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The Influence of the Increase in Energy Prices on the Profitability of Companies in the European Union

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Abstract: This study evaluates the influence of rising energy prices on firm-level profitability. According to the policies of the European Union, the aim is to achieve an energy union that offers all community economic agents safer, cleaner, and more affordable energy. For this study, 1342 updated observations from 16 European countries for the year 2022 were used, studying the influence of increasing energy prices on the decrease in profit. The increase in energy prices influences the risk of firms experiencing negative profitability in 2022 compared to 2018, as measured by the increase in the number of firms that register a profit of less than or equal to zero. Company characteristics, such as size and age, which positively influence the level of profitability, are statistically significant. Furthermore, this study shows that the business sector in which the firm operates influences the level of profitability in a differentiated manner. Linear and logistic regression methods were employed for the methodology.

Keywords: company; energy; inflation; profit; sector

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1. Introduction

This study delves into the pressing concern of how escalating energy prices are affecting the profitability of companies operating within the EU. At the core of this research lies the exploration of the intricate relationship between rising energy costs and the financial performance of businesses in the European Union. In our study, energy is measured using electricity as a proxy. Escalating electricity prices can significantly affect a company's operational costs. As energy is a fundamental input for almost all businesses, any increase in its price can erode profit margins and competitiveness. Understanding the extent of this impact is vital for companies in the EU as it can inform strategic decisions related to cost management and resource allocation. Several researchers saw a connection between the troubled economic environment during the COVID-19 pandemic, price changes, and the energy market [1], as well as the repercussions of energy cost fluctuations on the economy [2,3]. This study does not focus on the COVID-19 pandemic itself; instead, it considers it as a timeframe during which energy prices rose and economic conditions underwent significant changes. The evidence of increased corporate overdrafts in the U.S. implies that a business "dash for cash" was triggered by the pandemic period, demonstrating a surge in liquidity demands [4,5]. The obstacles to continuing the activity arise due to the increase in costs above the income level, and these barriers can be measured as a risk of decreasing profit. The authors in [6] showed that more sustainable European companies performed better and were more able to absorb the shocks during the COVID-19 pandemic period if they had higher levels of cash and liquid assets in the pre-COVID period. Researchers with various theoretical perspectives argue over the existence or nonexistence of a significant link between rising energy costs, a company's profit, and its operational sector. These disruptions might affect a company's expenses due to the growth of energy costs, leading to changes in cost structure. Additionally, these rising expenses may constrain

companies to stay competitive, thereby requiring some cost cutbacks, sales amplification, and/or price adjustments for sold products. If all other conditions remain constant, the increased energy cost could lead to a decline in profits for some companies under specific circumstances. If companies have not optimized the balance between revenue changes and production expenses by adjusting their selling prices, they may need to explore other financing methods to sustain their operations, like loans.

Rising energy costs are not only a financial concern but also have implications for environmental sustainability. Companies may need to adapt and invest in energy-efficient technologies or renewable energy sources to mitigate the impact of higher electricity prices. The role of sustainability practices and energy efficiency measures gains prominence in the context of an energy crisis. Firms that embrace sustainable energy sources or reduce their energy consumption may find themselves in a more favorable position during the crisis.

This study aims to evaluate the relationship between the increase in electricity prices and a company's competitiveness, using profit as a proxy for competitiveness. The research problem involves measuring the risk associated with increasing electricity prices at the firm level on changing profit as a result of the increase in the price per kilowatt-hour. The authors aim to conduct an analysis of the potential correlation between the profit, size, age, and sector of activity of European Union firms and to provide substantiated answers to the question: is there a relationship or not? If the answer is affirmative, to what extent and with what intensity does the level of competition, measured through profit, size, age, and sector of activity, have an influence?

This study aims to fill the gap in research regarding its effects on the profitability and competitiveness of firms in specific sectors. In light of the ongoing energy crisis, discussion regarding firms' resource allocation during the pandemic takes on added significance. Firms may have diverted funds from certain areas to cover rising energy costs. In the current energy crisis, where energy costs remain a pressing concern, this resource allocation strategy may continue to influence firms' financial decisions. Limited research assessing business-level economic shifts following the pandemic period exists; therefore, this examination of the impact of escalating energy prices on the profitability of European Union companies is considered valuable.

The justification for employing linear and logistic regression methods in the methodology outlined in the research article can be based on several rationales. The research encompasses diverse outcomes, encompassing both continuous variables (e.g., profitability) and categorical variables (e.g., firms encountering negative profitability or not). Linear regression proves effective for continuous variables, such as assessing changes in profitability, while logistic regression is particularly apt for binary outcomes, like evaluating the occurrence of negative profitability. The utilization of regression models offers the advantage of interpretable coefficients, which convey both the direction and magnitude of the relationships between the independent variables (e.g., energy prices, GDP, and company characteristics) and the dependent variables (e.g., negative profitability and risk of negative profitability). The study is poised to draw broad and generalizable conclusions concerning the influence of these external factors on firm-level negative profitability, encompassing a comprehensive analysis across 16 European countries in the year 2022.

The findings of this study may have policy implications. If a strong relationship is established between energy price increases and declining profits, this may require regulatory measures or incentives to help companies cope with these challenges. The study's intention to analyze the potential correlation between profit, company size, age, and sector of activity is valuable. It can reveal nuances in how different types of companies are affected by energy price increases. This information is vital for policymakers, industry associations, and companies themselves to tailor their responses to specific needs and challenges. Sector-specific responses during an energy crisis underscore the importance of understanding how different industries are uniquely affected. Energy-intensive sectors, for example, may face more significant challenges in adapting to rising energy costs. Assessing sector-specific vulnerabilities and potential adaptation strategies is essential for policymakers and industry

stakeholders. In the context of the energy crisis, the discussion on government policies and support takes on added significance. Government interventions, such as incentives or subsidies to mitigate energy costs, may play a crucial role in helping businesses cope with the crisis.

Several theories offer insights into how the escalation of energy prices affects the profitability of companies. According to Porter's theory of competitive advantage [7], firms can gain an edge over rivals by minimizing costs. The Resource-Based View (RBV) theory argues that a firm's resources and capabilities exert a significant influence on its competitiveness and overall success in the market. The transaction cost theory expounds on how the costs of executing economic exchanges impact a firm's capabilities [8].

This article is divided into five parts: First, this article summarizes the literature review with regard to firm competitiveness, and profit is used as a proxy for competitiveness. Second, based on the background of energy prices and firm profitability, four theoretical research hypotheses are proposed. Third, this paper describes the data used in the models. The results and interpretations of the linear regression, bootstrap, and logit probabilistic models are presented in the fourth part of this paper. Finally, policy suggestions are put forward according to the empirical results.

2. Literature Review

According to [7], a firm that operates with costs lower than its competitors can potentially establish itself as a market leader in terms of cost efficiency. Some businesses adopt a strategy known as "low-road competitiveness", striving to compete by minimizing costs, often at the expense of other factors such as product quality or durability. Firms following this approach are highly sensitive to cost increases, including those related to energy prices. For instance, a company competing on cost-effectiveness within an energy-intensive sector, like heavy industry, could experience a significant decline in profits in the face of rising energy prices.

The Resource-Based View (RBV) argues that a firm's resources and capabilities have an important influence on its market competitiveness and success. In the scenario of increasing energy costs, a firm with effective energy resources and energy management capabilities can gain a competitive advantage and maintain or boost profits. Therefore, under this theory, there would be a meaningful relationship between energy cost hikes and company profit, contingent on the firm's resources and abilities. This suggests a powerful correlation between energy prices and business profits in such contexts. Anticipation of variance in firms' ability to compensate for the increase in energy costs to sustain profitability is expected, with performance variations likely contingent on each firm's distinct characteristics and operational sector.

Analysis of the extant literature on profit persistence, the significance of characteristics related to profit persistence, the sector of economic activity, the sector of product or service marketing, and the level of economic development in the country of operation was carried out. Comprehending the correlation between energy price fluctuations and competitiveness plays a crucial role in the discourse surrounding the shift toward environmental and economic sustainability [9–13]. Considering these external shocks, it is asserted that the inclusion of data prior to 2018 from the BEEPS (The Business Environment and the Enterprise Performance Survey) questionnaires provided by the World Bank would misrepresent the economic landscape.

According to the authors in [14], a company's 'competitiveness' is defined as its consistent ability to satisfy customer needs while making a profit. This capability can be achieved by delivering products and services that customers perceive to be superior to those that competitors can offer. The authors in [15] perceive competitiveness as a company's capability to expand its market share, extend its operations into international markets via exports, and secure long-term growth and profitability. The authors in [7] posit that when a company operates at costs lower than competitors, it could become a market leader in cost terms; simultaneously, if its products or services are consistently perceived

to be superior to those of rivals, the company can attain significant differentiation. The competitive advantage strategy through cost refers to the strategy of minimizing costs as much as possible, often by cutting wages, work standards, and investment in human capital and research.

The authors in [16] propose that the Resource-Based View (RBV) is a solid theory for assessing a firm's competitive advantage. The RBV concentrates on internal inputs, like resources and competencies, to explain a firm's competitive advantage. The RBV underscores the significance of efficient resource and competency management to maintain competitiveness and reduce costs. The authors in [17] discovered that small independent retailers, having limited resources, focus their efforts on customer relationships and suffer due to competition or external factors. The authors in [18] found that specific firm competencies, especially in information, relationships, and marketing, combined with competitive strategies such as differentiation and cost-based leadership, give exporting firms added competitiveness and boost their efficiency in the international market.

The transaction cost theory refers to the influence of transaction costs on firm capabilities [8]. The increased transaction costs resulting from a rise in energy prices reduce the overall profitability of firms, as resources are allocated towards managing these costs instead of other potentially profit-generating activities. In sectors where energy is a significant operational cost, firms would be more heavily impacted. These sectors would likely have to bear higher transaction costs as they seek alternatives, negotiate with suppliers, and implement energy-saving measures. For some economic entities, the escalation in energy prices resulted in a decline in their profits during the first quarter of 2022 [19]. The authors in [20] indicated that firms tend to be more cautious and might lower investments when the uncertainty around energy prices heightens. Being competitive in terms of costs is an essential factor for a firm's advantage, and the volatility of energy costs poses a significant risk to the company's long-term survival [21].

The authors in [22] proposed that there has been a surge in international competitiveness over the recent decades, and profits have seen an upward trend in developing countries. During the COVID-19 pandemic period, firms had varied expectations, with more pessimistic ones anticipating a prolonged lockdown period, hence reducing investments and laying off employees [19]. Research by [23] indicated that investments in employee development prior to the pandemic led to fewer layoffs during the crisis due to financial constraints. Moreover, a firm's capability to effectively manage its information systems has a direct and substantial impact on its competitive position, as well as its resilience to challenges like the COVID-19 pandemic ([24–26].

The authors in [27] linked the introduction of new production lines to an enhanced performance in response to COVID-19, particularly for manufacturing firms. They also discovered a positive correlation between a firm's age and the addition of new product lines. The authors in [28] found a direct impact of IT capabilities on a firm's flexibility. Furthermore, they showed the direct effect of this flexibility on firm performance and how IT capabilities indirectly influence firm performance via agility, offering a partial mediation.

According to [29], the fertilizer industry weathered the COVID-19 pandemic relatively well. Fertilizer firms have fostered a 'global immunity' by operating in highly volatile conditions for an extended period. This 'global immunity' is founded on a collection of competitive benefits, with only sustainable competitive advantages contributing to the continuous growth of these fertilizer firms.

The authors in [30] have shown that adherence to sustainable business strategies can enhance a firm's resilience in challenging situations, such as the COVID-19 pandemic. Larger firms, possessing abundant resources from reserves or significant profits, are better equipped to undertake large-scale investments compared to smaller firms. The authors in [31] have argued that prices have a mild yet statistically significant influence on firms' long-term profits.

An increase in production costs, including those of energy, could affect a firm's profitability. For example, manufacturing firms with a high energy consumption may ex-

perience reduced profits with rising energy costs compared to firms with lower energy consumption, such as consultancy services. Nevertheless, this relationship might not be significant if firms can compensate for the increased costs by raising prices, employing technological advancements, or improving process efficiency. The Resource-Based View (RBV) suggests that firms can achieve a competitive edge by owning and controlling valuable, rare, difficult-to-replicate, and non-substitutable internal resources and competencies [32]. Companies could, therefore, invest in efficient energy resources and capabilities to remain competitive. The authors in [33] studied the impact of the 2008 financial crisis on firm profitability and found that firm traits are more critical under strenuous conditions, while industry characteristics have less influence. In other words, a firm's profitability is largely determined by its own management.

Firms surviving market conditions have a learning mechanism to cope, as shown by [34]. The authors in [35] argue that firm performance is positively and significantly influenced by the age of the firm. Furthermore, Ref. [36] shows that many economists have correlated firm failure rates with the increased age of the firm and argue that there is a significant relationship between the age of the firm and the growth rate of sales. From a microeconomic theory perspective, the demand elasticity for certain products may be more affected by energy prices. For instance, if demand is inelastic (like in the medical or food sector), then rising energy prices might have a minimal impact on sales and profits. Conversely, if demand is elastic (like in the tourism or luxury industry), increasing energy prices might lead to a decrease in demand, sales, and, consequently, profits. Therefore, understanding the implications of energy costs in different sectors and optimizing resource management could significantly influence a company's competitive edge and profitability. This implies that there could be a significant interplay between energy prices and the earnings of a firm, although it might be more pronounced in some sectors.

Companies can mitigate the effects of escalating energy costs by adopting competitive approaches such as product differentiation, technological advancements, or improving energy efficiency. Consequently, the right tactics could potentially moderate or even negate the connection between energy prices and firm profitability. However, the ability of a firm to apply these tactics might hinge on the industry it operates in. For instance, in capital-intensive sectors like the oil or construction industry, it may be unfeasible to entirely compensate for increased energy costs. The authors in [37] showed that energy intensity and relative energy intensity could influence a company's growth regarding capital accumulation and profits in different ways. The authors in [38] demonstrated that integrated reporting, the balance sheet value, and earnings per share have a substantial impact on the market value of energy sector firms. The authors in [39] showed a connection between sustainability performance and income, consistent with assumptions of the natural resource-based perspective. A study conducted by [40] on Greek manufacturing companies spanning 1963-1988 found that a consistent profit rate existed in most sectors, while significant profit rate differences occurred between sectors. The authors in [41] explored the sources of profitability for service industry and manufacturing firms in Belgium, France, Italy, and the UK during the period from 1993 to 2001. They identified a positive link between market share and profitability, which was more evident in the manufacturing sector than the service sector. The authors in [42] examined characteristics that influence profitability in service sector firms and discovered that profitability persisted over time. They also found that firms with higher growth rates, lower debt, and a lower fixed asset volume were more profitable. The authors in [43] examined the persistence of profits for European firms in the food industry and found that profit persistence in the food field was lower than in other manufacturing sectors due to increased competition and that firm size was a significant source of profit persistence; however, firm age and risk negatively influenced profit persistence. The authors in [44] conducted a study on 590 food sector firms in Belgium, France, Italy, Spain, and the UK and found both short-term and long-term profit persistence, with profit influenced by industry characteristics and firm characteristics. The authors in [45] conducted a firm-level study across several countries, including

using the gross domestic product per capita as a control variable. The authors in [46] developed an econometric model with firm-level data from several countries, considering gross domestic product per capita as a fixed effect at the country level. This variable ensures the comparability of econometric estimates corresponding to the other variables simultaneously.

3. Theoretical Framing and Research Hypothesis

Based on the analysis of the specialist literature, null hypotheses were formulated:

Null Hypothesis 1 (H1.0): There is no significant correlation between the rise in energy prices and the decline in profits for the analyzed European firms in 2022. Null Hypothesis 2 (H2.0): There is no significant correlation between the size, age, and profitability level of the firm. Null Hypothesis 3 (H3.0): There is no significant correlation between the type of sector in which the firm operates and its level of profitability. Null Hypothesis 4 (H4.0): There are no significant differences between the manufacturing and service sectors in terms of vulnerability to the rise in energy prices.

Additionally, the alternative hypotheses that constituted the research approach were formulated:

Hypothesis 1 (H1.1): *The surge in energy prices has resulted in a decline in the profits earned by European firms in 2022.*

Different industries and sectors have varying levels of sensitivity to energy price fluctuations. Some sectors may be more energy-intensive, while others rely less on energy as a cost component. This diversity can dilute the overall correlation between energy prices and profit decline when aggregated at the European level. Many companies have been actively investing in energy-efficient technologies and practices in recent years. These advancements can mitigate the impact of rising energy costs, making firms less vulnerable to cost increases and profit declines. Some companies have diversified their energy sources, incorporating renewable and sustainable options. This diversification can insulate them from the full brunt of energy price spikes, as they are less reliant on fossil fuels, which tend to be more volatile in price. In certain industries, firms have the ability to pass on increased energy costs to consumers through price adjustments. This strategic flexibility can help maintain profit margins, even in the face of rising energy expenses.

Hypothesis 2 (H2.1): *The characteristics of the firm in terms of size and age have a positive impact on its profitability.*

Firms of varying sizes and ages often pursue diverse business strategies and models. This diversity can lead to a wide range of profitability levels within each category, making it challenging to establish a direct correlation. Some younger firms might prioritize rapid growth and investment over immediate profitability, while older and larger firms might focus on stability and consistent profits. Market conditions and industry-specific factors can have a substantial impact on a firm's profitability. These factors can vary widely across different sectors and time periods, further complicating attempts to establish a straightforward correlation. Economic cycles, including periods of recession and growth, can significantly influence profitability. Firms of different ages and sizes may react differently to economic fluctuations, leading to variations in profitability that are not directly tied to these factors. Firms have different financial strategies, including debt levels, investment priorities, and dividend policies. These strategies can impact profitability and may not necessarily align with firm size or age.

Hypothesis 3 (H3.1): *The specific sector in which the firm operates affects its level of profitability.*

Different sectors encompass a wide array of business models and strategies. These variations in approach can lead to significant differences in profitability, even within the

same sector. For instance, some companies within a sector may prioritize cost leadership, while others focus on differentiation, affecting their profit margins differently. Market conditions, competitive dynamics, and consumer preferences can vary widely between sectors. These external factors have a substantial impact on a firm's profitability and may not align with sector categorization. Changes in market conditions can also occur rapidly, further complicating the establishment of a direct correlation. Firms that innovate and adopt cutting-edge technologies can gain a competitive advantage, regardless of the sector they operate in. Technological advancements can significantly impact profitability and may not be tied directly to sector categorization.

Hypothesis 4 (H4.1): *In the manufacturing sector, energy costs have a more substantial effect on a company's profit compared to the service sector.*

Manufacturing companies typically engage in energy-intensive production processes involving machinery, heating, cooling, and transportation. These operations often rely heavily on energy inputs, making them more susceptible to fluctuations in energy prices. In contrast, many service sector businesses, such as IT services or consulting, may have lower energy requirements. Manufacturing companies often directly consume large quantities of energy in their day-to-day operations. This direct energy usage contributes significantly to their overall operational costs, making them more vulnerable to energy price increases. Service sector firms may rely less on direct energy consumption. Manufacturing companies frequently use specialized and energy-intensive equipment that may be costly to operate. As energy prices rise, the cost of operating such equipment escalates, affecting the bottom line. Service sector firms often do not rely on such equipment to the same extent.

4. Data Description

In order to achieve the research objectives and validate the hypotheses formulated, quantitative research was carried out using data from the BEEPS (The Business Environment and the Enterprise Performance Survey) questionnaires, which are made available by the World Bank. The latest data set available is for the period 2018–2020; data from this study were used at the company level, using a simple random sample from the following European Union countries: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, and Hungary.

From the BEEPS data, all available EU countries were selected without using any other criteria for country selection. The data were collected by phone, and the main advantage of using the BEEPS questionnaire is the rigorous collection and processing of data. The analyzed company population was proportionally represented in all sectors of activity. All European countries for which data were available were analyzed based on company responses to the questionnaire. The sample included EU member countries for which data were available for 2018. Variables were selected based on contributions and findings in the specialized literature. The total number of observations included in our model was 1342 updated observations for 16 European countries for 2022.

In order to address the first research objective concerning the relationship between the increase in energy prices and the decline in companies' profits in 2022 compared to 2018, the 2018 revenues and expenses of the companies were adjusted to 2022 prices, and the following steps were taken (See Table 1):

- Values that were negative were removed from the questionnaire, as the value "−9" is associated with situations where respondents do not know or do not wish to answer the questionnaire's questions, according to the World Bank's available questionnaires.
- The year 2018 was selected because it represented the year with the highest number of simultaneous observations for all analyzed European countries.
- All values expressed in national currency were converted into Euros at the official exchange rate.

- Based on the questionnaire data concerning the cost per kWh and declared kWh consumption, the unit price per kWh at the company level was calculated by dividing the declared energy cost by the declared energy consumption. This calculation was performed to facilitate a comparison between the kWh price derived from the questionnaires and the official kWh price. The objective of this comparison was to identify and exclude companies that reported an inaccurate kWh price. The questionnaire data were adjusted by excluding values that deviated by more than +/−15% from the official kWh price in the respective country. Subsequently, only the filtered data were utilized in the analysis.
- KWh prices for the years 2018 and 2022 were obtained from Eurostat. The final electricity prices for companies (with an hourly consumption < 20 MWh) were identified on Eurostat using biannual data spanning the period 2018–2022. KWh prices for the year 2018 were calculated as a simple arithmetic average for both semester one and semester two, with values expressed in Euro per kWh. However, for the year 2022, only data from semester one were available, so the kWh price for 2022 was assumed to be the same as the price from semester one.
- For the sake of comparability and the adjustment of 2018 data to 2022 prices, the increase indices of kWh prices in 2022 relative to 2018 were calculated using the ratio $IPkWh2022/2018 = PkWh2022/PkWh2018$.
- To adjust the 2018 revenues to reflect the 2022 prices, the Harmonized Consumer Price Increase Index IPkWh2022/2018 was determined as IP2022/2015 divided by IP2018/2015. This calculation involved the ratio between the Harmonized Price Increase Index for 2022 compared to 2015 and the Harmonized Price Increase Index for 2018 compared to 2015. This approach was employed because the price indices provided by Eurostat and IMF utilize Laspeyres indices with a fixed base year of 2015 (2015 = 100). The harmonized price increase indices were obtained from the International Monetary Fund (IMF) since equivalent data for the year 2022 were not available from Eurostat. The adjustment of the data was performed using inflation indicators from IMF.org. To update the various cost categories, excluding energy, for the year 2018, a procedure was employed involving the calculation of the difference between the total cost and the energy cost. This outcome was subsequently adjusted using the IP2022/2018 factor. Following this adjustment, the energy cost from the year 2022 was incorporated. The update for the 2022 energy cost was accomplished by multiplying it by the consumption reported by each company for the year 2018, employing the IPkWh2022/2018 factor while assuming consistent energy consumption since 2018. The adaptation of revenue figures was conducted using the harmonized consumer price increase indices. This process entailed the multiplication of the revenues reported by the company in 2018 by the IP2022/2018 factor. The dependent variable within the econometric model is profit, which was determined as the distinction between revenue and costs for both 2018 and 2022. The profit for 2018 was computed as the divergence between the revenue reported by the company in 2018 and the total cost reported for the same year. For 2022, due to constraints in data availability, an extrapolation of the annual GDP value was performed based on the data from the first three quarters. The GDP was ascertained through a straightforward arithmetic averaging of the data from these three available quarters to estimate the value for the fourth quarter. All figures are presented in millions of Euros.

Table 1. Description of variables.

Variable	Type	Definition	Source
Profit in 2022 (Profit2022)	Dependent variable	Profit calculated as the difference between the company's income and expenses, in Euros, at the company level	World Bank, International Monetary Fund, Eurostat
Profit in 2022 (Profit2022dum)	Dependent variable	Profit as dummy variable, 0 if profitable, 1 if profit is less than or equal to zero	World Bank, International Monetary Fund, Eurostat
Company size (Size2022)	Independent variable	Firm size measured by the number of permanent employees in the firm in 2022	World Bank
Gross domestic product per inhabitant (GDPcap2022)	Independent variable	The ratio between the gross domestic product and the number of capita in each country, in Euros per capita, at current prices	Eurostat
The cost of energy in each company (Costenergy2018)	Independent variable	The cost of energy at company level in 2018, in Euros	World Bank, Eurostat
The cost of energy in each company (Costenergy2022)	Independent variable	Energy cost updated with the energy price index in 2022 compared to 2018, in Euros	World Bank, Eurostat
Age of the company (Age2022)	Independent variable	The age of the company calculated as the difference between the year 2022 and the year of establishment, in number of years	World Bank
Sector (A4a)	Independent variable	Sector according to the activity of the firm, as a dummy variable, 1 = Manufacturing, 2 = Retail trade, 3 = Other services, 4 = Food and beverages, 5 = Textiles, 6 = Clothing, 7 = Non-metallic mineral products, 8 = Manufactured products of metal, 9 = Machinery and equipment, 10 = Other manufactures	World Bank

Source: The author's calculations based on data from the World Bank, Eurostat, International Monetary Fund, 2022.

5. Results and Discussion

5.1. Descriptive Statistics

As previously mentioned, our analysis will focus on highlighting the relationship between the increase in energy prices and how it affects the amount of profit at the firm level. For the year 2018, companies with profit $<= 0$ represented 6.39% of the total, which equates to 181 out of 2831 firms (from these, firms with Profit2018 < 0 represented 2.90% of firms, or 82 out of 2831), and frequency of firms with profit > 0 represented 93.61% of firms or 2650 out of 2831 firms. For the year 2022, firms with profit $<= 0$ represented 10.13% of firms, or 136 out of 1342 firms (from these, firms with Profit2022 < 0 represented the same percentage of 10.13% of firms, or 136 out of 1342 firms), and the frequency of firms with profit > 0 represented 89.87% of firms, or 1206 out of 1342 firms. The results can be seen in Table 2.

Table 2. Descriptive statistics with the frequency of profitable firms in the years 2018 and 2022.

	(1)	(2)	(3)	(4)
Variables	**Profit 2018**	**Profit 2022**	**Profit 2018 <= 0**	**Profit 2022 <= 0**
Number of valid observations	2831	1342	181	136
Average	5,926,058	5,384,982	−3,694,959	−4,241,359
Median	270,000	286,119	0	−224,977
Minimum value	−315,646,982	−177,824,284	−315,646,982	−177,824,284
Maximum value	5,442,663,614	559,950,503	0	−354

Source: The author's calculations based on data from the World Bank, Eurostat, International Monetary Fund, 2022.

It can be observed that there was an increase in the number of firms with a profit less than or equal to zero in 2022 compared to 2018. Additionally, there was an increase in the number of firms with a profit of strictly less than zero in 2022 compared with 2018. These results suggest that, on average, firms were adversely impacted by the evolving economic conditions following the pandemic, aligning with the conclusions drawn in the study conducted by [47]. It is possible that some firms that had negative profits before the COVID-19 pandemic were more strongly affected by the increase in production costs as a result of rising energy prices, according to the results obtained by [48]. The results show a strong influence of energy prices on increasing production costs. Also, cost is an important aspect in forming the competitive advantage of the firm, according to the authors in [19,21]. In order to cope with increasing costs, some firms reduce investments and/or lay off employees [19]. Prices have a minor influence on firms' long-term profits, although the relationship is statistically significant [31].

5.2. Econometrics Analysis

Alongside fundamental research based on the literature review, regression analysis was used for this study, following the two stages of model estimation and hypothesis testing. Within the regression analysis, the relationship between a firm's profit (Profit2022) as the dependent variable of EU member states and a series of characteristics, considered explanatory variables, was examined, as can be seen in Table 3. The research hypotheses were sequentially tested on the econometric model based on the equation:

$$\text{PROFIT2022} = \alpha 0 + \alpha 1 * \text{COSTENERGY2018} + \alpha 2 * \text{COSTENERGY2022} + \alpha 3 * \text{SIZE2022} + \alpha 4 * \text{AGE2022} + \alpha 5 * \text{GDPcap2022} + \varepsilon$$

where αi represents the regression coefficients, and ε represents the residual variable. This regression model was initially defined, and the functions implemented in the EViews 12 program were used to carry out validation tests: F-statistic for model validation, the Breusch–Godfrey serial correlation LM test for testing the autocorrelation of errors, the Breusch–Pagan–Godfrey statistic for the heteroscedasticity of errors, and multicollinearity through variance inflation factors.

Given that the Jarque–Bera test for normality of the error distribution yielded an invalid result (with a *p*-value close to 0), the bootstrap method was employed to validate the estimators. The results are presented in Table 4, after conducting 10,000 iterations, indicating that the estimators exhibit no significant differences compared to those previously reported in Table 3.

Table 3. Estimates of the regression model with the dependent variable Profit2022 with linear regression.

Variable/Results	Coefficients (OLS) (1)	Standard Deviation (2)	t-Statistic (3)	Prob. (4)
The free term	*−12,242,094.7827*	2078244.	−5.890596	0.0000
COSTENERGY2018	*1.19956273911*	0.120261	9.974686	0.0000
COSTENERGY2022	*−1.05300633834*	0.092534	−11.37963	0.0000
SIZE2022	*26,102.1859038*	3422.043	7.627661	0.0000
AGE2022	*109,382.929171*	32472.12	3.368518	0.0008
GDPcap2022	*545.400365271*	95.76851	5.694987	0.0000
Model validation				
Sample size	*1342*	*1342*	*1342*	*1342*
R^2	0.318965			
R^2 adjusted	0.316417			
F-statistic	125.1442			
Prob (F-statistic)	0.000000			

Source: The author's calculations based on data from the World Bank, Eurostat, International Monetary Fund, 2022.

Table 4. Estimates of the regression model with the dependent variable Profit2022 with the bootstrap method.

Variable/Results	Coefficients (OLS) (1)	Standard Deviation (2)	t-Statistic (3)	Prob.	Centered VIF (4)
The free term	−12,041,123	2503029.	−4.810620	0.0000	NA
COSTENERGY2018	1.376333	0.580125	2.372479	0.0178	1.740602
COSTENERGY2022	−1.120633	0.178430	−6.280505	0.0000	1.011848
SIZE2022	27,153.71	7064.629	3.843614	0.0001	1.803545
AGE2022	105,417.4	35342.72	2.982719	0.0029	1.174453
GDPcap2022	534.5150	124.2953	4.300363	0.0000	1.128524
Model validation					
Sample size	*1342*	*1342*	*1342*	*1342*	
R^2	0.318965				
R^2 adjusted	0.316417				
F-statistic	125.1442				
Prob (F-statistic)	0.000000				
Breusch–Godfrey Serial correlation LM Test (Prob. chi-Square)				0.8870	
Heteroskedasticity test: Breusch–Pagan–Godfrey (Prob. chi-Square)				0.1510	

Source: The author's calculations based on data from the World Bank, Eurostat, International Monetary Fund, 2022.

The tests indicate the absence of heteroscedasticity, autocorrelation, and multicollinearity. The F-statistic, which was statistically significant, stood at 125.1442, with an R^2 value of 0.318965. These findings align with existing research in the field, confirming an inverse relationship between cost and profit. Consequently, the rise in energy costs in 2022 is associated with a decline in a company's profit. Therefore, the alternative hypothesis H1.1., according to which the increase in energy price led to a decrease in the profit recorded by European companies, was verified and the null hypothesis H1.0. was rejected. The model also revealed a direct relationship between the size and age of the company and the profit obtained by companies in 2022. Consequently, the alternative hypothesis H2.1. was verified, and the null hypothesis H2.0. was rejected. Established firms are better equipped to navigate competitive market conditions thanks to their internal learning mechanisms [34,49]. Moreover, a company's age exerts a positive and substantial impact on its overall performance [35]. Additional research suggests that age, along with size, serve as

control variables that capture the diversity among companies. In the context of the 2008 economic crisis, [33] demonstrated that a company's profitability is primarily shaped by its internal attributes rather than industry-specific characteristics.

The analysis at the sector level was further conducted through the estimated equation, and the results can be seen in Table 5.

$$\text{PROFIT2022} = \alpha 0 + \alpha 1 \times \text{COSTENERGY2018} + \alpha 2 \times \text{COSTENERGY2022} + \alpha 3 \times \text{SIZE2022} + \alpha 4 \times \text{AGE2022} + \alpha 5 \times \text{GDPcap2022} + \alpha 6 \times (\text{A4A} = 2) + \alpha 7 \times (\text{A4A} = 3) + \alpha 8 \times (\text{A4A} = 4) + \alpha 9 \times (\text{A4A} = 5) + \alpha 10 \times (\text{A4A} = 6) + \alpha 11 \times (\text{A4A} = 7) + \alpha 12 \times (\text{A4A} = 8) + \alpha 13 \times (\text{A4A} = 9) + \alpha 14 \times (\text{A4A} = 12) + \varepsilon$$

Table 5. Estimates of the sector-level regression model with the dependent variable Profit2022 Factor.

Variable/Results	Coefficients (OLS) (1)	Standard Deviation (2)	t-Statistic (3)	Prob. (4)
The free term	−18,145,542	2,636,592.0	−6.882197	0.0000
COSTENERGY2018	1.178757	0.120012	9.821989	0.0000
COSTENERGY2022	−1.054274	0.092274	−11.42546	0.0000
SIZE2022	26,565.88	3431.341	7.742127	0.0000
AGE2022	97,811.58	32,664.59	2.994422	0.0028
GDPcap2022	630.4685	97.90754	6.439428	0.0000
A4A = 2	5,895,454	5,243,902	1.124250	0.2611
A4A = 3	1,448,358	4,208,143	0.344180	0.7308
A4A = 4	7,984,762	1,950,694	4.093293	0.0000
A4A = 5	5,968,755	15,175,894	0.393305	0.6942
A4A = 6	1,264,769	3,837,705	0.329564	0.7418
A4A = 7	5,005,876	15,174,994	0.329877	0.7415
A4A = 8	3,567,543	1,953,357	1.826365	0.0680
A4A = 9	5,077,592	2,008,566	2.527968	0.0116
A4A = 10	5,354,263	1902,798	2.813890	0.0050
Model validation				
Sample size	*1342*	*1342*	*1342*	*1342*
R^2	0.328728			
R^2 adjusted	0.321646			
F-statistic	46.41751			
Prob (F-statistic)	0.000000			

Source: The author's calculations based on data from the World Bank, Eurostat, International Monetary Fund, 2022.

In comparison to the preceding model, it is evident that the coefficient values exhibited no significant change, indicating the model's robustness. Across various sectors, including retail, other services, textiles, clothing, non-metallic mineral products, and manufactured metal products, there were no notable differences when compared to the manufacturing sector. Conversely, firms operating in the food and beverage sector, machinery and equipment sector, and other manufacturing sectors exhibited higher profitability when compared to the manufacturing sector. The model successfully passed the significance tests conducted in this sector-level analysis. Unlike the study by [47], which utilized company data during the COVID-19 pandemic, our approach involved updating available data from 2018 while maintaining constant consumption and income levels, with adjustments made to account for price increases. Our assessment of profitability levels was contingent upon the modification of costs and revenues.

The model reveals that the alternative hypothesis H3.1., according to which the type of sector in which the company operates influences the level of profitability, was verified, and the null hypothesis H3.0. was rejected.

The results show that there is a variation in profit between certain sectors, just like in [40]. The authors in [41] showed that there is a stronger influence on profit in the manufacturing sector compared to the services sector, an aspect that could not be supported by our results for the data from 2022 in the current economic context. In contrast to findings

reported by other researchers, including those in [48], the evidence does not substantiate the hypothesis that the price dynamics resulting from post-COVID-19 pandemic conditions could lead to more significant negative profits in the services sector. The authors in [43] studied the persistence of profit for European companies in the food sector and found that the persistence of profit in the food field is lower than in other manufacturing sectors. However, our results showed the opposite trend, namely that the food and beverage sector recorded a higher profit than the manufacturing sector. One potential rationale for the disparities in results compared to those of other researchers is the comprehensive update of both manufacturing and food and beverage revenues in this study, accounting for inflation levels. During the COVID-19 pandemic, prices in the food and drink sector increased significantly and, implicitly, so did the profit of companies in this sector. Other authors have argued that European companies in the food sector are profitable both in the short term and in the long term [44]. The analysis regarding the impact of the main product/service field marketed for forming profit did not lead to significant results from an econometric point of view.

The obtained results demonstrate the fact that the alternative hypothesis H4.1. was verified, according to which, in the manufacturing sector, the cost of energy has a greater impact on profit compared to the services sector; therefore, the null hypothesis H4.0 was rejected.

The last part of the analysis aimed to evaluate the impact of energy costs from 2022 on the risk of a decrease in profit below the profitability threshold. The results can be seen in Table 6.

Table 6. Estimates of the logit probabilistic model to identify variables impacting the risk of firms experiencing negative profitability.

Variable/results	Coefficients (ML Binary Logit, Newton–Raphson/Marquardt Steps) (1)	Standard Deviation (2)	z-Statistic (3)	Prob. (4)
The free term	1.759021	0.359081	4.898673	0.0000
COSTENERGY2018	4.65×10^{-7}	1.88×10^{-7}	2.475764	0.0133
COSTENERGY2022	-4.93×10^{-7}	8.58×10^{-8}	−5.746042	0.0000
SIZE2022	0.001196	0.000796	1.502077	0.1331
AGE2022	0.000505	0.005809	0.086955	0.9307
GDPcap2022	2.82×10^{-5}	1.72×10^{-5}	1.639256	0.1012
Model validation				
Sample size	*1342* (136 had a profit < = 0 and 1206 had profit > 0)	*1342*	*1342*	*1342*
McFadden R^2	0.149266			
LR statistic	131.4149			
Prob (LR statistic)	0.000000			

Source: The author's calculations based on data from the World Bank, Eurostat, International Monetary Fund, 2022.

Even though the COSTENERGY2022 variable is econometrically significant, its very small size could mean that the influence is at its most marginal. The same analysis, but using sectors of activity, did not lead to significant results from an econometric point of view.

6. Conclusions and Policy Recommendations

Our results are similar to those in the specialized literature. We observed an inverse relationship between profit decrease and the firm's energy cost in 2022 and a direct relationship between the company's profit and size, age, and GDP per capita. The direct relationship between profit and company size can be explained by the fact that larger companies have more substantial reserves and can make a more significant volume of investments than smaller companies. Older companies can better cope with market com-

petition due to an internal learning mechanism [34,49]. The company's performance is positively and significantly influenced by its age [35]. Other authors have shown that the size and age of the company are control variables that capture their heterogeneity [50]. The authors in [33] studied the economic crisis of 2008 and concluded that the profitability of a company is influenced to a lesser extent by industry characteristics and, to a greater extent, by the internal characteristics of the company.

In contrast to the findings reported by other authors, such as [48], the data analyzed in this study do not provide support for the hypothesis stating that the post-COVID-19 pandemic economic conditions could result in significantly larger negative profits in the services sector. Our results showed that the food and beverage sector recorded a higher profit than the manufacturing sector. This is in contrast to the results of other authors, such as [43], who studied the persistence of profit for European companies in the food sector and found that the persistence of profit in the food sector was lower than in other manufacturing sectors. One potential explanation for the disparities compared to the outcomes reported by other researchers is the inclusion of inflation adjustments for both manufacturing revenues and those from the food and beverage sector in this study. During the COVID-19 pandemic, prices in the food and beverage sector have increased significantly and, implicitly, so has the profit of companies in this sector. The authors in [44] argue that European companies in the food sector are profitable both in the short term and in the long term.

In this study, an analysis was conducted to assess the effect of energy costs in 2022 on the risk of companies experiencing a profit decline below the profitability threshold. While the COSTENERGY2022 variable exhibited statistical significance in econometric terms, its magnitude appears to be exceedingly small, suggesting, at most, a marginal impact. The same analysis, but using sectors of activity, did not lead to significant results from an econometric point of view. Some results could also be influenced by the data collection errors observed by checking the responses to survey questionnaires. Limitations of the research are related to the fact that the data were collected via a survey, and our analysis resulted in the observation of numerous outliers. Subsequently, additional processing was required, which reduced the degrees of freedom and possibly the quality of the estimators. It is necessary to reconfigure the model with more recent data that includes the current socio-political context, the post-COVID pandemic period, and the military conflict situation at the EU border. Further developments may involve expanding the research to encompass multiple countries and updating the data. For future research, as a way of developing the analysis, the following methods could be employed: panel type analysis, updating the data with new values, and filtering and cleaning the data through new methods to eliminate erroneous responses.

Drawing from the empirical findings outlined above, this paper presents the following policy suggestions:

1. Implementation of a government mentorship and consultancy program for older companies, providing assistance in adapting to market changes and developing long-term growth strategies.
2. Granting special fiscal or financial incentives, such as tax reductions or preferential interest rates on loans, to companies with significant longevity to encourage modernization and expansion.
3. Launching an energy efficiency promotion program in the industry, including subsidies or tax deductions for companies investing in energy-saving technologies and practices.
4. Promotion of the use of renewable and sustainable energy sources through financial support schemes, such as guaranteed purchase rates for green energy.
5. Development of tariff policies that reflect the actual costs of energy, motivating companies to optimize their energy consumption.

These economic policies could contribute to stimulating economic development and growth, improving energy efficiency, and protecting the environment. They can be implemented at the governmental level or in partnership with private sector organizations to maximize their positive impact on the economy and society.

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