

## THE EVOLUTION OF PROFIT MARGINS IN THE MINING AND EXTRACTION INDUSTRY

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**Purpose:** The aim of this paper is to test the hypothesis of the occurrence of increased margin values in the mining and extraction industry in an environment of increased CPI inflation rates in selected EU countries.

**Design/methodology/approach:** The study used selected quantitative methods, including: categorising companies by mean and standard deviation and the Kruskal-Wallis test for non-parametric independent variables.

**Findings:** The study showed that an increase in margins was observed in France and Italy in the 2021 and 2022 periods analysed. The largest increase was found in France, where the median gross profit margin increased from 3.5 per cent between 2015 and 2020 to 7.3 and 6.3 per cent, respectively, between 2021 and 2022.

**Research limitations/implications:** A significant limitation is the limited access to complete data. In addition, the analysis included countries that differ in terms of the availability of raw material deposits and also have varying levels of socio-economic development. As soon as more data becomes available, it would be worth expanding the area of analysis.

**Practical implications:** The occurrence of increased gross profit margins is a phenomenon limited to selected countries and not generally observable in the global market. These findings can be valuable for understanding economic trends in specific regions and can help isolate countries where companies experience higher margins compared to others. Our research provides basic information that can provide a starting point for decision-makers involved in the extractive sector at both EU and individual EU member state level. The conclusions drawn by the authors suggest the need for further exploration of the identified research area.

**Originality/value:** To our knowledge, this is one of the first articles on the verification of elevated margin values in the mining and extraction industry. The study contributes to the assessment of the adaptability of the European Union mining and quarrying industry and the phenomenon of increased margins.

**Keywords:** mining and extraction industry, profit margins, European Union.

**Category of the paper:** testing of data.

## 1. Introduction

Mineral resources remain one of the pillars of socio-economic development (Bustillo Revuelta, 2018; Karaś, 2020). Securing access to mineral resources is crucial for the global economy as it affects its innovation and competitiveness (Ferro, Bonollo, 2019; Hofmann et al., 2018). The demand for mineral resources, as well as the extraction of mineral resources, is constantly increasing (Balci, Kumral, 2022; Bustillo Revuelta, 2018). A particular focus is on critical raw materials<sup>1</sup>, which have applications in many strategic sectors (Mancini et al., 2015). The dynamic growth in demand for critical raw materials is largely driven by their role in the energy transition and digitalisation (Johnston, 2022; Lewicka et al., 2021).

Geopolitical events have always had an impact on the economy, affecting the extractive sector as well (Laing, 2020; Umar et al., 2022). Over the last three years, two crises affecting the economy have overlapped: the COVID-19 pandemic and the war in Ukraine (Adekoya et al., 2021; Kuzemko et al., 2022). The outbreak and spread of the COVID-19 pandemic forced the introduction of restrictions. This resulted in disruptions of an economic, political and social nature (Gałaś et al., 2021). As a result of the global economic downturn, there was a decline in industrial production and an increase in commodity stocks, which led to a decline in mineral prices (Jowitt, 2020). In the case of metal prices, bauxite and copper saw the largest losses (Laing, 2020). However, it was oil prices that fell the most, due to a decline in demand, as well as Saudi Arabia and Russia's decision to not restrict oil production, causing an oversupply (Jowitt, 2020).

Before the start of the war in Ukraine, the two countries involved in the conflict - Russia and Ukraine - remained significant players for global commodity markets and leading energy suppliers on the European continent (Benton et al., 2022; Umar et al., 2022). The unprecedented economic sanctions imposed on Russia, which included imports and exports of service goods, political interventions, and informal pressure on private companies to leave the Russian market led to an increase in mineral and energy prices (Benton et al., 2022; Markus, 2022; Tosun, Eshraghi, 2022). Thus, the war in Ukraine has global implications, despite its direct interest in only two countries (Adekoya et al., 2021). The conflict has increased global geopolitical risks, caused commodity shocks and disrupted supply chains, and further contributed to inflation (Akcil et al., 2019; Markus, 2022). The war in Ukraine has also highlighted the nature of commodity security (Johnston, 2022).

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<sup>1</sup> Critical raw materials - mineral resources of economic and strategic importance to the European economy, for whose continuity of supply there is a high degree of risk. Published in March 2023, the fifth list of Critical Raw Materials includes 34 materials: Antimony, Arsenic, Baryte, Bauxite, Beryllium, Bismuth, Boron/Borate, Cobalt, Coking Coal, Copper, Feldspar, Fluorspar, Gallium, Germanium, Hafnium, Heavy rare earth elements Helium, Lithium, Magnesium, Manganese, Natural Graphite, Nickel, Niobium, Platinum group metals, Phosphate Rock, Phosphorus, Scandium, Silicon metal, Strontium, Tantalum, Titanium metal, Light rare earth elements, Tungsten, Vanadium (European Commission, 2023).

The aim of this research paper is to verify the hypothesis of the existence of elevated margin values in the Mining & Extraction industry in an environment of elevated CPI inflation rates. The study was based on the selected quantitative methods, including: the categorisation of companies with respect to the mean and standard deviation, and the Kruskal-Wallis test for non-parametric independent variables.

The originality of the study conducted can be summarised as follows. The study contributes to the knowledge of the mining and extraction industry. Research on the mining sector still remains fragmented. In previous years, research on minerals and the mining sector in the European Union has focused on the low-carbon economy and climate neutrality (Guzik et al., 2021; Smol et al., 2017; Smol, Kulczycka, 2019), critical raw materials and their impact on sustainability (Blengini et al., 2017; Christmann, 2021; Hofmann et al., 2018; Hund et al., 2020; Mancini et al., 2015, 2018), as well as the potential for mineral recycling and substitution (Ferro, Bonollo, 2019; Hagelüken et al., 2016; Kulczycka et al., 2016; Løvik et al., 2018). Achieving the 2020 and 2030 climate and energy targets is important for the European Union in the transition towards a low-carbon economy (Ślusarczyk et al., 2023). Hence, the European Union is a leading actor in the pursuit of climate neutrality and the achievement of a sustainable development model (Janik et al., 2020; Smol et al., 2020). This study aims to link inflation rates and profit margins to the mining sector.

In addition, to our knowledge, this is one of the first articles on the verification of elevated margin values in the mining and extraction industry. Another important element of the study is that the analysis was related to the European Union countries, which allows for a more complete depiction of the issue of the phenomenon of elevated margins in the mining sector.

The research article is structured as follows: the next section provides a literature review. The following part presents the research methodology used to analyse the value of margins in the extractive sector. Subsequently, the results of the analysis carried out are presented together with the main conclusions of the analysis. The final section summarises the main conclusions and presents the limitations of the research.

## **2. Literature review**

The spread of the COVID-19 pandemic had a huge impact on the global economy (Cai, Luo, 2020). A number of wide-ranging measures were taken globally to limit the spread of the pandemic. This has involved the introduction of numerous restrictions that have had an impact on the economic and social dimensions. It also led to a recession of the European economies (Jestl, Stehrer, 2021). The mining sector was not prepared and resilient to the effects of the COVID-19 pandemic (Laing, 2020). The pandemic affected metal and mineral production, as well as industries supplied by the mining and extraction sector (Jowitt, 2020). During the

COVID-19 pandemic, mining operations continued in most states; however, some facilities were operating at reduced capacity (Jowitt, 2020; Kumar et al., 2020). In this regard, there was also less demand as a result of the economic downturn and the decline in production, the risk of oversupply of minerals increased, which in turn caused prices to fall (Gałaś et al., 2021; Jowitt, 2020; Kumar et al., 2020; Laing, 2020). Interestingly, gold and palladium prices increased during the COVID-19 pandemic. This was due to the temporary closure of the mining sector by South Africa. Additionally, both gold and palladium were in demand among investors. Platinum prices did not rise, driven by uncertainty about future demand, including a reduction in demand for the metal by the automotive sector (Jowitt, 2020).

Climate change is now seen as a major challenge for the global economy (Khurshid et al., 2023). The European Union has numerous actions and targets for a low-carbon and climate-neutral economy. However, this is feasible depending on the capacities of individual member states and unforeseen events (Ślusarczyk et al., 2023). The category of unforeseen events can include the war in Ukraine, which has highlighted the importance of raw material security, as well as the fragile raw material supply chain (Johnston, 2022; Nerlinger, Utz, 2022). Russia is an important producer of minerals such as gold, palladium and nickel. With the outbreak of war in Ukraine, the focus was primarily on precious metals and nickel, scandium and titanium that are categorised as critical raw materials (Johnston, 2022). There was concern about shortages and disruptions to the supply of these raw materials, on which an increasing number of economies are dependent (Akcil et al., 2019; Nakatani et al., 2018). Palladium, nickel, scandium and titanium play an important role in the energy transition, thereby affecting availability and prices (Khurshid et al., 2023). The war in Ukraine contributed to an increase in raw material prices, which translated into higher inflation (Korosteleva, 2022). There has also been a decline in production in the mining sector (Irtysheva et al., 2022). As a result of the outbreak of war in Ukraine, for example, nickel prices rose by more than 100% during the first two weeks of the conflict (Johnston, 2022). The metal has applications such as in battery storage systems or new energy vehicles, which include electric vehicles (EVs) and plug-in hybrid vehicles (PHEVs) (Wang et al., 2023; Yao et al., 2021). Russia, along with Indonesia and the Philippines, is one of the largest nickel producers. The nickel market was already in deficit before the war in Ukraine due to steadily increasing demand, and global nickel prices have been subject to a drastic fluctuation trend in recent years (Guohua et al., 2021; Wang et al., 2023). Hence, the war in Ukraine has exacerbated concerns about trade impediments and supply delays (Johnston, 2022).

Both the effects of the COVID-19 pandemic and the war in Ukraine contributed to a marked increase in inflation in 2021-2022, which impacted individual economies. Inflation levels in individual EU member states were clearly dispersed. Headline inflation in the Baltic States was 20-25%, which was three to four times higher than in the euro area countries with the lowest inflation rates (Topalova et al., 2023). Rising consumer prices represented a new economic, political and social challenge faced by the European Union (Menyhért, 2022). The inflation rate

was expected to reach lower levels despite the COVID-19 pandemic and the war in Ukraine (Topalova et al., 2023). However, inflation has reached levels that significantly affect household and business decisions (Visco, 2023).

In addition, with the lifting of restrictions introduced during the COVID-19 pandemic, there was an increase in demand for energy, the price of which began to rise. The energy crisis that affected the European Union intensified with the outbreak of war in Ukraine. The effects of the pandemic were still being felt, and there were additional concerns about the ongoing hostilities, including the impact on the global economy or the duration of the conflict (Adekoya et al., 2021; Bounou, Yatié, 2022). Russia is one of the largest producers and exporters of oil and natural gas (Umar et al., 2022). In contrast, Ukraine has the seventh largest proven coal deposits in the world (Johannesson, Clowes, 2022). Before the start of the war in Ukraine, 1/3 of the natural gas and oil consumed by the European Union had been from Russia. Conventional energy markets experienced sudden price increases that were caused by supply shocks (Umar et al., 2022). The increase in energy prices is indicated as the main reason for the increase in the cost of living. Energy prices in August 2022 were on average 40 per cent higher compared to August 2021. This posed a challenge not only for households, but also for other stakeholders (Menyhért, 2022).

It is highlighted that inflation related to the COVID-19 pandemic and the war in Ukraine coincided with sustained increases in corporate profits and margins (De Loecker et al., 2020). The sharp rise in inflation that occurred between 2021 and 2022 has been attempted to be explained in a number of ways. Some of the causes have been identified as: demand-supply mismatches, temporary disruptions in supply chains, and a price-wage spiral (Glover et al., 2023). However, it is increasingly suggested that the cause of the 2021-2022 inflation was the pricing strategy policies of firms. Hence, the concept of 'Greed inflation', which assumes that firms exploit their market position by raising prices faster than there is an increase in production costs, has gained prominence (De Loecker et al., 2020). 'Greed inflation' can contribute to the disruption of companies' relationships with stakeholders. Companies have protected their margins by passing on higher production costs to consumers. Moreover, in order to increase their profits, companies also chose to increase their margins. It has been pointed out that the increase in profit margins in the euro area in 2021 and 2022 was due to the desire to catch up with the declines recorded by individual companies in 2020 due to the COVID-19 pandemic (Bénassy-Quéré, 2023). Therefore, businesses are accused of both 'Greed inflation' and profit-taking, as well as deliberately prolonging the inflationary environment (Dekimpe, van Heerde, 2023).

Thus, an increasing number of studies point to a relationship between dynamic profit growth and the overall price level. It is shown that the price-profit spiral has replaced the wage-price spiral (Dekimpe, van Heerde, 2023). For this reason, profits are considered to contribute to inflation (Weber, Wasner, 2023). To date, research on the mining and extraction industry in the European Union has not addressed the possibility of elevated margins. This gap provides a basis

for further research to extend previous studies. The next chapter describes the materials and methods that should enable replication of the research and use of the results.

### 3. Methodology

The aim of this article was to investigate the hypothesis of the occurrence of increased margin values in the mining and extraction industry in an environment of increased CPI inflation rates, i.e. the occurrence of the so-called 'Greed inflation' phenomenon.

The study used data relating to financial results from 812 companies operating in selected European countries: Belgium (BE), Finland (FI), France (FR), Italy (IT), Latvia (LV), Poland (PL), Sweden (SE) and Slovakia (SK). The selection of the sample was dictated by its availability - the countries were represented by a minimum of 25 companies in the industry that, for the years 2015-2022, provided information on the level of profit margins and operating turnover to the ORBIS database used in the study. The industry category 'Mining & Extraction' was assigned to a company according to the breakdown found in the ORBIS database. Similarly, for the margin indicator, which in the database used means the so-called gross profit margin, defined by the formula (*Orbis Internet User Guide, Bureau Van Dijk, A Moody's Analytics Company*):

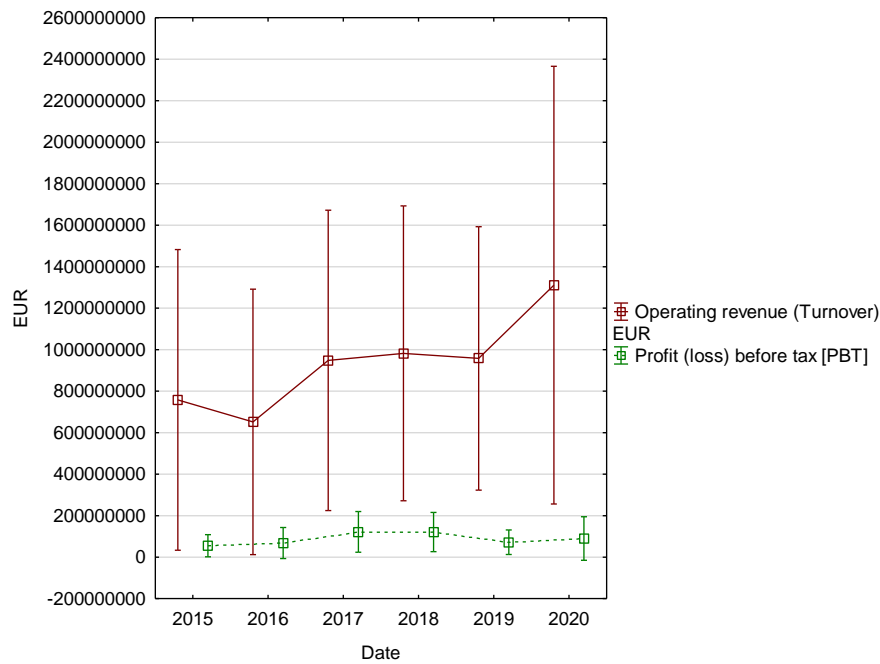
$$\text{Gross profit margin (\%)} = \frac{\text{Profit before tax}}{\text{Operating income (turnover)}} \quad (1)$$

A selected quantitative methods was used to carry out the study, including: categorising enterprises by mean and standard deviation, and the Kruskal-Wallis test for non-parametric independent variables.

The selection of research methods contributed to the fulfilment of two research quality criteria: validity and reliability. Validity was obtained through the selection of appropriate indicators that enabled the study to be conducted. Reliability was achieved through the use of a reliable data source, making the research replicable.

### 4. Results and discussion

The study focused on analysing the hypothesis of the occurrence of elevated profit margins in the mining and extraction industry in an environment of elevated CPI inflation rates. From the perspective of mining companies, the ability to generate profits is extremely important. However, corporate profit growth is currently being monitored due to the level of inflation (Colonna, Torrini, Viviano, 2023).



**Figure 1.** Evolution of the value of the margins of the surveyed companies in the period 2015-2020.

Source: own elaboration.

The initial identification of the disturbance in the dynamics of changes in the level of gross profit margins was based on the determination of the share of the number of companies outside the market equilibrium ranges. It was assumed that there is a range in the level of margins expected for the industry under the initial conditions, which is defined at the level of the country and the industry. Its determination was based on determining the average value of the margins for a given company (over the period 2015-2020) and then determining the standard deviation defining the limits of the range within which the observed margins could be considered expected. The limits of the ranges were thus determined by the formula:

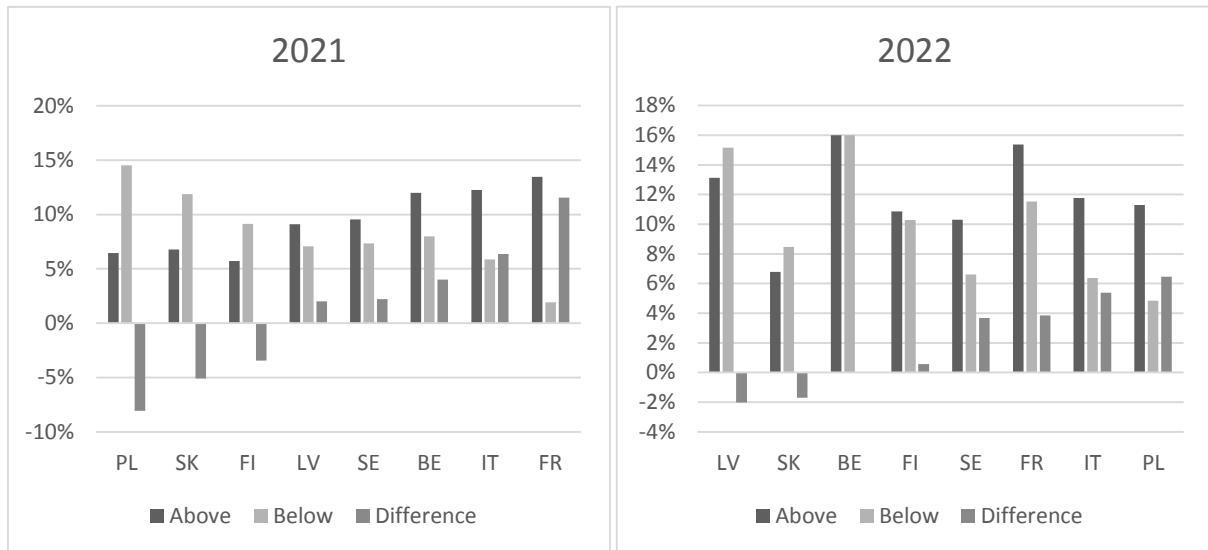
$$g = \frac{\sum_{t=2015}^{2020} m_i}{6} \pm 2 * \sigma \quad (2)$$

where:

$g$  - the lower or upper limit of the range within which margin values are expected,

$m$  - the margin value of the  $i$ -th company,

$\sigma$  - the standard deviation of the gross profit margin values for 2016-2020 of the company in question.

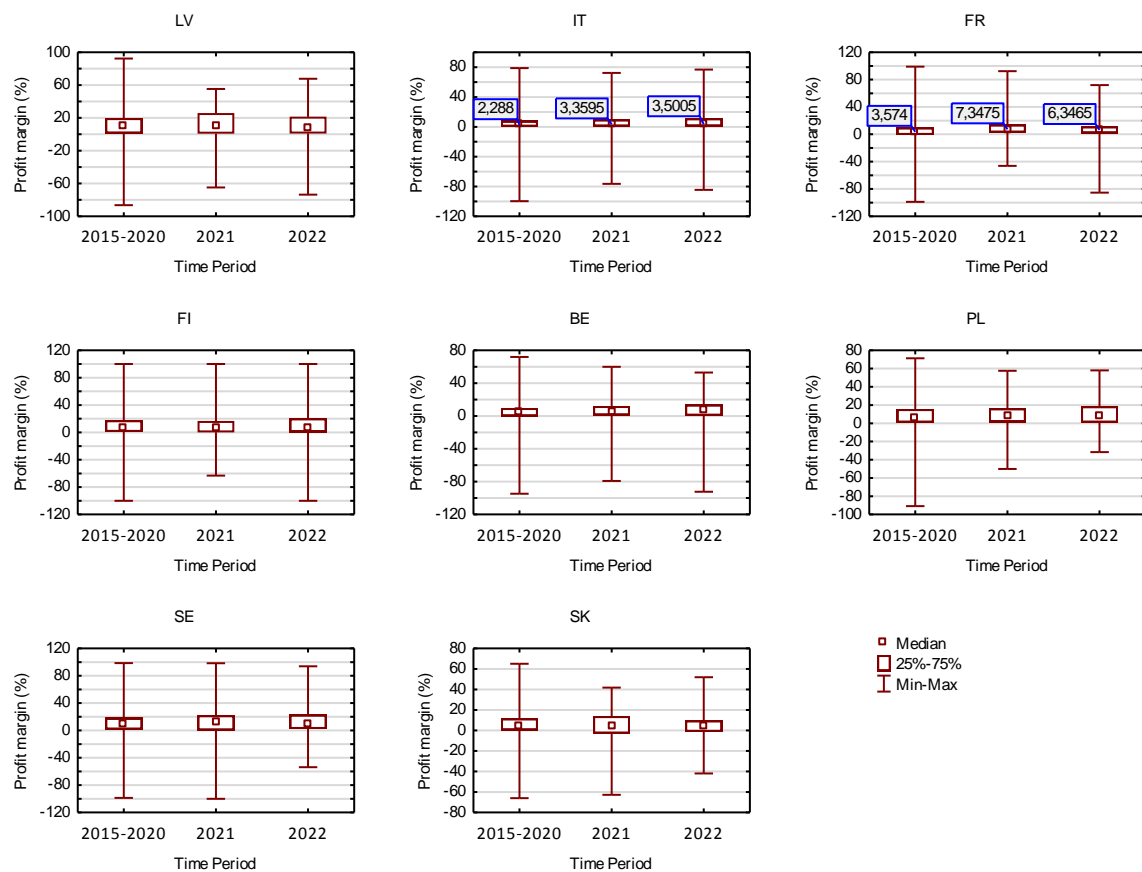


**Figures 2-3.** Share of companies with under- or over-margins in 2021 and 2022 compared to 2015-2020 values by country.

Source: own elaboration.

According to the equilibrium assumption, not all companies in the industry will be within the expected range of margins, but the distribution outside this range should be similar in the absence of market disturbances. The next step, therefore, was to determine the countries that were characterised by a significantly higher proportion of companies with gross profit margins above, rather than below, the observed level. According to charts 4-5, it can be seen that only Italy, France and Sweden have a higher share of companies with above-margin levels compared to the number of companies with below-margin levels, indicating that the possible occurrence of 'Greed inflation' in the mining and extraction industry could only take place in these countries.





**Figures 4-11.** Distribution of median values and outliers for a set of margin scores over selected time periods in countries with a positive Kruskal-Wallis test.

Source: own elaboration based on ORBIS database.

A deeper examination of the distribution of margins was based on the results of the Kruskal-Wallis test, which is the equivalent of the parametric test of variance that indicates the occurrence of differences between the tested sets based on the median value. The p-value of the Kruskal-Wallis test for non-parametric independent variables indicated that only in the case of Italy and France, significant differences could be identified in the distribution of the margin indicator values in 2021 and 2022 compared to the values of 2015-2020. For the subsequent countries, the parameter value for the test was as follows:  $p(\text{BE}) = 0.44$ ;  $p(\text{FI}) = 0.53$ ;  $p(\text{FR}) = 0.0028$ ;  $p(\text{IT}) = 0.0053$ ;  $p(\text{LV}) = 0.497$ ;  $p(\text{PL}) = 0.52$ ;  $p(\text{SE}) = 0.21$ ;  $p(\text{SK}) = 0.64$ . The average value of the margin ratio (shown in the x-y diagrams) for Italy remained at 2.3 per cent in 2015-2020, while in 2021 and 2022 it was, respectively: 3.4 and 3.5 per cent. For France, the differences were higher: in 2015-2020, the gross profit margin averaged 3.5 per cent, while in 2021 and 2022 it was 7.3 and 6.3 per cent, respectively.

The differences in the distribution of margin indicator values in 2021 and 2022 compared to 2015-2020 values in France and Italy were influenced by the increase in energy prices (González, 2022). Italy is dependent on energy imports and the increase in energy prices contributed significantly to inflation. In December 2022, energy prices in Italy were 70% higher compared to December 2021 (Simone, Pianta, 2023). In response to the energy crisis, Italy

decided to reduce the excise tax and VAT rate on energy products and introduced subsidies for companies (Amaglobeli et al., 2023; Simone, Pianta, 2023). In addition, a tax on additional profits made by energy companies was introduced (Amaglobeli et al., 2023). Simone and Pianta (2023) indicate that, without public control of energy markets, the Italian industry has made large profits.

France shows less dependence on energy imports compared to Italy, basing its energy sector on nuclear power and hydropower (Pinto et al., 2023; Plane, Vermersch, 2022). Energy prices in France rose more slowly than in other EU countries, which also contributed to a lower inflation rate. However, France was also affected by the energy crisis, forcing the French government to introduce a tariff shield. This shield included a discount on gas, electricity and fuel prices. Furthermore, in France, profit margins of non-financial companies remained relatively high compared to pre-pandemic times (Plane, Vermersch, 2022). At the same time, the change in aggregate profit margins was uneven, due to the support received by companies for the negative effects of the COVID-19 pandemic in the second half of 2020 and the first half of 2021. The increase in profit margins in non-financial companies in France was also due to support to pay energy bills and a reduction in the corporate contribution to value added (Bénassy-Quéré, 2023).

## 5. Conclusions

The study aimed to test the hypothesis of the occurrence of elevated profit margins in the mining and extraction industry in an environment of elevated CPI inflation rates, i.e. the occurrence of the so-called 'Greed inflation' phenomenon. The analysis showed that the countries that were characterised by a higher share of companies with inflated gross profit margins in 2015-2020 and in 2021-2022 were France, Sweden and Italy. The study did not reveal the prevalence of the phenomenon of overstated margins in the outlier category in the 2021 and 2022 periods analysed. Further analysis focused on a deeper investigation of the distribution of margins. The Kruskal-Wallis test was used, which indicated the existence of differences between the study sets, based on the median value of the margins. France and Italy showed significant differences between the distribution of margins in the period 2015-2020 and the distribution in 2021 and 2022. No significant differences were observed for the other countries.

There was a clear increase in margins for France and Italy in the 2021 and 2022 periods analysed, with the largest rise in France, where the median gross profit margin increased from 3.5 per cent in 2015-2020 to 7.3 and 6.3 per cent in 2021-2022 respectively.

In conclusion, the study suggests that the occurrence of increased gross profit margins is a phenomenon limited to selected countries, rather than generally observable in the global market. These findings can be valuable for understanding economic trends in specific regions and help to isolate countries where companies are experiencing higher margins compared to others. Our research provides fundamental information that can provide a starting point for decision-makers involved in the extractive sector at both EU and individual EU member state level. The extractive industry is regarded as one of the pillars of the European Union's development and of vital importance to the EU economy (Galaś et al., 2021; Yousefian et al., 2023). In addition, policy makers are concerned about energy and material independence, especially in metals.

Like any scientific article, this paper is not without research limitations. The literature review and research achieved the objective of the article - the analysis of the hypothesis of the occurrence of elevated profit margin values in the mining and extraction industry in a 'Greed inflation' environment. A significant limitation was the limited access to complete data. In addition, the analysis included countries that differ in terms of the availability of raw material deposits and also have varying levels of socio-economic development. As soon as more data becomes available, it would be worth expanding the area of analysis. This would significantly deepen the knowledge of the extractive sector in the European Union. In addition, the environmental factor, including the ecological footprint, is also worth considering in future studies. In view of the European Union's policy to move towards climate neutrality and sustainability, companies are increasingly emphasising environmental aspects in their strategies.

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