) valuation is a valuation method where one values each segment of a business separately. If the economics of a company's segments are different, valuing each segment separately and adding them up to estimate the value of the company will generate more insight (McKinsey, 2020, page 391). Since Glencore has such a large number of business segments, we wish to value the corporation based on a SOTP valuation, in addition to a traditional top-down discounted cash flow analysis. The analysis is multiple based, meaning that we attach an EV/EBITDA multiple to each of Glencore's business segments based on what other similar companies trade for in the market today, e.g., we give the copper assets a specific EV/EBITDA multiple based on the multiples of other copper producing companies, we give zinc assets an EV/EBITDA based on zinc producing peer's, et cetera.

Table 35: Glencore plc: Base case SOTP

EBITDA NTM	USDm	Multiple	Enterprise value (£)	GBP/sh
Copper assets	4 690	5,8x	22 240	1,76
Zinc assets	1 406	4,6x	5 255	0,42
Nickel assets	860	4,6x	3 234	0,26
Ferrous alloys and PGMs	515	3,6x	1 494	0,12
Coal	13 660	3,0x	33 507	2,66
Oil & Gas	220	4,0x	718	0,06
Corporate & Other	-605		-496	-0,04
Marketing	5 052	5,8x	23 957	1,90
Sum	25 796	3,5x	89 909	7,14
Net (debt) / cash			-4 018	-0,32
Equity value			85 891	6,82
Upside				53,9 %

The copper assets, in conjunction with the marketing business will have the highest multiples while valuing the segments. As highlighted in the strategic analysis, copper plays an important role in the production of renewable energy sources and is therefore valued on higher EV to EBIDTA. We want to underline that the valuation of the marketing business along with the peer group is a conservative measure, as we believe an important part of the competitive advantage of the company lies in the integration between the production and logistics, as it provides a valuable insight. However, being conservative in the valuation gives us some margin of safety.

Figure 24: Glencore plc: Base case SOTP – illustration



Furthermore, the biggest contributor to the valuation of the company is the coal assets. These assets are valued at the lowest exit multiple, as we do not see coal production as a segment with longevity and since the competitors trade at low multiples as well. We do, however, believe that the energy demand for the next year will drive the global coal demand to relatively high volumes, and therefore be a big contributor to the enterprise value of the company.

7.3 Discounted free cash flow

The discounted cash flow is the theoretically correct way to evaluate a company's worth. It is flexible since we can take different scenarios into account while trying to estimate the valuation of the company. Trying to address different scenarios for the company's future is

important, since the quality of the DCF is based upon the assumptions made. In our case we forecast a bull, bear and base case scenario.

7.3.1 Perpetuity growth model

Since our projections only lasts until 2030, we need to estimate the terminal value. As we get further into the forecast, it gets harder to estimate the cash flows with certainty. While in the sum of the parts we used an exit multiple to calculate the value until infinity, we use another approach for the DCF. Here, we use the perpetual growth model. This model assumes that the company will grow at a constant rate, and we simply get the terminal value by dividing last year's cash flow by the discount rate minus the growth rate. Choosing an appropriate growth rate can be difficult, as the valuation is sensitive to small changes in growth.

By setting the growth close to the real domestic product rate, we assume that the company will grow in line with the overall economy. However, we choose a perpetual growth rate of 2 % in our analysis. This is a bit lower than the domestic growth rate. The reason for this lies in our forecast, as we believe that a considerable amount of the company's value lies in coal production, which we do not see as a long-term asset. Based on this, and assumptions stated earlier in the thesis, we arrive at the following base case scenario.

Table 36: Glencore plc: base case scenario - PV of cash flows

Date of cash flow	31.12.2023	31.12.2024	31.12.2025	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	Terminal
Exponent	0,8	1,8	2,8	3,8	4,8	5,8	6,8	7,8	7,8
Discount Factor	1,08	1,19	1,32	1,45	1,60	1,77	1,96	2,16	2,16
Free cash flow	21 013	9 488	8 132	9 335	10 268	11 252	10 130	9 641	117 349
Present value of cash flows	19 448	7 953	6 176	6 423	6 400	6 352	5 181	4 467	54 376

When using the unlevered free cash flow in the, we are essentially computing the cash available to all investors. Hence, by adding the present value of the cash flow from the forecast period, in addition to the terminal value, we arrive at the enterprise value.

Table 37: Glencore plc: Enterprise value

PV of terminal value	54 376
PV of forecast period cash flows	62 401
Enterprise value	116 777

7.3.2 Enterprise to equity value

The enterprise value is the intrinsic value of the total enterprise. Our goal with the valuation is to see how much is available to the equity holders of the company. To go from the enterprise value to the equity value, we start by subtracting the total debt. After that we add the liquid assets that can easily be converted into cash. For Glencore this means cash and

cash equivalents and marketable securities. We also choose to add what the company calls readily marketable inventory. Because of the nature of Glencore's marketing business, we believe that this is essentially a cash equivalent since it can easily be liquidated. We do, however, only add 75% of the inventory, to compensate for the difference in liquidity compared to marketable securities.

By completing this calculation, we arrive at the equity value. Glencore reports in US dollars and the share is traded in pounds, therefore we need to divide the equity value by the exchange rate of 1.22.

Table 38: Glencore plc: Equity value in USD and GBP

Enterprise value	116 777
-Debt	28 777
-Non controlling interest	4 191
+Cash, cash equivalents and marketable securities	23 863
Equity value (USD)	107 672
Equity value (GBP)	88 039

7.3.3 Per share value

To complete the final step of the DCF analysis we simply divide the equity value by the number of outstanding shares. By doing this we arrive at a target price of £6.99 compared to the last close of £4.43 the 24th of March. This amounts to an upside of 57.7 %.

Table 39: Glencore plc: Per share value

Equity value (GBP)	88 039
TP (GBP)	6,99
Last close	4,43
<i>Upside</i>	<i>57,7 %</i>

7.3.4 Weighted target price

To be more certain of our analysis we choose to weigh the sum of the parts together with the discounted cash flow analysis. We assign the different analyses with 50 % weight and end up with a weighted target price of £6.9.

Table 40: Glencore plc: Weighted target price

	TP	Weight
DCF	6,99	50 %
SOTP	6,82	50 %
Weighted	6,90	100 %
<i>Upside</i>	<i>55,8 %</i>	

7.4 Sensitivity analysis

As valuation must be seen as a range, and not an absolute, we must consider that some of our estimates may be off by some margin. By incorporating a sensitivity analysis on different parts of the valuation, we can understand how the valuation will change with changes in our estimates. We look at the bear and bull case as discussed earlier, in addition to changes in the beta, the weighted average cost of capital and the terminal growth rate.

7.4.1 Bear case

For the bear case we forecast lower commodity prices and production, in addition to lower exit multiples in the sum of the parts analysis. The exit multiples we choose in this scenario is 20 % lower than the peer groups for the different commodities.

As stated earlier, the bear case assumes 5% lower commodity prices in 2023 and 10% lower for the years 2024-2030. For cobalt we assume prices will be slightly higher than the normal cobalt price levels in the years before 2020. Production is also missed by 5% in the next three fiscal years.

Table 41 Glencore plc: Bear case SOTP

EBITDA NTM	USDm	Multiple	Enterprise value (£)	GBP/sh
Copper assets	4 250	4,6x	16 123	1,28
Zinc assets	1 257	3,7x	3 757	0,30
Nickel assets	776	3,7x	2 335	0,19
Ferrous alloys and PGMs	464	2,8x	1 079	0,09
Coal	11 952	2,4x	23 454	1,86
Oil & Gas	196	3,2x	512	0,04
Corporate & Other	-605		-496	-0,04
Marketing	4 885	4,6x	18 534	1,47
Sum	23 174	2,8x	65 297	5,18
Net (debt) / cash			-4 018	-0,32
Equity value			61 279	4,86
<i>Upside</i>				<i>9,8 %</i>

By weighing the DCF and the SOTP with a weight of 80 % and 20% respectively, we end up with a target price of 3.72 and a downside of 17.6 %.

Table 42 Glencore plc: Bear case weighted equity value

	TP	Weight
DCF	3,45	80 %
SOTP	4,86	20 %
Weighted	3,73	100 %
<i>Upside</i>		<i>-15,8 %</i>

7.4.2 Bull case

Our bull case is driven by a copper “supercycle” for both the prices and production. We also value each segment with a 20% premium compared to the peer group in our bull case sum of the parts. This assumes that the synergies the company gets from an integrated marketing and production business deserves a premium compared to the peer groups.

Table 43 Glencore plc: Bull case SOTP

EBITDA NTM	USDm	Multiple	Enterprise value (£)	GBP/sh
Copper assets	4 924	7,0x	28 022	2,22
Zinc assets	1 444	5,5x	6 475	0,51
Nickel assets	903	5,5x	4 074	0,32
Ferroalloys and PGMs	540	4,3x	1 882	0,15
Coal	14 659	3,6x	43 149	3,42
Oil & Gas	237	4,8x	930	0,07
Corporate & Other	-605		-496	-0,04
Marketing	5 205	7,0x	29 622	2,35
Sum	27 307	4,2x	113 659	9,02
Net (debt) / cash			-4 018	-0,32
Equity value			109 641	8,70
<i>Upside</i>				<i>96,4 %</i>

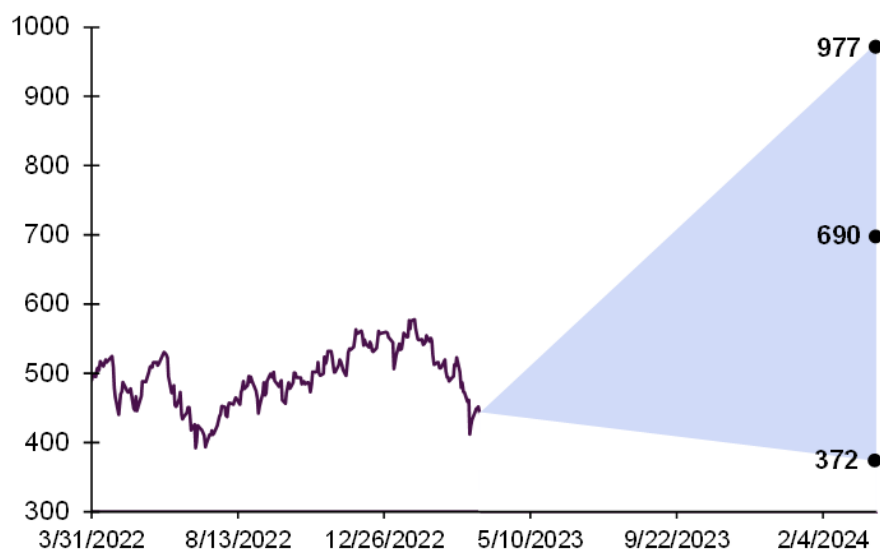
Valuing each segment with 50 % weight we arrive at a target price of 9.77 or an upside of 116 %.

Table 44 Glencore plc: Bull case weighted equity value

	TP	Weight
DCF	10,90	50 %
SOTP	8,70	50 %
Weighted	9,80	100 %
<i>Upside</i>	<i>121,2 %</i>	

To see the spread in intrinsic value with regards to the bear and bull case, we add an illustration of the different scenarios regarding changes in the exit multiple, the production and prices. The different scenarios showcase a substantial upside and a limited downside for the company’s shares.

Figure 25 Glencore plc: Valuation scenarios (pence)



7.4.3 Beta

Because of the way we calculate the systematic risk, we cannot be certain that we have found the “true” beta of the company. Because of this we want to see how the value of Glencore changes within the confidence interval of the beta.

Table 45 Glencore plc: Sensitivity analysis – Beta

Beta	Target price	Upside
1,36	7,75	75 %
1,56	7,28	64 %
1,76	6,90	56 %
1,96	6,59	49 %
2,16	6,33	43 %

The change in beta has some impact on the valuation but does not affect the conclusions we have drawn earlier in the thesis.

7.4.4 Weighted average cost of capital and terminal growth rate

Beta is an important part of the cost of equity, but a small change in beta will have an even smaller effect on the discount rate. We want to see how bigger changes in the weighted average cost of capital affect the valuation. In addition, we want to look at the perpetual growth rate.

Table 46 Glencore plc: Sensitivity analysis – Terminal growth and Wacc

		Terminal growth rate				
		1,00 %	1,50 %	2,00 %	2,50 %	3,00 %
Wacc	6,99 %	7,33	7,59	7,88	8,22	8,61
	9,38 %	6,94	7,16	7,41	7,69	8,02
	9,88 %	6,58	6,77	6,99	7,23	7,50
	10,38 %	6,26	6,43	6,61	6,82	7,06
	10,88 %	5,97	6,12	6,28	6,46	6,66

Again, we see that the sensitivity analysis does not change our conclusions earlier in the thesis, even though it has some impact on the valuation.

8. Discussion - Is the ESG discount justifiable?

What we have found so far is that Glencore's stock is trading at a 52.8% discount to its intrinsic value, in addition to trading at lower multiples than comparable companies.

However, there is an element that has been left out of the discussion until now. As introduced in section 2.5, the company has been involved in an abundance of controversies, mostly related to their unethical practices in Africa in addition to their thermal coal business. This begs the question of whether their discount to industry multiples can be justified or not.

As the company carries a high ESG risk due to unethical practices, this would naturally be reflected in the cost of capital, reducing Glencore's intrinsic value. Investors will be less willing to pay premiums for companies with business segments in decline and litigation risk. Furthermore, since the inverse of the P/E multiple is Gordon's growth formula, the higher cost of capital would imply a lower P/E multiple, in addition to a lower EV/EBITDA.

The company currently trades at a forward EV/EBITDA of 3.8x. This is on par with what other fully integrated coal companies trade at (Damodaran, 2023b). However, Glencore is not solely a coal company and has other business segments that deserve higher multiples. This denotes that the discount potentially cannot be rationalized. Moreover, Glencore's mining operations in Sub-Saharan Africa do not follow the highest ethical standards, which also suggests that the company should trade at a discount. However, we see low risk for drastic interferences by state institutions in Glencore's operations since the commodities they provide are so vital for both the western economy and the green transition. 3 of the metals Glencore produces (cobalt, coking coal, PGMs) are considered critical raw materials by the EU, while copper and nickel are considered strategic raw materials (European Commission, 2023). Furthermore, China is the largest producer of the majority of the commodities EU

considers critical (European Commission, 2023, p. 23). China also accounts for an estimated one-eighth of Africa's industrial output (The Economist, 2022), which indicates that the country has large ownership interests in the continent.

The aforementioned matters point to the fact that anyone interfering too much with Glencore's operations could increase China's influence and ownership in Africa. Brazil, Russia, India, China and South Africa (BRICS in short) are the key producers of most of the materials in the world (European Commission, 2023, p. 23). The last thing the EU, the US and practically the whole Western world wants is for the BRICS countries to gain additional control over the world's raw materials. Additionally, all the comparable companies mentioned throughout this thesis have all been convicted of serious controversies: Anglo American's lead poisoning incident in Zambia, Rio Tinto's destruction of an aboriginal site, Vale's part in the destruction of the Amazon rainforest.

The controversies are many, and we don't believe Glencore should trade at such a discount to its competitors due to this. We do, however, believe the firm should trade at a smaller discount to its non-coal peers due to Glencore's coal exposure. Furthermore, we do not believe the company deserves 30-70% lower multiples than comparable companies. The sensitivity analysis also suggests there is a lot of wiggle room for the WACC before the valuation reaches its current market value. To conclude, although some unethical elements are involved in Glencore's practices, its stock is still undervalued.

9. Conclusion

The purpose of this thesis has been to delve into the valuation of Glencore plc and the acceptable discount due to their history of unethical practices. By performing a strategic analysis of both the internal and external factors, we thoroughly examined the company, and the competitive landscape. By supplementing this with a deliberate financial statements analysis, we had a basis for the free cash flow projections and the computation of the intrinsic and relative valuation. The discussion in the last part of the thesis aims to contemplate any unanswered questions and consider how unethical practices affect valuation, but also how Glencore's operations are necessary to satisfy the demand of critical raw materials.

Our intrinsic valuation, based on a weighted target price of the SOTP and a top-down DCF, resulted in a valuation range from 372 to 977 pence sterling. With a last close of 452, we

conclude that the equity holders have limited downside risk, and a significant upside. The comparable analysis showed that the company is traded at a considerable discount, which cannot be justified based on a history of accusations and litigations, considering Glencore's crucial role in the supply chain of materials and energy products.

List of sources

Anglo American plc (2023) *What we do*. Available at: <https://www.angloamerican.com/about-us/what-we-do> (Accessed: February 14, 2023).

Antofagasta plc (2022) *Annual Report 2021*. Available at: <https://www.antofagasta.co.uk/media/4300/antofagasta-annual-report-2021.pdf> (Accessed: February 15, 2023).

Antofagasta plc (2023) *About us*. Available at: <https://www.antofagasta.co.uk/about-us/> (Accessed: February 15, 2023).

Baffes, J. and Nagle, P. (2022) *Commodity prices surge due to the war in Ukraine - World Bank Blogs*. Available from: <https://blogs.worldbank.org/developmenttalk/commodity-prices-surge-due-war-ukraine> (Accessed: March 21, 2023)

BHP Group (2023a) *Our Businesses*. Available at: <https://www.bhp.com/about/our-businesses> (Accessed: February 14, 2023).

BHP Group (2023b) *Annual Report 2022*. Available at: https://www.bhp.com/-/media/documents/investors/annual-reports/2022/220906_bhpannualreport2022.pdf (Accessed: March 23, 2023)

Biesheuvel, T. (2022) *Glencore Flags That Cash Is Tied Up in Record Trading Profits, Bloomberg*. Available at: <https://www.bloomberg.com/news/articles/2022-07-29/glencore-flags-that-cash-is-tied-up-in-record-trading-profits>

Boliden AB (2023) *Boliden - A world-class metals company*. Available at: <https://www.boliden.com/operations> (Accessed: February 15, 2023).

Bowman, C. and Husain, A. M. (2004) *Forecasting Commodity Prices: Futures Versus Judgment*. Available at: <https://www.imf.org/external/pubs/ft/wp/2004/wp0441.pdf>

Business & Human Rights Resource Centre. (2021). *Transition Minerals Tracker: 2021 Analysis*. Available at: https://media.business-humanrights.org/media/documents/Transition_Minerals_Tracker_Global_analysis.pdf (Accessed: April 14, 2023).

CME Group (2013) *Timeline of CME Achievements*. Available at: <https://www.cmegroup.com/company/history/timeline-of-achievements.html> (Accessed: January 30, 2023).

Corporate Finance Institute (2022) *Bottom-Up Forecasting*. Available at: <https://corporatefinanceinstitute.com/resources/financial-modeling/bottom-up-forecasting/> (Accessed: March 20, 2023).

Damodaran, Aswath (2022) *Estimating country risk premium exposure*. Available at: <https://pages.stern.nyu.edu/~adamodar/podcasts/valspr22/session5slides.pdf>

Damodaran, Aswath (2023a) *Estimating market value of debt*. Available at: https://pages.stern.nyu.edu/~adamodar/New_Home_Page/valquestions/mktvalofdebt.htm (Accessed: March 15, 2023).

Damodaran, Aswath (2023b) *Enterprise Value Multiples by Sector (U.S)*. Available at: https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/vebitda.html

ECB. (2023). *Government bond, nominal, all issuers whose rating is triple A*. Available at: https://sdw.ecb.europa.eu/quickview.doSERIES_KEY=165.YC.B.U2.EUR.4F.G_N_A.SV_C_YM.SR_10Y (Accessed: March 25, 2023).

European Commission (2023) *Study on the Critical Raw Materials for the EU*. Available at: https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en (Accessed: April 13, 2023)

Fernando, J. (2021) *Dojima Rice Exchange*. Available at: <https://www.investopedia.com/terms/d/dojima-rice-exchange.asp> (Accessed: February 6, 2023).

Garside, M. (2023) *Copper mine production worldwide 2010-2022*. Available at: <https://www.statista.com/statistics/254839/copper-production-by-country/> (Accessed: February 15, 2023).

Glencore (2021) *Pathway to net zero – 2021 progress report*. Available at: <https://www.glencore.com/dam/jcr:ad341247-c81e-45b4-899d-a7f32a9d69a0/2021-Climate-Change-Report-.pdf> (Accessed: April 03, 2023).

Glencore (2022) *Annual Report 2021*. Available at: <https://www.glencore.com/.rest/api/v1/documents/ce4fec31fc81d6049d076b15db35d45d/GL-EN-2021-annual-report-.pdf> (Accessed: April 20, 2023).

Glencore (2023a) *2022 Investor Update*. Available at: <https://www.glencore.com/.rest/api/v1/documents/8b6635428cf3e09828ea2d8b79fd0223/2021206+GLEN+Investor+Day+2022.pdf> (Accessed: March 8, 2023).

Glencore (2023b) *2023 BMO Capital Markets – GMMCM Conference*. Available at: <https://www.glencore.com/publications> (Accessed: April 03, 2023).

Glencore (2023c) *Training and awareness*. Available at: <https://www.glencore.com/sustainability/ethics-and-compliance/training-awareness> (Accessed: March 22, 2023).

Glencore (2023d) *Preliminary Results 2022*. Available at: <https://www.glencore.com/.rest/api/v1/documents/7ce9527cb786528b7016cd495780a4af/GL-EN-2022-Preliminary-Results.pdf> (Accessed: March 21, 2023)

Glencore (2023e) *Who we are: At a glance*. Available at: <https://www.glencore.com/who-we-are/at-a-glance> (Accessed: March 21, 2023)

Glencore (2023f) *What we do: Marketing*. Available at: <https://www.glencore.com/what-we-do/marketing> (Accessed: April 13, 2023)

Glencore (2023g) *Debt investors*. Available at: <https://www.glencore.com/investors/debt-investors/> (Accessed: April 17, 2023)

Glencore (2023h) *Sustainability: Our People*. Available at: <https://www.glencore.com/sustainability/esg-a-z/our-people> (Accessed: March 28, 2023).

Glencore (2023i) *Operations and projects*. Available at: <https://www.glencore.com.au/operations-and-projects> (Accessed: March 28, 2023)

Guimarães, F. (2021) Market sees value of up to R\$ 858 billion for Vale on the stock exchange with ore explosion, *CNN Brasil*. Available at: <https://www.cnnbrasil.com.br/business/mercado-ve-valor-de-ate-r-858-bi-para-vale-na-bolsa-com-explosao-do-minerio/> (Accessed: February 15, 2023).

Gunvor Group (2022) *Gunvor Group 2021 Results*. Available at: <https://gunvorgroup.com/news/gunvor-group-2021-results/> (Accessed: February 17, 2023).

Gunvor Group (2023) *Who We Are*. Available at: <https://gunvorgroup.com/who-we-are/> (Accessed: February 17, 2023).

Hayes, A. (2021a) *Commodity Market: Definition, Types, Example, and How It Works*. Available at: <https://www.investopedia.com/terms/c/commodity-market.asp> (Accessed: January 30, 2023).

Hayes, A. (2021b) *Future Contract Definition: Types, Mechanics, and Uses in Trading*. Available at: <https://www.investopedia.com/terms/f/futurescontract.asp> (Accessed: March 8, 2023)

ICAR. (2022). *Accountable for corruption, but not for human rights abuse: the case of Glencore*. Available at: [ccountable for Corruption, But Not For Human Rights Abuse: The Case of Glencore - ICAR](#) (Accessed: April 16, 2023)

IndustriALL Global Union (2020) *Glencore workers in Peru stage indefinite strike over labor abuse*. Available at: <https://www.industriall-union.org/glencore-workers-in-peru-stage-indefinite-strike-against-labor-abuses> (Accessed: March 2, 2023).

IndustriaLL Global Union (2022) *Glencore workers on strike in Canada*. Available at: <https://www.industrialunion.org/glencore-workers-on-strike-in-canada> (Accessed: March 2, 2023).

IndustriaLL Global Union (2021) *Unions address accountability as Glencore prepares to reopen Mutanda mine*. Available at: <https://www.industrialunion.org/due-diligence-in-battery-supply-chains-as-glencore-prepares-to-reopen-mutanda-mine> (Accessed: March 24, 2023)

Kavanagh, M, J. (2022) *Glencore Cobalt Mine Scrutinized as Congo Reviews Deals*, *Bloomberg.com*. Available at: <https://www.bloomberg.com/news/articles/2022-04-22/glencore-cobalt-mine-scrutinized-as-congo-revisits-foreign-deals?leadSource=uverify%20wall>

Kenton, Will (2022) *Human Capital Definition: Types, Examples, and Relationship to the Economy*. Available at: <https://www.investopedia.com/terms/h/humancapital.asp> (Accessed: March 22, 2023)

Koller, T., Goedhart, M., & Wessels, D. (2020). *Valuation: measuring and managing the value of companies*. John Wiley and sons.

Library of Congress (2022) *Commodities Markets and Instruments*. Available at: <https://guides.loc.gov/commodities/markets-instruments> (Accessed: February 6, 2023).

Mercuria (2023a) *About us*. Available at: <https://www.mercuria.com/about-us> (Accessed: February 16, 2023).

Mercuria (2023b) *Our history*. Available at: <https://www.mercuria.com/about-us/our-history> (Accessed: February 16, 2023).

Murphy, A. and Contreras, I. (2022) *The global 2000*, *Forbes*. Available at: <https://www.forbes.com/lists/global2000/?sh=7293377e5ac0>. (Accessed: February 10, 2023)

Nagle, A. (2022). *Edited Transcript – Glencore PLC Investor Day*. Refinitiv.

New South Wales Government (2023) *Lodging your coal royalty return*. Available at: <https://www.revenue.nsw.gov.au/taxes-duties-levies-royalties/royalties/coal> (Accessed: February 28, 2023)

Nichols, S. (2022) Aboriginal cultural heritage protected as NSW rejects Glendell coalmine expansion, *The Guardian*. Available at: <https://www.theguardian.com/australia-news/2022/oct/29/aboriginal-cultural-heritage-protected-as-nsw-rejects-glendell-coalmine-expansion> (Accessed: February 28, 2023)

Peterdy, K. (2023) *PESTEL Analysis*. Available at: <https://corporatefinanceinstitute.com/resources/management/pestel-analysis/> (Accessed: March 1, 2023).

Porter, M. (1979) How Competitive Forces Shape Strategy, *Harvard Business Review*, March-April 1979. Available from: https://asiakas.kotisivukone.com/files/laatuoptimi2013.kotisivukone.com/tiedostot/porter_5c_ompetitive_forces.pdf (Accessed: March 22, 2023).

Queensland Government (2023) *Mineral royalty rates*. Available at: <https://www.business.qld.gov.au/industries/mining-energy-water/resources/minerals-coal/authorities-permits/payments/royalties/calculating/rates> (Accessed: March 12, 2023).

Reuters Staff (2019) *Factbox: Glencore mining fatalities in recent years*. Available at: <https://www.reuters.com/article/us-congo-mining-glencore-fatalities-fact-idUSKCN1TS2RU> (Accessed: March 2, 2023)

RioTinto (2023) *About*. Available at: <https://www.riotinto.com/en/about> (Accessed: February 14, 2023).

South African Revenue Service (2021) *External Guide: Mineral and Petroleum Resources Royalties*. Available at: <https://www.sars.gov.za/wp-content/uploads/Ops/Guides/GEN-GEN-01-G01-Guide-for-Completion-for-Mineral-and-Petroleum-Resources-External-Guide.pdf>

The Climate Council (2022) *The great deluge: Australia's new era of unnatural disaster*. Available at: <https://www.climatecouncil.org.au/resources/the-great-deluge-australias-new-era-of-unnatural-disasters/> (Accessed: March 5, 2023).

The Economist (2022) *The Chinese-African relationship is important to both sides, but also unbalanced*. (20.04.2022). Available at: <https://www.economist.com/special-report/2022/05/20/the-chinese-african-relationship-is-important-to-both-sides-but-also-unbalanced> (Accessed: April 16, 2023)

The Economist Intelligence Unit (2015) *Long-term macroeconomic forecasts - Key trends to 2050*. Available from: https://espas.secure.europarl.europa.eu/orbis/sites/default/files/generated/document/en/Long-termMacroeconomicForecasts_KeyTrends.pdf (Accessed: March 5, 2023)

The Serious Fraud Office of the United Kingdom (2022) *Glencore to pay £280 million for 'highly corrosive' and 'endemic' corruption*. Available at: <https://www.sfo.gov.uk/2022/11/03/glencore-energy-uk-ltd-will-pay-280965092-95-million-over-400-million-usd-after-an-sfo-investigation-revealed-it-paid-us-29-million-in-bribes-to-gain-preferential-access-to-oil-in-africa/> (Accessed: March 6, 2023).

The State of Queensland (2022) *Coal Royalties*. Available at: <https://budget.qld.gov.au/highlights/coal-royalties/> (Accessed: February 28, 2023).

The World Bank Group (2021) *Congo, Dem. Rep.* Available at: <https://climateknowledgeportal.worldbank.org/country/congo-dem-rep/vulnerability> (Accessed: March 6, 2023).

Trafigura Group (2022) *Annual Report 2022*. Available at: <https://www.trafigura.com/brochure/2022-trafigura-annual-report/> (Accessed: February 16, 2023).

United Nations (2022) *World Population Prospects 2022*. Available from: <https://population.un.org/wpp/Graphs/DemographicProfiles/Line/900> (Accessed: March 5, 2023)

University of Notre Dame (2022) *ND-GAIN Country Index*. Available at: <https://gain.nd.edu/our-work/country-index/> (Accessed: March 6, 2023).

US Department of Justice (2022) *Glencore entered guilty pleas to foreign bribery and market manipulation schemes*. Available at: [Glencore Entered Guilty Pleas to Foreign Bribery and Market Manipulation Schemes | OPA | Department of Justice](#) (Accessed: April 14, 2023).

Vale Limited (2023a) *Mining is closer than you think*. Available at: <https://www.vale.com/what-we-do> (Accessed: February 14, 2023).

Vale Limited (2023b) *Financial Statements December 31, 2023*. Available at: <https://api.mziq.com/mzfilemanager/v2/d/53207d1c-63b4-48f1-96b7-19869fae19fe/f385c6fb-db84-048f-7a1b-cf16cdd6b6c3?origin=1> (Accessed: March 23, 2023)

Vitol (2022a) *Environmental, Social & Governance Report 2021*. Available at: <https://www.vitol.com/wp-content/uploads/2022/12/ESG-2021-Report-digital-1.pdf> (Accessed: February 16, 2023).

Vitol (2022b) *Vitol 2021 volumes and review*. Available at: <https://www.vitol.com/vitol-2021-volumes-and-review/> (Accessed: February 16, 2023).

World Bank Blogs (2020) *Projecting global extreme poverty up to 2030: How close are we to World Bank's 3% goal?* Available from: <https://blogs.worldbank.org/opendata/projecting-global-extreme-poverty-2030-how-close-are-we-world-banks-3-goal> (Accessed: March 5, 2023)

Worldsensing (2018) *The Top 6 Tech Trends Improving Mining Productivity*. Available at: <https://www.worldsensing.com/article/tech-trends-mining-productivity/> (Accessed: March 4, 2023)



Norwegian University of
Science and Technology