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# Distribution of Competitiveness of Copper Industry: The Case of Kazakhstan\*

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## Abstract

**Purpose:** The purpose of the research is identified factors influencing the competitiveness of the copper industry in Kazakhstan. **Research design, data and methodology:** A few studies are dedicated to the analysis in developing countries, particularly Kazakhstan. The algorithm was chosen for research provision: statistical and comparative analysis, correlation, and regression analysis. The data of 1999-2021 obtained from the World Bank, Bureau of National Statistics, National Bank of Kazakhstan. **Results:** The obtained results demonstrate the trends in the development of the industry since 2000. The development of the copper industry is strongly influenced by the distribution and state of the business environment, economic situation, and trends in the global commodity markets. **Conclusions:** According to econometric modeling, there is a correlation between the profitability of the copper industry, GDP, copper prices, liquidity, and energy resource prices. Trends in global commodity and energy markets have a significant impact on the state of the industry. Further research should be conducted to include an analysis and forecast of internal factors that may affect the development of the industry, such as copper reserves, condition of fixed assets, government programs, etc. It is also important to examine the correlation with the trends in the development of the global green economy and the revival of the Chinese market.

**Keywords:** Distribution, Profitability, Environment policy, Copper, Kazakhstan**JEL Classification Code:** B4, C10, L10, L61

## 1. Introduction

Copper makes a significant contribution to the development of technologies. Accordingly, the global demand for copper will at least remain stable. This means that the development of the copper industry leads to the

intensification of the development of various other sectors and also leads to the distribution of economic profit depending on the implementation of new technologies.

Kazakhstan has significant copper reserves of 13 million tones (Mudd & Jowitt, 2018). Considering the industrial nature of the economy, it is worth noting that having a

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significant raw material base and producing sufficient amounts of unrefined and refined copper, the domestic economy of Kazakhstan is only engaged in exporting refined raw materials, remaining dependent on imports of more complex copper products. Moreover, Kazakhstan's existing export of refined copper is too concentrated geographically. Thus, more than 70% of all export deliveries of refined copper from Kazakhstan are to China, which significantly increases the risks of poor sales diversification with the possible changes in demand from the primary buyer.

In Kazakhstan, copper mining is highly monopolized, as only two companies, KAZ Minerals PLC and Kazakhmys Corporation, are the leading players in the national market. In October 2004, the Kazakhmys group was reorganized into two companies: Kazakhmys Corporation LLP (Central Kazakhstan) and KAZ Minerals PLC (Eastern Kazakhstan). In May 2021, KAZ Minerals PLC was delisted from the London and Kazakhstan Stock Exchanges. East region concentrate is toll processed into cathode copper at the Balkhash smelter (Central Kazakhstan). Both companies together produce more than 80% of copper ore and its concentrates.

In their activities, these companies, like others, focus primarily on financial indicators. Profitability is a commonly acknowledged metric for determining a company's profit margins.

The purpose of the research is identified factors influencing the competitiveness of the copper industry in Kazakhstan.

According to the analysis of publications on the topic of the research, financial indicators of a company are used as an indicator of the organization's development and potential growth. Although there are many indicators that assess financial performance, the choice of appropriate coefficients depends on the characteristics of the studied objects and the goals of the research. Various studies have used indicators such as return on assets (ROA), return on equity (ROE), and return on sales (ROS) (Walsh, 1987; Waddock & Graves, 1997; Ruf et al., 2001; Madaleno & Barbuta-Misu, 2019; Hossain & Alam, 2019).

The investigation of profitability determinants has been the focus of numerous studies. For example, Barney (2001) and Stulz (1990) found that a company's internal resources and assets significantly affect its profitability. Margaretha and Supartika (2016) have examined the influence of company size, age, sales volume, and productivity. Krishnan and Moyer (1997), Zeitun and Tian (2007), and Yazdanfar (2013) found a positive and significant relationship between firm growth and company profitability. Olusola et al. (2022) find that cultural, political, and institutional differences should be taken into consideration when assessing the impact of capital structure on firm's performance. Sholichah et al. (2021) notes that companies with good financial

performance will easily develop because there are sufficient funds for company operations.

The industry affiliation is usually disregarded, without distinguishing between financial and industrial firms. There are also a few studies that analyze the macroeconomic factors of influence, especially in developing countries (Tan & Floros, 2012).

In Kazakhstan, research on the impact of financial and macroeconomic factors on industry's competitiveness is still limited. The current research study aims to address these limitations. This study is relevant because modern businesses operate in more complex conditions affected by trade restrictions, shocks in commodity markets, and currency volatility. Thus, maintaining profitability becomes a challenge for all firms, and such research may be relevant.

Based on the above, it should be noted that the development of the copper industry is important for the economy of Kazakhstan, and its further development should be oriented towards maintaining its profitability. Industry development in the Republic of Kazakhstan will be determined by several factors, including the availability of a quality raw material base, the development of the electric vehicle market in the world, the implementation of projects to decarbonize the global economy, and the growing demand from China. The main business risks are associated with "three pillars" of sustainable development: environmental, social, and governance factors (ESG) and decarbonization. On the other hand, the decarbonization trend will support high metal prices in the global market in the short term, at least, as decarbonization will increase metal consumption and profitability of the industry.

## 2. Literature Review

### 2.1. Financial Performance Indicators

The main indicators that determine the impact on the financial condition of companies are internal indicators, such as liquidity, debt ratio, and external indicators, such as country's economic growth, prices for products and resources.

Nguyen et al. (2022) studied the impact of internal financial factors on the financial performance of mining companies listed on the Vietnamese stock exchange. Quantitative and qualitative methods were used to analyze the collected data. The results showed that the determinants of internal financial factors, including solvency, have a negative correlation with return on sales (ROS); firm's rate of growth (RG) has a positive correlation with ROS; capital structure positively affects return on equity (ROE), while capital structure negatively affects ROE; capital structure and debt ratio have a negative effect on return on assets

(ROA); working capital structure has a positive correlation with ROA; current ratio negatively impacts ROA, while firm size and age have a positive correlation with ROA; and the remaining determinants have no significant impact on financial performance.

Among other variables, Deitiana (2011) notes that high sales growth is one of the signs of a successful business and can be used as a tool for forecasting future development.

Le Thi Kim et al. (2021) studied the impact of micro and macro factors on firm performance in the context of a developing economy. They concluded that two variables consisting of the overall asset turnover ratio (ATR) and sales growth significantly influence financial performance (FP) when measured by return on equity (ROE) or return on sales (ROS).

Seema et al. (2011) evaluate the financial condition of the company using the total asset turnover, long-term asset turnover, and short-term asset turnover. They conclude that the higher the efficiency of asset utilization, the higher the operational efficiency of the company.

Stephen et al. (2010) analyzed how effectively companies use their assets to increase sales. High total asset turnover theoretically indicates some potential growth opportunities for the company, such as increasing sales, expanding market share, and ultimately improving its financial performance. They found a significant positive relationship between financial performance and total asset turnover of firms.

Högerle et al. (2020) empirically investigated the development of working capital management and its impact on the profitability and shareholder value of companies in Germany. The results suggest that effective working capital management, which is reflected in a shorter cash conversion cycle, has a positive impact on profitability and shareholder value. The results emphasize the need for managers to pay more attention to optimizing working capital and debt levels even in a low-interest-rate environment.

Kotane and Mietule (2022) concluded that there is a 100% correlation between profitability and ROA when evaluating statistically significant relationships between financial analysis indicators of manufacturing enterprises (dependent variables) and the main type of activity indicators of manufacturing enterprises (independent variables).

Among the indicators listed above, liquidity plays an important role in managing working capital (Adams & Buckle, 2003; Fama & Jensen, 1983; Hoskisson & Hitt, 1990; Saleem & Rehman, 2011; Jaworski et al., 2018; Hossain & Alam, 2019), and its influence should be carefully considered when making strategic decisions for the company.

The use of debt financing for company needs has a certain impact on the capital structure, as the debt ratio is related to the capital used in the company. Some researchers,

such as Asimakopoulos et al. (2009) and Al-Jafari and Al Samman (2015), have found that leverage negatively correlates with financial performance; the reason being that high debt requires more resources to pay it off. However, others, such as Burja (2011) and Humera et al. (2011), argue that additional debt can be implemented as an investment that enhances a company's financial performance.

Among macroeconomic variables, inflation is noted to have an impact. Although a number of studies have been conducted on the impact of this factor on a company's financial performance, their results differ from each other. Research by Demirguc-Kunt and Maksimovic (1999) and Booth et al. (2001) show that an increase in the consumer price index can lead to a decrease in the use of debt in enterprises, and a decrease in the extent of debt can increase the efficiency of a company's business.

Thus, we propose the following research hypotheses **H1**: the relationship between profitability, liquidity, and debt ratio will be significant and negative.

## 2.2. Price Levels

Pricing strategies help companies in market penetration, and lower prices are more associated with lower profits and vice versa. Many experts note the influence of the price level on the efficiency of the company's business. De Toni et al. (2017) concludes that price policy affects corporate profitability, and managers should focus more on the price level in the market. An even deeper insight into the significance of the price level is reflected in research by Hinterhuber (2004), who notes that price changes have the highest impact on corporate profits compared to other financial indicators. At the same time, even slight fluctuations can significantly change the real picture. His conclusions are in line with the recommendations of other authors (Kohlia & Surib, 2011), who call the price level one of the most accessible and relevant tools for influencing the level of profit from a company's activities.

Thus, we propose the following research hypotheses **H2**: the high price levels of copper in global markets has a direct and positive impact on company's profitability.

## 2.3. Macroeconomic Indicators

Above, we discussed the existing experience in researching financial indicators at the level of individual firms, industries, and technological concepts (using the example of the impact of indicators on green production). It is also important to understand how individual indicators and factors depend on economic growth. Tan and Floros (2012) aimed to investigate three types of determinants influencing the profitability of Chinese banks: bank-specific, industry-specific, and macroeconomic variables (GDP

growth). The model also examined the influence of external factors such as product prices in global markets and economic development, as well as internal factors such as debt ratio, asset turnover, and liquidity. The approach described allowed for obtaining and comparing data on both internal and external factors, covering levels from individual companies to national levels, in order to obtain the most relevant picture of the development of the banking industry in China.

Meanwhile, Ononye et al. (2022) and Uzoma et al. (2022) conducted a study on the relationship between green production and financial performance. The results showed that green production directly stimulates financial performance.

Thus, we propose the following research hypotheses **H3**: the relationship between industry profitability and country GDP will be positive.

The authors consider it important to include indicators of energy prices in the model to obtain relevant data, based on the possibilities that have been used in other authors' studies. Xu et al. (2022) found that increase in energy prices deteriorate firm's profitability and productivity.

Thus, we propose the following research hypotheses **H4**: The increase in electricity prices has a negative impact on the profitability of industry sectors.

In summary, the factors influencing profitability are both internal, such as liquidity and debt ratio, and external, such as GDP growth, prices of copper on global markets, and the cost of energy. In the next section, based on existing research and factual data, we will examine the impact of these indicators on the profitability of the industry.

### 3. Research Methods and Materials

The following types of data were used for the research: the data of 1999-2021 obtained from the World Bank, Bureau of National Statistics, data of certain companies. The purpose of the study is to determine the relationship between the profitability of the copper industry and internal factors (liquidity, debt ratio), as well as external factors (copper prices on global markets, GDP, electricity price).

The algorithm of research consists of the following stages:

- 1) analysis of the development of the copper industry in Kazakhstan;
- 2) assessment of factors affecting the profitability of the copper industry in Kazakhstan.

For the 1 - statistical and comparative analysis; for 2 - factor analysis (OLS). In this research, ordinary least squares (OLS) regression is used. This approach is in line with the logic of the aforementioned studies, which predominantly used descriptive statistics and OLS to

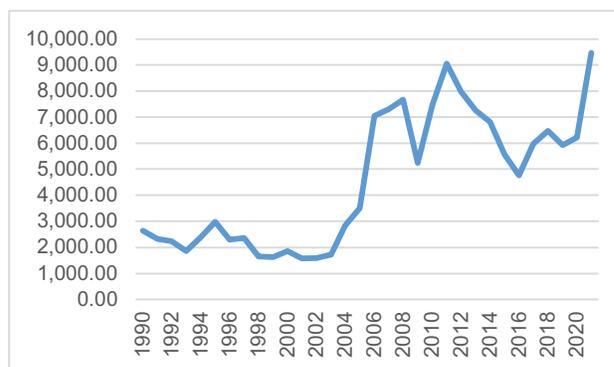
investigate the profitability of individual companies and industries. The White test and Durbin Watson statistic are used to check the existence of heteroskedasticity and the autocorrelation problem, if there are both issues.

Profitability is an economic indicator of business efficiency. We calculated profitability as the ratio of net profit (profit after tax) to the cost of goods sold. An enterprise is profitable if the amount of revenue from the sale of products is sufficient not only to cover the costs of production and sale, but also to generate profit.

Other independent factors included GDP, copper price on world markets, liquidity, debt ratio, and energy resource prices.

GDP - Gross domestic product (GDP) is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time period. As a broad measure of overall domestic production, it functions as a comprehensive scorecard of a given country's economic health.

Copper price - dynamics of average copper prices in London Metal Exchange for 1990-2021 years.



source: LME

**Figure 1:** Dynamics of Copper Prices (Average price per ton, USD) for 1990-2021 years

This figure 1 shows the dynamics of average copper price. It is shows trend of the growth or fall over time.

Liquidity (Current ratio). The current ratio is one of the liquidity ratios. It measures a company's ability to pay its short-term financial obligations, including payroll, taxes, and payments. The current ratio considers current assets, which can be converted into cash in less than a year, and current liabilities, which are due to be paid in less than a year.

Debt ratio is the amount of liabilities relative to total assets,

Electricity price is a metric indicating the cost of 1 kWh of energy. With an increase in tariffs, the costs of companies increase, which leads to a rise in product prices and consequently a decrease in the profitability of the enterprise.

Based on the identified independent variables, we can write the equation:

$$\ln \text{Prof} = \beta_0 + \beta_1 \ln \text{GDP} + \beta_2 \ln \text{CP} + \beta_3 \ln \text{Liq} + \beta_4 \ln \text{D} + \beta_4 \ln \text{EIP} + \varepsilon_i \quad (1)$$

In the regression model presented above, we have the natural logarithm of the following variables:

LnProf is the logarithm of the profitability of the copper industry;

LnGDP is the logarithm of the GDP in US dollars,

LnCP is the logarithm of the price of copper in US dollars,

LnLiq is the logarithm of the current liquidity,

lnD is the logarithm of the debt ratio,

LnEIP is the logarithm of electricity price.

$\varepsilon_i$  is the error term

To test the quality of the regression model, we use the White test to check for multicollinearity, autocorrelation, and heteroscedasticity.

Therefore, this research hypothesis can be formulated as follows:

- H1:** The relationship between profitability, liquidity, and debt ratio will be significant and negative.
- H2:** The high price levels of copper in global markets has a direct and positive impact on company's profitability.
- H3:** The relationship between industry profitability and country GDP will be positive.
- H4:** The increase in electricity prices has a negative impact on the profitability of industry sectors.

## 4. Analysis and Results

### 4.1. Analysis of Copper Industry

Copper is a primary metal, like nickel, zinc, aluminum, lead, and others. Copper is the most conductive non-precious metal, making it indispensable in many industries. Over the past decade, global copper reserves have increased from 630 million tons in 2010 to 870 million tons as of 2020. Meanwhile, the total global copper mine production volume was approximately 21 million tons in 2021.

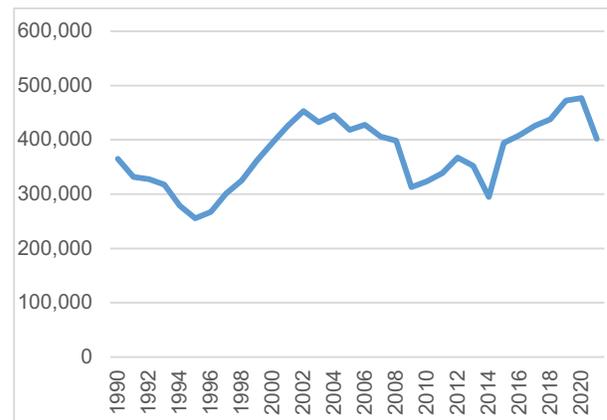
The average monthly price of copper reached a peak in 2011 at \$8,828 USD per ton. Prices declined after 2011 to an average monthly price of \$4,868 per ton in 2016, and then partially recovered in 2018 to \$6,530. Prices dipped in 2020 with the start of the pandemic but quickly rebounded. In 2021, the average price of copper was \$9,322 per ton.

Although copper production is expected to rise to 26.14 million tons in 2025, this will not prevent a supply deficit after 2025. This is due to the fact that when demand for

copper increases, supply does not keep up with it. Over the past quarter century, copper supply has grown more slowly than other metals. According to S&P Global, from 2026 to 2030, the copper industry will not be able to meet the growing demand for concentrate, even taking into account ongoing projects under development that could potentially be launched during this period. Renewable or clean energy technologies require more and more complex minerals to produce energy compared to nuclear and fossil fuel energy. According to data from the consulting company CRU Group, copper consumption by green energy sectors worldwide is expected to increase fivefold in 10 years by 2030.

In 2020, the largest exporters of refined copper were Chile (\$14.5 billion, 20.3%), the Democratic Republic of Congo (\$11.1 billion, 15.4%), Russia (\$5 billion, 6.97%), Japan (\$4.73 billion, 6.59%), and Kazakhstan (\$2.86 billion, 3.98%). The bulk of refined copper exports are accounted for by 22 countries.

The volume of domestic copper ore and concentrate production in the country showed a confident positive trend from 2014 to 2020. The volume of national production at the end of 2021 was 402 thousand tons, which is less than the 2020 figure of 477 thousand tons (Figure 2). At the same time, over 99% of the copper concentrate produced in Kazakhstan is exported. The specificity of the Kazakhstani copper industry is the specialization in the production and sale of low-margin final products based on copper, as well as raw materials components (Figure 2).



source: Bureau of National Statistics.

**Figure 2:** Dynamics of Copper Production (refined, tons) for 1990-2021 years

The data analysis shows fluctuations in production volumes over a thirty-year period, ranging from 255.6 thousand tons in 1995 to a maximum of 477 thousand tons in 2020. The indicators change smoothly from year to year, while there are noticeable (unusual) fluctuations in the form of a sharp decrease in 2009 and 2014. The difference

between production in 2008 compared to 2009 was 85.6 thousand tons, and then gradually decreased in subsequent years. The next downturn began in 2012, with production levels falling from 367 thousand tons to 294.8 thousand tons in 2014, followed by a sharp rise to 477 thousand tons (a difference of 182 thousand tons) in 2020.

The reasons for these fluctuations are different. In 2009, it was due to a decrease in the available raw materials, while in 2014, the shutdown of the Zhezkazgan Copper Smelting Plant for modernization of production facilities was the cause. This indicates that the industry is highly influenced by the productivity of individual market players and the overall economic growth (about 12% of the country's GDP). Last 5 years, due to high operating cash flow, companies (Kazakhmys and KAZ Minerals) have low debt levels (less than 1) and high current ratios (more than 1.2). Net profit growth of the same period amounted to about 20% for these companies.

#### 4.2. Factors of profitability copper industry

Table 1 shows a correlation matrix of the independent variables investigated in this study. Within this sample, no significantly high correlations were found for these variables.

The maximum correlation is equal to 0.92. The results indicate a relationship between GDP and profitability, liquidity and energy resource prices, debt ratio and liquidity. The relationship between GDP and profitability is negative, as is the relationship between liquidity and energy resource prices, and liquidity and debt ratio.

**Table 1: Correlation Test Result**

	Profitability	GDP	Copper price	Debt	Lliquidity	Price
Profitability	1	-.812**	.128	-.314	.294	-.468
GDP	-.812**	1	.332	.340	-.570*	.558*
Copper	.128	.332	1	-.377	-.004	-.213
Debt	-.314	.340	-.377	1	-.835**	.927**
Quickratio	.294	-.570*	-.004	-.835**	1	-.920**
Price	-.468	.558*	-.213	.927**	-.920**	1

Note: \*\*. Correlation is significant at the 0.01 level (2-tailed).

\*. Correlation is significant at the 0.05 level (2-tailed).

As a result, using these data factors, regression equation 2 was obtained:

$$\ln\text{Prof} = 20,44 - 2 \ln\text{GDP} + 0,85 \ln\text{CP} - 0,33 \ln\text{Liq} - 0,57 \ln\text{EIP} + \varepsilon_i \quad (2)$$

The equation does not include the debt ratio factor because the coefficient for this variable was not statistically significant and therefore the debt ratio does not affect profitability according to the available data.

**Table 2: Regression Analysis**

Variable		Coefficient	Standard errors	t-Stat	Adjusted RSquared
Dependent	Independent				
Profitability	C	20.443	2.868	7.128	0.938
	GDP	-2.004	.175	11.445	
	Copper price	.853	.208	4.102	
	Liquidity	-.326	.084	-3.894	
	electricity price	-.566	.265	-2.137	

Note: estimation from SPSS 22

All variables are statistically significant, with GDP, copper price, and the quick liquidity coefficient affecting company profitability. A 1% increase in GDP leads to a 2% decrease in profitability, while a 1% increase in copper prices leads to a 0.85% increase in profitability. A 1% increase in the quick liquidity coefficient leads to a 0.33% decrease in profitability, and an increase in electricity prices leads to a 0.57% decrease in profitability. Based on standardized coefficients, GDP and copper price have the greatest impact on profitability, with opposite directions of influence.

The R2-value for the model is 0.96 and adjusted R2-value is 0.94. R2 is a measure of goodness of fit, i.e. what share in the dependent variable that can be described by the model. Accordingly, 96.0% of the dependent variable can be described by the covariates.

Heteroscedacity and autocorrelation: given the results from the White test the conclusion that homoscedasticity is highly prevalent can be drawn, because Obs\*R-squared = 13,77. The null hypothesis which states that the model is homoscedastic is accepted. Our model is homoscedastic because we used a logarithmic model for our variables.

Based on the Durbin-Watson statistic (DW = 1.99), we can conclude that there is no autocorrelation.

To investigate the presence of multicollinearity, a collinearity test has been conducted yielding statistics on VIF and tolerance. The findings are presented in Table 3. According to (O'Brien, 2007), the threshold for a concerning level of multicollinearity is 5.00. For this sample, the highest VIF value is 11.5, which is upper the threshold level. Tolerance is another indicator for this phenomenon and a minimum value of 0.20 is recommended by (Menard, 1995). Any tolerance value lower than .20 indicates a multicollinearity problem. For this sample, each tolerance value well surpasses this cut-off value, the lowest value being 11.5.

According to the results, we can see a strong correlation between the price of electricity and liquidity. The dynamics of electricity prices lead to a lack of liquidity in the industry due to its high energy consumption. It should be noted that the leading company in the industry has its own energy-producing facilities, which provide both its production

capacity and serve a social function of providing energy to residential areas around the company's plants.

The conclusion from the VIF-test is that there is a multicollinearity in the model (table 3).

**Table 3:** Collinearity Statistics

	Tolerance	VIF
GDP	.391	2.556
Copper price	.443	2.258
Current liquidity	.087	11.486
electricity prices	.107	9.387

Note: estimation from SPSS 22

One solution to dealing with multicollinearity is to remove some of the violating predictors from the model or linearly combine the independent variables or use modified variables. We used logarithm of index of electricity price instead of logarithm of electricity price.

As a result, using these data factors, regression equation 3 was obtained:

$$\ln\text{Prof} = 17,6 - 2 \ln\text{GDP} + 0,85 \ln\text{CP} - 0,17 \ln\text{Liq} - 0,85 \ln\text{EIP} + \epsilon_i \quad (3)$$

All variables are statistically significant (table 4), with GDP, copper a 1% increase in GDP leads to a 2% decrease in profitability, while a 1% increase in copper prices leads to a 0.85% increase in profitability, 1% increase in the quick liquidity coefficient leads to a 0.17% decrease in profitability, and an increase in electricity prices leads to a 0.85% decrease in profitability. 96.0 % of the dependent variable can be described by the covariates (R2-value is 0.96), no autocorrelation (DW = 1.8) and homoscedasticity (Obs\*R-squared=1,3 in White test) in model. The conclusion from the VIF-test is that there is a no multicollinearity (all VIF less 2).

**Table 4:** Regression Analysis

Variable		Coeffisient	Standard errors	t-Stat	Adjusted RSquared
Dependent	Independent				
Profitability	C	17.57	1.95	8.99	0.94
	GDP	-2.00	.156	-13.50	
	Copper price	.849	.196	4.34	
	Liquidity	-.170	.034	-5.15	
	electricity price (index)	-.847	.357	-2.37	

Note: estimation from SPSS 22

## 5. Discussion

The research results indicate that some of our hypotheses were consistent, while others were not. Thus, for the first

hypothesis (H1) The relationship between profitability, liquidity, and debt ratio will be significant and negative. Regarding the third hypothesis, the results indicate that an increase in liquidity leads to a decrease in profitability and vice versa. Our results confirm results of Saleem and Rehman (2011) and Jaworski et al. (2018) (for ratio more than 2.0), which found a negative relationship, but contradict the body of literature pointing to a positive relationship (Madaleno & Barbuta-Misu, 2019; Hossain & Alam, 2019). Also, we find for Kazakhstan's copper industry that the debt ratio does not affect profitability. According to the available data for the copper industry, there is a low share of the debt ratio, which explains the absence of a correlation with the company's profitability. With positive profitability dynamics, the company has a low level of liquidity, which requires management decisions aimed at balancing these indicators. The optimization of current liquidity can be achieved by increasing the profitability of activities and increasing the share of profits remaining at the disposal of the enterprise (reducing the share of profits directed towards non-production purposes and dividend payments). Based on the above, it can be concluded that hypothesis 1 is partially accepted.

According to the second hypothesis (H2) The high price levels of copper in global markets has a direct and positive impact on company's profitability, the conclusion of its validity is made. Data from national statistics show that dynamics of copper production correlated with world copper price. This, in turn, is supported by a model in which the high price of copper in world markets is positively impact on the profitability of the copper industry. In accordance with this conclusion, hypothesis 2 is accepted. Our results confirm results of De Toni et al (2017), who found that high price levels have a direct and positive impact on profit margin.

Hypothesis 3 (H3) The relationship between industry profitability and the country's GDP will be positive, we can conclude that it is not confirmed. According to the modeling results, the relationship between copper industry profitability and GDP turned out to be negative, and the effect of this factor is significant. This may indicate a countercyclical relationship. Data from national statistics show that in the first half of the 2000s, with the rise in oil prices and the corresponding rapid growth in GDP (where the oil and gas industry accounts for a significant share of about 30% and half of exports), the dynamics of copper production showed a decrease, and during the period of falling prices in 2016 – growth in production and profitability. Therefore, hypothesis 3 is not accepted. Tan and Floros (2012) also conclude that there is a negative relationship between GDP growth and profitability.

To compare the results of this hypothesis in our study and others, it is worth noting that despite the significant

number of studies on profitability in general, most empirical studies focus on financial indicators. In addition, previous studies typically focus on firms operating in countries such as Indonesia, India, and China, or in EU countries and the US, but not for commodity dependent countries. Therefore, it is quite problematic to draw clear parallels between the obtained results and the search for confirmations based on global case studies. Therefore, more detailed research is needed to forecast the development of industry in the future.

Hypothesis 4 (H4) The increase in electricity prices has a negative impact on the profitability of industry sectors. Including a variable such as the cost of energy resources became relevant in light of modern challenges related to the energy crisis (and the corresponding sharp rise in energy prices) in European countries due to the situation in Ukraine. Logically, energy expenses can be assumed to be a significant cost factor affecting industrial enterprises, including the copper industry.

With respect to the fourth hypothesis, we have concluded that the growth in electricity prices negatively affects the profitability of the industry, which in our case is associated with its high energy intensity. Our results are consistent with Xu et al. (2022), which also found a negative relationship.

## 6. Conclusions

### 6.1. Conclusions

The copper industry plays an important role in the economy of Kazakhstan and on the global market, and its development can positively affect the expansion of green economy opportunities and the distribution of its benefits among countries.

In this research, we identified the main factors influencing the development of the copper industry. Furthermore, we attempted to assess the degree of influence of the specified factors on the development of the copper industry in Kazakhstan by using regression analysis and forming research hypotheses.

According to results, we made the following conclusions. First, the copper industry in Kazakhstan is one of the most important in the world and is among the top five exporters. The production of copper in Kazakhstan has been showing positive dynamics since 2014, with some fluctuations in production decline (demonstrating a decline in 2009, 2014, and 2021).

Secondly, a statistically significant (direct) correlation is observed between industry profitability and the following indicators: GDP, liquidity, copper prices on the global markets, and the profitability of the copper industry in Kazakhstan. However, the factor of economic growth, in the

form of the GDP variable, is strongly negatively correlated, with a significant impact. This result indicates a countercyclical relationship between these variables, which is due to economic imbalances in the development of the country's industry. This situation is interconnected with the dynamics of the development of the oil industry. Data from national statistics show that in the first half of the 2000s, with the rise in oil prices and the corresponding rapid growth in GDP (where the oil and gas industry accounted for a significant share of about 30% of GDP and half of exports), the dynamics of copper production showed a decrease, and during the period of falling oil prices in 2016 - growth. This is why we have an interesting situation where indicators of economic growth, expressed through GDP, negatively affect the industry, as the transition to green technologies implies a decrease in demand for oil against the backdrop of growing demand for copper. At the same time, Kazakhstan's GDP still depends heavily on oil prices and its export volumes.

Currently, base metals are becoming cheaper against the backdrop of tightening monetary policy by leading central banks in the world, while food and energy prices are rising, which could lead to a decline in production volumes. As some experts note, a decrease in the price of copper may reflect investors' sentiments about the overall state of the economy and indicate that more people are anticipating a global recession. Accordingly, the price of copper will depend on the effectiveness of the monetary policies being implemented by leading countries in the world. For Kazakhstan, the price of copper is an important factor in the development of the national industry. This, in turn, is supported by a model: the price of copper in world markets is positively correlated with the profitability of the copper industry.

### 6.2. Limitations and Future Research

Despite identifying a number of factors that determine the impact of the copper industry in Kazakhstan, the study has some limitations:

Firstly, the research did not focus on internal indicators such as the number of enterprises, the quality of equipment and knowledge distribution, the need for production modernization, the number of explored deposits, data on explored copper reserves, qualified staff availability, and state industrial policy. Secondly, the research indicates a counter-cyclical relationship between GDP and industry profitability, explaining it through trends in the global market and oil production volumes. However, more detailed research is needed to forecast the industry in the future. Thirdly, the research mentions the relationship between green economy development and copper demand, but it is not reflected in the model. In the future, further research in

this direction could be conducted to understand how green economy development and industrial growth in China may impact the industry's development and therefore the profitability of companies in Kazakhstan.

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