The evolution of profit margins in the energy sector in selected EU countries

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***Abstract*— The aim of this article is to verify the hypothesis of the occurrence of increased profit margins in the electricity, gas, steam and air conditioning supply industry in an environment of increased CPI inflation rates in selected countries in the European Union. The study was based on the selected quantitative methods, including: the categorisation of companies by mean and standard deviation, and the Kruskal-Wallis test for non-parametric independent variables. The analysis showed that a clear increase in margins was observed in France and Italy during the 2021 and 2022 periods analysed. The largest increase was found in France, where the median gross profit margin increased from 18.9 per cent between 2015 and 2020 to 25.6 and 26.9 per cent respectively between 2021 and 2022. The study contributes to the assessment of the adaptability of the European Union energy sector and the problematic nature of the phenomenon of increased margins.**

Keywords— Greed inflation, Energy sector, European Union

I. INTRODUCTION

Energy is one of the key economic drivers (Ozcan and Ozturk, 2019; Su *et al.*, 2020). The development of the energy sector plays an important role in stimulating economic growth as well as creating new jobs (Narayan and Smyth, 2005; Fuinhas and Marques, 2012; Dergiades, Martinopoulos and Tsoulfidis, 2013; Solarin and Shahbaz, 2013; Gozgor, Lau and Lu, 2018). Energy is seen as a strategic good that requires the involvement of policy makers economically and geopolitically (Kivimaa *et al.*, 2022) .

Events of a geopolitical nature have always affected the economy (Umar, Riaz and Yousaf, 2022). Two crises have overlapped in recent years: the COVID-19 pandemic and the war in Ukraine (Kuzemko *et al.*, 2022). Developed economies tend to struggle with common shocks around the world (Fedeli, Forte and Ricchi, 2015). Both the COVID-19 pandemic and the war in Ukraine are affecting the global economy, including the energy sector (Zakeri *et al.*, 2022). The outbreak of the COVID-19 pandemic and the restrictions imposed have contributed to a reduction in industrial activity and a decline in energy demand (Abadie, 2021; Eroğlu, 2021; Hauser *et al.*, 2021). In addition, during the COVID-19 pandemic a drop in energy prices was observed (Abadie, 2021). In contrast, even before the war in Ukraine began, there was an increase in energy demand in the European Union due to the relaxation of restrictions introduced during the COVID-19 pandemic. Demand in the energy market outstripped supply, leading to an increase in energy prices (Benton *et al.*, 2022) . This increase in energy demand was mainly met by fossil fuels (Zakeri *et al.*, 2022).

Prior to Russia's invasion of Ukraine, both countries remained significant players for global raw material markets, including energy (Benton *et al.*, 2022). Economic sanctions imposed on Russia and political interventions by the European Union and individual member states led to an increase in mineral and energy prices (Benton *et al.*, 2022; Zakeri *et al.*, 2022). In addition, during this time, EU member states, like other economies, struggled with inflation.

The aim of this research paper is to verify the hypothesis of the occurrence of increased profit margins in the electricity, gas, steam and air conditioning supply industry in an environment of increased CPI inflation rates. The study was based on the selected quantitative methods, including: categorisation of companies by mean and standard deviation, and the Kruskal-Wallis test for non-parametric independent variables.

The new aspects of this study can be summarised as follows.

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The study contributes to the development of knowledge on the energy sector. Research on the energy sector is still fragmented. A number of articles, particularly on the European Union, refer to the low-carbon economy and climate neutrality. The European Union is seen as one of the leaders in moving towards climate neutrality and achieving a model of sustainability (Janik, Ryszko and Szafraniec, 2020; Kulkarni, Wang and Venetsanos, 2022). Hence, the potential for the development of renewable energy sources and the deployment of innovative energy technologies is being explored. In addition, studies are being conducted on the impact of the energy sector on economic growth (Papież, Śmiech and Frodyma, 2019). Another important topic under study is the issue of energy poverty (Karpinska and Śmiech, 2020, 2021). This study aims to link the inflation rate and the profit margins of companies in the electricity, gas, steam and air conditioning supply industry with the energy sector.

Furthermore, to the best of our knowledge, this is one of the first articles on the verification of increased profit margins in the electricity, gas, steam and air conditioning supply sector in an environment of increased CPI inflation rates.

Another important element of the study is that the analysis was referenced to a number of European Union countries, allowing for a fuller picture of the issue of increased profit margins in the electricity, gas, steam and air conditioning supply sector.

The research paper is structured as follows: the next section will review the literature. The next section focuses on presenting the research methodology used in the analysis of the profit margins in the energy 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.

II. Literature Review

As the COVID-19 pandemic spread around the world, extensive measures were taken to limit its transmission. This involved the introduction of numerous restrictions, which had an impact on the economic and social dimensions. It also led to the recession of European economies (Jestl and Stehrer, 2021). The energy sector faced numerous challenges during the COVID-19 pandemic, which included: change in energy demand, changes in energy consumption patterns (increase in household energy consumption), changes in the energy mix, or the resilience of the energy system (Siksnelyte-Butkiene, 2021). Energy policy has also become an important element to ensure access to energy (Lu, Ma and Ma, 2021). In addition, after the COVID-19 pandemic, bottlenecks in the global supply chain emerged, leading to price increases (Sgaravatti, Tagliapietra and Zachmann, 2023).

Another important factor affecting the energy sector in the European Union was the outbreak of war in Ukraine, which clearly highlighted Europe's dependence on energy imports from Russia (Sgaravatti, Tagliapietra and Zachmann, 2023). It is indicated that the sharp increase in retail energy prices that was recorded in 2022 was caused by a geopolitical factor (the war in Ukraine) and resulted from an artificial shortage of natural gas. Thus, the European Union is exposed to the impact of external factors on the generation, distribution and commercialisation of energy (Haan, M., 2023). Before the outbreak of war in Ukraine, Russia remained one of the world's largest energy exporters (Umar, Riaz and Yousaf, 2022). Energy systems in the European Union are moving towards sustainability, but fossil fuels still play an important role in energy production (Kuzemko *et al.*, 2022).

Nonetheless, the marked increase in inflation between 2021 and 2022, which affected individual economies, was significant. Inflation reached its highest level in many decades, driven by supply shocks resulting from the COVID-19 pandemic (Caporale *et al.*, 2022; Ruiz Estrada, 2022; Topalova *et al.*, 2023). In addition, the war in Ukraine exacerbated this phenomenon. The level of inflation in individual EU countries was 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 levels (Topalova *et al.*, 2023).

It is worth noting that the behaviour of inflation in the European Union countries has surprised economists over the past few years (Yong, 2019; Ball and Mazumder, 2021). With regard to the global financial crisis of 2008-2009 and the European debt crisis of 2011, it is emphasised that inflation has fallen. In the following years, inflation in the European Union remained relatively low. Furthermore, increasing globalisation, as well as the growing importance of the service sector, were expected to have an impact on inflation in the European Union (Ball and Mazumder, 2021). In contrast, the rise in inflation in light of the COVID-19 pandemic and the war in Ukraine also surprised economists, as inflation was estimated to reach lower levels (Topalova *et al.*, 2023).

Importantly, inflation has a positive impact on income inequality, and economies with higher levels of income inequality tend to have higher levels of inflation (Thalassinos, Uğurlu and Muratoğlu, 2012). Inflation not only reduces the competitiveness of the economy, but also affects public confidence and their purchasing power (Čiegis et al., 2008). Inflation together with income inequality contribute to lower average per capita income (Thalassinos, Uğurlu and Muratoğlu, 2012). At the end of 2021 the European Union began to face an energy shock caused by a shortage of energy supply. The energy shock arose as individual economies began to recover from the COVID-19 pandemic and ease the restrictions put in place, stimulating energy demand and was further exacerbated by the war in Ukraine. This resulted in a dynamic increase in energy prices, aggravating the problem of energy poverty (Belaïd, 2022; Siksnelyte-Butkiene, 2022).

It is pointed out that the inflation associated with the COVID-19 pandemic and the war in Ukraine coincided with sustained increases in corporate profits and margins (De Loecker, Eeckhout and Unger, 2020; Weber and Wasner, 2023). The surge in inflation that occurred in 2021-2022 has been attempted to be explained in a number of ways - demand-supply mismatches, temporary disruptions in supply chains, or a price-

wage spiral. However, corporate policies related to pricing strategy are increasingly being pointed to as the cause of 2021-2022 inflation. The concept of "greedy inflation" ("Greed Inflation") has gained prominence, which assumes that companies take advantage of their market position by raising prices faster than there is an increase in production costs (Glover, Mustre-del-Río and von Ende-Becker, 2023). "Greed inflation" can have serious implications for companies and their relationships with stakeholders. It is emphasised that the price increases applied by companies were aimed at increasing their profits (Mão-de-Ferro and Ramelli, 2022). Ragnitz's research in Germany found that in some sectors companies were using price increases to increase their profits (Ragnitz, 2022). Significantly, businesses are accused not only of 'greedy inflation' and profiteering from it, but also of deliberately prolonging the inflationary climate (Dekimpe and van Heerde, 2023).

Thus, an increasing number of studies point to a relationship between dynamic profit growth and the overall price level. There are concerns that the wage-price spiral has been replaced by a price-profit spiral (Dekimpe and van Heerde, 2023). Hence, in both Europe and the United States, profits have been recognised as contributing to inflation (Weber and Wasner, 2023). Previous research on the European Union energy sector 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.

III. MATERIALS AND METHODS

The aim of the study was to investigate the hypothesis of the occurrence of increased profit margins in the electricity, gas, steam and air conditioning supply industry in an environment of increased CPI inflation rates, i.e. the occurrence of the so-called 'greedy inflation' phenomenon.

The study used data relating to financial performance from 3,531 companies operating in selected European countries: Belgium (BE), Czech Republic (CZ), Germany (DE), Estonia (EE), Finland (FI), France (FR), Greece (GR), Italy (IT), Latvia (LT), Lithuania (LV), Poland (PL), Sweden (SE), Slovenia (SI) and Slovakia (SK). The selection of the sample was dictated by its availability - the countries were represented by a minimum of 30 companies in the industry that, for the period 2015-2022, had submitted margin information to the ORBIS database used in the study. The electricity, gas, steam and air conditioning supply industry category were assigned to the company according to the NACE division. For the margin indicator, the gross profit margins used in the ORBIS databases were used, which is defined by the formula (Orbis Internet User Guide, Bureau Van Dijk, A Moody's Analytics Company):

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

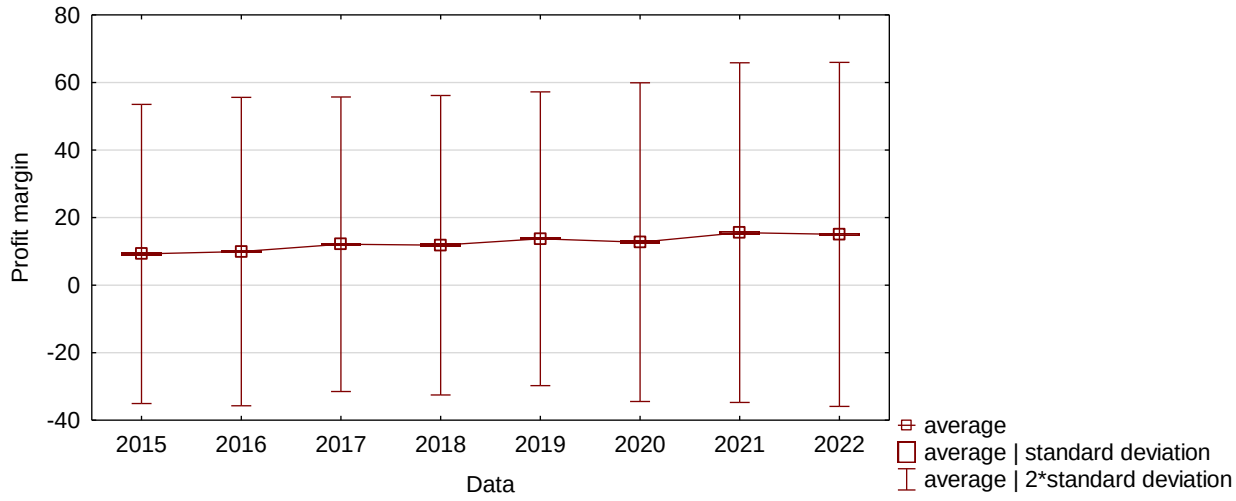
The study used selected quantitative methods, including: categorising companies by mean and standard deviation, and the Kruskal-Wallis test for non-parametric independent variables.

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

IV. RESULTS AND DISCUSSION

This study focused on analysing the hypothesis of the occurrence of elevated margins in the electricity, natural gas, steam and air conditioning supply industry in an environment of elevated CPI inflation rates. The ability to generate profits is essential for the growth of companies in the energy sector (Joaqui-Barandica and Manotas-Duque, 2023). However, the aspect of corporate profit growth due to inflation levels is currently being monitored (Colonna et al., 2023).

CHART 1. EVOLUTION OF THE VALUE OF THE MARGINS OF THE COMPANIES SURVEYED OVER THE PERIOD 2015-2022



Source: own study based on ORBIS data, bvdinfo.com, download date: 19.07.2023.

Figure 1 shows the development of the level of margins in the companies of the countries surveyed - globally, it shows a slightly higher level of margins in 2021-2022 at 15 per cent. In earlier years, this value was in the range of 8.7 per cent (2015) to 14 per cent (2019). Thus, on the one hand, we can observe a trend towards increasing margins in the sector overall, and on the other hand, an actual maximum occurring in 2021-2022.

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:

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

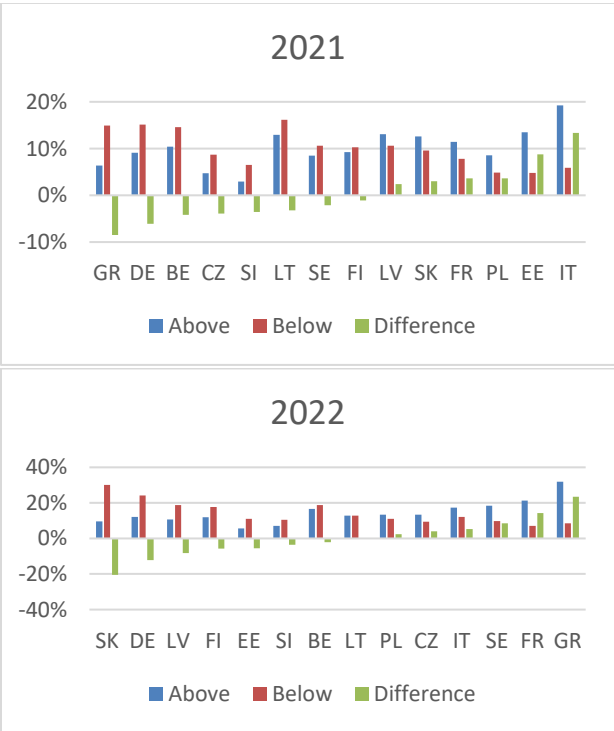
Where:

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

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

σ - standard deviation of the gross profit margin values for 2016-2020 of the respective company.

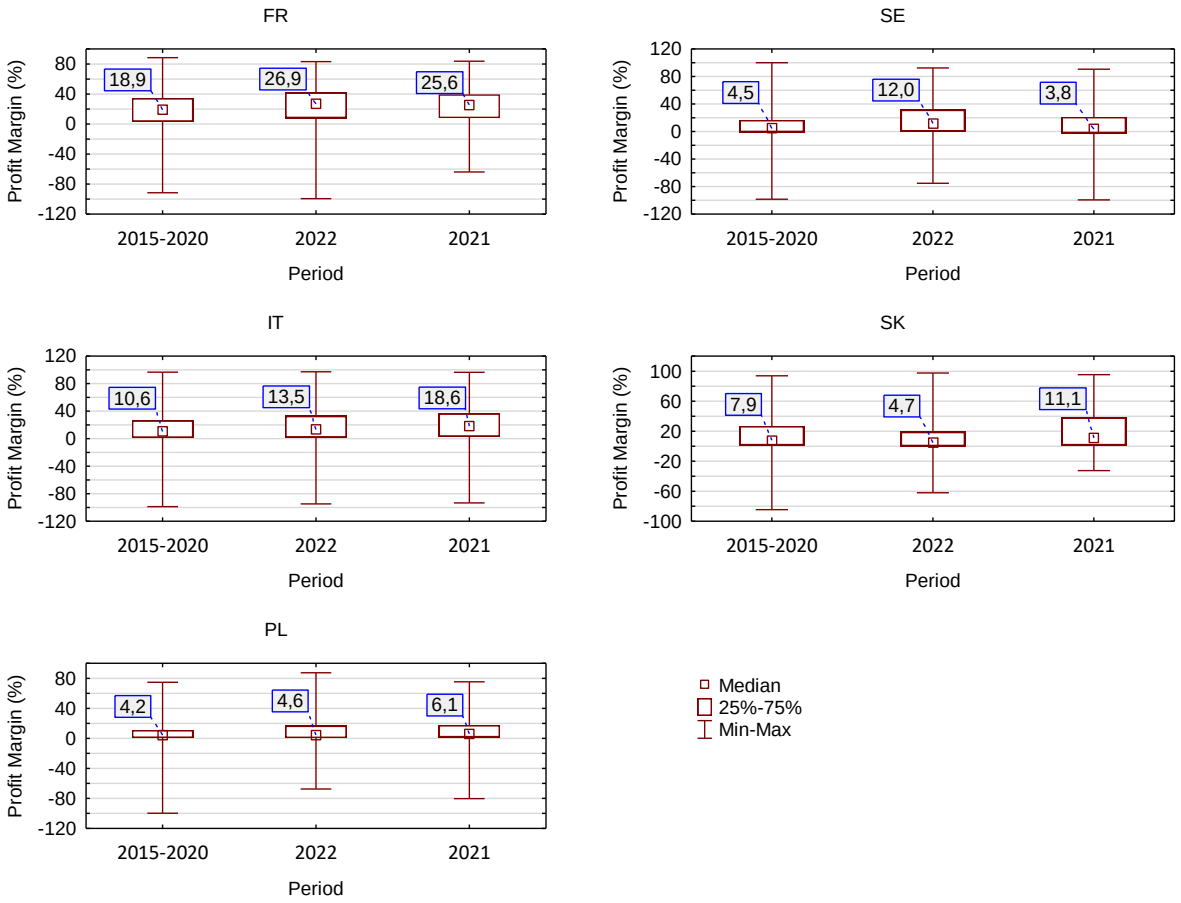
CHART 2-3. SHARE OF COMPANIES WITH UNDER- OR OVER-MARGINS IN 2021 AND 2022 RELATIVE TO 2015-2020 VALUES BY COUNTRY



Source: own study based on ORBIS data, bvdinfo.com, download date: 19.07.2023.

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 turbulence. 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 level observed in 2015-2020. According to Figures 2.-3, it can be seen that a higher number of companies with excessive margins relative to those with negative margins was maintained in both periods (i.e. 2021 and 2022) in France, Poland and Italy. An examination of the dynamics of outlier observations thus indicates that the phenomenon sought, i.e. the occurrence of excessive margins in the 2021 and 2022 alts, is not widespread. 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, in the case of France, Sweden, Italy, Slovakia and Poland, differences could be identified between the distribution of industry margins in the period 2015-2020 and the distribution of this result in 2021 and 2022. The p-values of the KW test for the other countries were: p(BE)=0.86; p(CZ)=0.78; p(DE)=0.52; p(EE)=0.5; p(FI)=0.31; p(GR)=0.24; p(LT)=0.9; p(LV)=0.41 and p(SI)=0.27. For the five selected countries, Figure 4.-8 shows the development of the median value in the individual sub-periods. In the case of France and Italy, a clear increase in margins can be indicated for both sub-periods, i.e. 2021 and 2022: the highest increase was observed in France where the median gross profit margin in 2015-2020 was 18.9 per cent, while in 2021-2022 it increased to levels of 25.6 and 26.9 per cent, respectively. Therefore, the effect of increased margins may only be observable in selected countries and is not a global phenomenon. In France, profit margins of non-financial companies remained relatively high compared to pre-pandemic times (Plane & Vermersch, 2022). In addition, an increase in energy prices in France had already been observed before the pandemic outbreak, with both energy and natural gas prices increasing by 50% between 2007 and 2019. With that said, the energy sector in France is based on nuclear power and hydropower (Pinto *et al.*, 2023). The French economy is less dependent on natural gas compared to other EU member state economies . Inflation has risen more slowly in France than in other eurozone countries due to lower energy price increases. However, France was also affected by the energy crisis and the French government applied a tariff shield (tarrif shield), which included a discount on gas, electricity and fuel prices. Moreover, corporate taxes were reduced in France and there was a faster increase in the VA deflator compared to consumer prices (Plane & Vermersch, 2022)..

CHART 4-8. DISTRIBUTION OF MEDIAN VALUES AND OUTLINERS FOR A SET OF MARGIN VALUES OVER SELECTED TIME PERIODS IN COUNTRIES WITH A POSITIVE KRUSKAL-WALLIS TEST



Source: own study based on ORBIS data, bvdinfo.com, download date: 19.07.2023.

In contrast, in Italy natural gas remains the most important fossil fuel used for heating purposes. Gas prices in Italy are characterised by high volatility. In response to the energy crisis, excise duties and VAT rates on energy products have been reduced in Italy. A tax on the extra profits made by energy companies has also been introduced (Amaglobeli et al., 2023) . It is worth mentioning that the Italian area is divided into market zones and energy prices vary significantly between the different zones. This is due to north-south transmission line constraints. This makes it difficult to address the regional imbalance in energy generation and demand between the two zones (Ghiani *et al.*, 2020).

V. CONCLUSIONS

The study aimed to test the hypothesis of the occurrence of profit margins in the electricity, gas, steam and air conditioning supply industry in an environment of elevated CPI inflation rates, i.e. the occurrence of the so-called 'greedy inflation' phenomenon. The analysis of the results showed that the countries that were characterised by a higher share of companies with inflated gross profit margins than with deflated ones in 2015-2020 and in 2021-2022 were France, Poland 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 profit margins. France, Sweden, Italy, Slovakia and Poland showed significant differences between the distribution of profit margins in the period 2015-2020 and the distribution in 2021 and 2022. No significant differences were observed for the other countries.

For France and Italy, a clear increase in profit margins was found for the 2021 and 2022 periods analysed, with the largest increase in France, where the median gross profit margin increased from 18.9 per cent in 2015-2020 to 25.6 and 26.9 per cent respectively in 2021-2022.

In conclusion, the study suggests that the incidence of elevated gross profit margins is a phenomenon limited to selected countries and not generally observable in the global market. These results can be valuable for understanding economic trends in specific regions and help to distinguish countries where companies experience higher profit margins compared to others. In addition, the study provides important information that can provide a starting point for energy policy makers. In this context, reference can be made to the national as well as the international (EU) level.

Like any scientific study, this research study is also not free

of limitations. The research methods used achieved the objective of testing the hypothesis of the occurrence of increased profit margins in the electricity, gas, steam and air conditioning supply industry in an environment of increased CPI inflation rates. Limited access to data has been a constraint, hence it is worth extending the area of analysis to the other EU member states as soon as data is available. This will undoubtedly provide a complete picture of the phenomenon of profit margins and contribute to a deeper understanding of the European Union energy sector.

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