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THE IMPACT OF THE CRISIS INDUCED BY THE CONFLICT IN UKRAINE ON FIRMS: EVIDENCE FROM NORTH MACEDONIA

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Abstract

This paper evaluates the impact of the Ukraine conflict-induced crisis on firms in North Macedonia using data from a survey conducted with 112 firms in April and May 2023. Through descriptive statistics and probit regression analysis, we find that small firms in low-wage sectors predominantly coped with the crisis by raising prices of final products and services, followed by cost-cutting measures. Larger firms tended to invest in self-electricity generation or energy-saving equipment. Our results show that firms with higher energy cost shares increased final prices more but experienced decreased competitiveness. Firms not addressing rising costs did not consistently pass these costs onto prices or maintain competitiveness, except for labor costs. Labor cost increases, such as from minimum wage hikes, may lead to cost-push inflation unless firms absorb these costs at the expense of profits.

Keywords: *crisis, firm costs, firm competitiveness, North Macedonia*

JEL classification: *D24*

1. Introduction

Following Russia's invasion of Ukraine on February 24, 2022, Europe experienced a profound transformation in its political and economic landscape, defying previous expectations. In response, Western allies swiftly implemented multiple rounds of sanctions targeting Russia to sever its economic ties with European and American nations (UN 2022). While these sanctions primarily targeted the Russian economy, their repercussions extended globally (Borin et al. 2022; Darvas and Martin 2022), given Russia's role as a major exporter of essential commodities, particularly grains, food, base metals, and energy. Notably, European economies, including Germany, heavily relied on Russian gas, although supply remained stable until late 2022. The resulting economic shifts led to unprecedented market distortions.

Three key impacts emerged from this crisis. Firstly, critical shortages arose in European and global grain and food markets due to Russia's export restrictions, directly affecting consumers (Artuc et al. 2022). Secondly, market instability, compounded by shortages of base metals like copper, nickel, and cadmium, exacerbated challenges across industries, including automotive, still grappling with supply chain disruptions

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from the fading COVID-19 pandemic. Thirdly, concerns over energy supply intensified as European energy production declined, particularly in renewable sources throughout 2021, leading to market disruptions and significant price increases in various sectors.

These market disruptions resulted in soaring prices across a wide range of products, significantly impacting household and business budgets, with real incomes declining sharply due to inflation. By the end of 2022, recessionary pressures mounted, with recessions on the doorstep in certain European economies by 2023 (World Bank 2022). Firms, already weakened by the lingering effects of COVID-19, faced heightened risks amid the emerging crisis. Rising energy costs, reduced foreign trade, increased raw material prices (especially critical for a net-importing country), and tightening access to finance compounded challenges for businesses.

Early studies suggest substantial negative effects on firms across Europe due to the Ukraine crisis. For instance, the EIB (2022) estimates a significant increase in EU firms generating losses and facing default. Sectors like chemicals, pharmaceuticals, transport, and food/agriculture are hardest hit. Emerging academic literature highlights negative abnormal returns, increased volatility, and lower equity returns for energy-intensive and carbon-intensive firms, along with inflationary pressures on product prices (Orhan 2022; Lo et al. 2022; Bougias, Episcopos and Leledakis 2022; Ferriani and Gazzani 2023; Abbassi, Kumari and Pandey 2023; Ropele and Tagliabracci 2024).

The objective of this study is to empirically analyse the impact of the Ukraine conflict-induced crisis on firms in North Macedonia. Moreover, we investigate impacts onto firms' cost structure, with emphasis on production and energy costs, and evaluate their strength to withstand the crisis. We rely on a freshly collected micro-survey of firms to understand the extent and nature of the crisis's impact, providing a foundation for designing targeted policy measures at the national level. This study contributes to the literature by offering a detailed, fresh and rapid micro-level analysis of how the Ukraine conflict-induced crisis has impacted firms in North Macedonia. Using freshly collected survey data, the study provides timely and contextually relevant insights into the extent and nature of these impacts. This contribution is also seminal given that business-relevant insights from the Ukraine and Russia conflict remain absent in the literature at the time of writing. By proposing policy-relevant conclusions based on identified challenges, the study bridges interdisciplinary perspectives, integrates geopolitical events with economic impacts, and addresses specific knowledge gaps related to crisis impacts on firms in smaller economies.

The study is structured as follows: Section 2 offers some stylized facts by reviewing the risks for Macedonian firms stemming from the Ukraine conflict-induced crisis and the government measures adopted to support firms during the crisis. Section 3 discusses methodological considerations, and Section 4 presents survey results documenting the crisis's impact on Macedonian firms. Finally, Section 5 summarizes the study's conclusions and implications.

2. Conceptual framework and literature overview

The impact of the crisis in Ukraine on firms in North Macedonia can be understood through a comprehensive framework that considers the interplay of geopolitical conflict, economic interdependence, and firm-level responses. The crisis, rooted in geopolitical tensions involving Ukraine, Russia, and international actors, had ripple effects across regions. North Macedonia, situated in the Balkans and in close proximity to Eastern Europe, experienced indirect consequences due to its geographic proximity to the conflict zone. Disruptions in trade routes and supply chains due to the crisis significantly impacted Macedonian businesses. Fluctuations in energy prices and supply dynamics, influenced by the crisis, altered the cost structure and operations of firms in North Macedonia.

Studies in conflict studies literature shed light on the intricate dynamics between geopolitical conflicts and business operations (e.g. Freedman 2014), with the crisis in Ukraine serving as a relevant case study. However, the impact of crises, including conflict situations, on business and crisis management strategies during such times has been rather limited (Lim et al. 2022). Existing studies on business crisis management during conflicts have primarily focused on understanding how businesses and continuity outside the conflict zones are affected and predominantly concentrate on pre-2000s wars (Lakomaa 2017).[1] This trend is evident in recent studies of the crisis in Ukraine, which investigate the impact of the conflict on businesses and societies beyond Ukraine's borders. For instance, researchers have examined the shocks and consequences experienced by European countries (Prohorovs 2022), the expected repercussions on firms listed in the G7 stock market (Abbassi, Kumari and Pandey 2023), as well as the broader economic implications for the United States, United Kingdom, Canada, and Europe (Mbah and Wasum 2022). Additionally, scholars have explored topics

related to geopolitics and international business strategies in response to the crisis (Ratten 2023), including the role of stakeholders and stakeholderism in international companies withdrawing from Russia due to the conflict (Marcinkowska 2022; Mol, Rabbiosi and Santangelo 2023; Pajuste and Toniolo 2022). These studies collectively shed light on the complex interplay between crisis events, business operations, and strategic responses in the global arena.

The literature on the impact of armed conflict spans multiple disciplines, encompassing economics, environmental science, public health, and sociology. Economically, armed conflict disrupts economic activity and global welfare, impacting human capital, international trade, and national income (Glick and Taylor 2010). The costs of conflict extend to negatively affecting private investment and stripping countries of growth potential (Imai and Weinstein 2000). Environmentally, conflicts can lead to deforestation and habitat destruction due to increased reliance on wood for fuel and bushmeat for protein (Draulans and Van Krunkelsven 2002). In terms of public health, conflicts devastate healthcare systems, leading to improper sexual practices, food and medical supply shortages, and increased health complications (Ashford and Huet-Vaughn 1997). Recent research emphasizes the impact of conflict on public health amid current conflicts (Sheather 2022; Zaliska et al. 2022). Socially, conflicts reshape societal role structures and lead to forced displacement, physical injuries, and psychological trauma for survivors (Modell and Haggerty 1991; Cliff and Noormahomed 1993; McKray 2003). The enduring effects include intergenerational trauma and disruptions in education that threaten social unity (Kreso 2008; Betancourt et al. 2015; Bürgin et al. 2022).

Conflict can disrupt firm-level productivity by affecting key determinants such as technology, capital, organizational structure, and management practices (Bloom and Van Reenen 2010), as well as the size and skills of the workforce (Iranzo, Schivardi and Tosetti 2008). Armed conflict can significantly influence incumbent firms' sales, exports, profitability, and investment decisions, thus affecting the allocation of inputs and outputs among existing firms (Abadie and Gardeazabal 2003; Guidolin and La Ferrara 2007; Ksoll, Macchiavello and Morjaria 2010). Additionally, armed conflict can impact firm entry and exit dynamics (Camacho and Rodriguez 2013). However, there is a scarcity of studies that have examined the effects of conflict on firm activity.

Applying insights from conflict studies to the specific context of North Macedonia enriches our understanding of how the crisis in Ukraine affected Macedonian firms. By examining specific channels of impact, including trade disruptions, risk management strategies, and institutional responses, this research contributes to a broader discourse on the economic ramifications of geopolitical conflicts on businesses operating in interconnected global markets.

3. Stylized facts

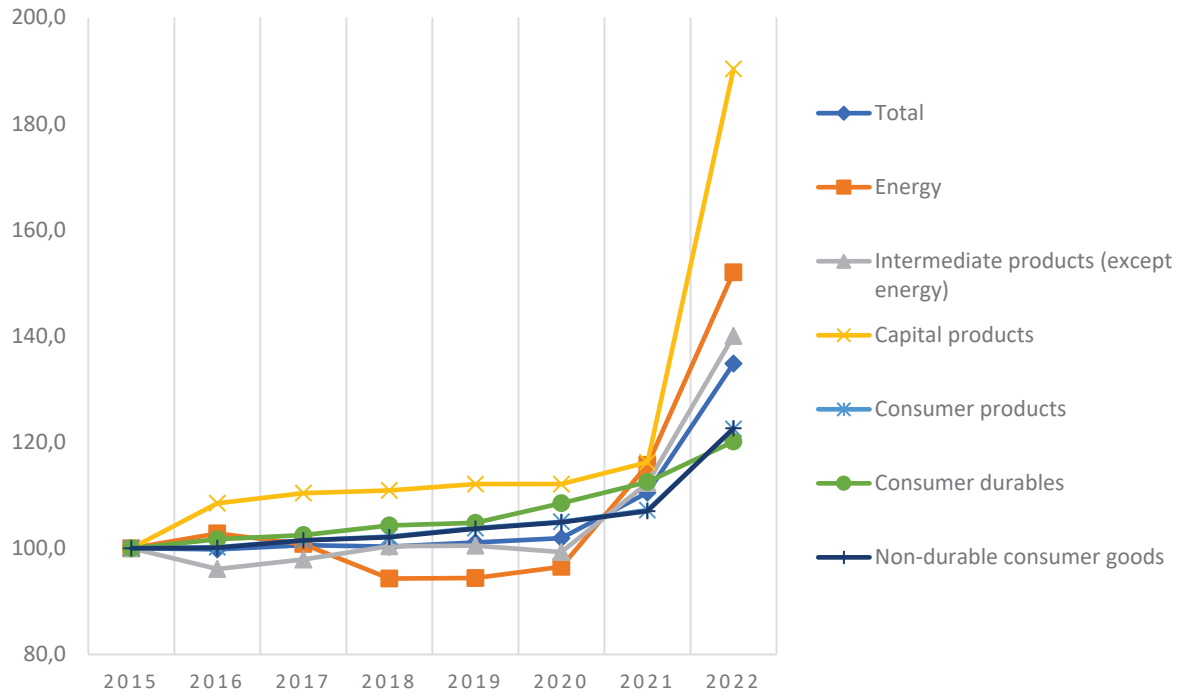
3.1. Risks for the firms in North Macedonia

North Macedonia has very weak economic ties with both Russia and Ukraine. These countries do not participate with more than 2.5% in North Macedonia's foreign trade. Yet, it should be noted that about a fifth of the fertilizers were imported from Russia in 2021, which together with gas and metals comprised most of the imports. Russia's and Ukraine's share in foreign direct investment inflow averaged less than a quarter of a percent over the last decade, with exception of certain years whereby Russian or Ukrainian companies entered the market mainly in the mining and oil trade. The financial system does not have Russian or Ukrainian bank or other financial institution. All this protected the economy from the direct impact of the crisis.

However, Macedonian firms has been indirectly affected in several ways. As a result of considerable trade openness, rising prices of key food and energy products were directly transmitted to the economy already in the first half of the year. By the end of 2022, inflation reached 19.5%, with an annual average of 14.2%, a level not seen since country's transition years in the early 1990s. Selling prices in manufacturing soared in 2022 (**Figure 1**), driven by the high input prices of, primarily, energy, though also the imported raw materials. Though, the observed price effect of the imported raw materials could be approximated by considering that almost half of the consumption of food, drinks and tobacco in the economy is being imported (**Figure 2**), which makes domestic firms price takers to a large if not exclusive extent. Within the primary food items, whose prices saw unprecedented surge on the global market, wheat supplies and nearly all of sunflower oil in North Macedonia is imported, which has been coupled with the dependence on fertilizers supply from Russia.

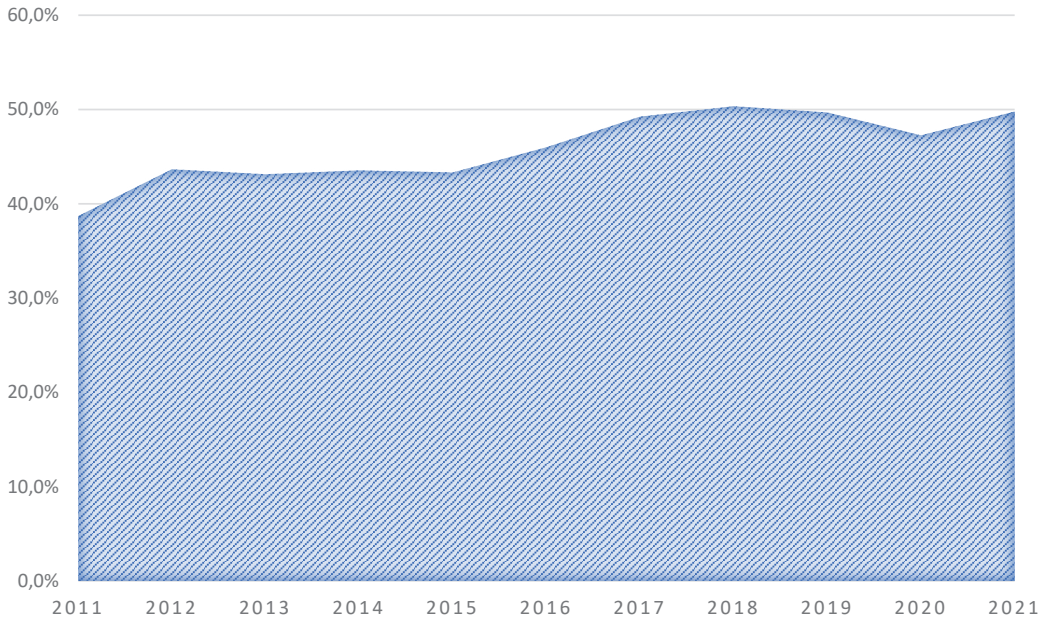
Large firms in North Macedonia have been particularly exposed to the energy/electricity price shock. Namely, only large firms in the country purchase electricity on the open market, usually on the Hungarian electricity market HUPX. The electricity price shock culminated in the summer of 2022, when the price of electricity per MWh has been twelvefold compared to the average of 2020. Households and small business

Figure 1. Selling prices of industrial producers (2015=100)



Source: State Statistical Office.

Figure 2. Share of import of food, drinks and tobacco in the total consumption of food, drinks and tobacco in North Macedonia



Source: State Statistical Office.

Note: The import of food, drinks and tobacco includes live animals, which is not included in the respective consumption item as such.

Table 1. Regulated prices for households and small business consumers (MKD/KWh)

Category	1.8.2020	1.7.2021	1.1.2022	1.7.2022	1.1.2023
Households, upper tariff*	5.9500	6.6900	7.3200	4.3484	4.7257
Households, lower tariff	2.9900	3.3600	3.6700	0.6193	1.3183
Small consumers, upper tariff	9.2700	10.4200	11.4100	13.8204	11.05
Small consumers, lower tariff	-	-	-	10.1348	8.1
Transmission and distribution fee	1.768	1.767	2.4570	2.6237	2.6795

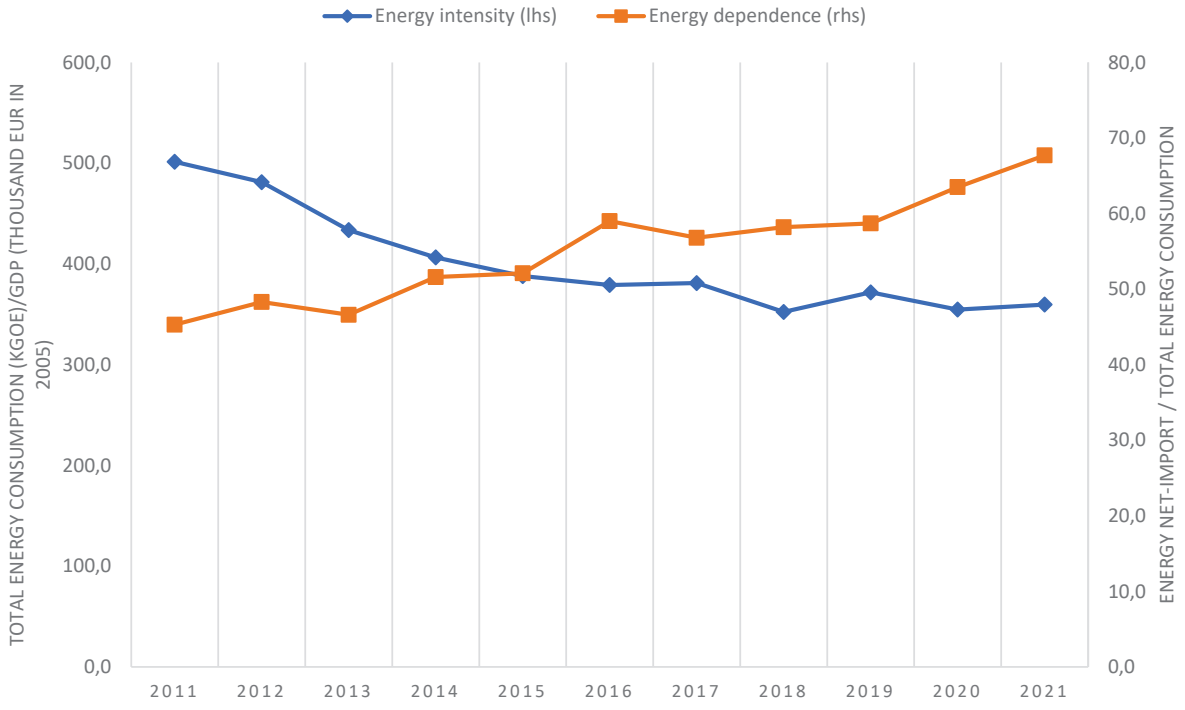
Source: Energy and Water Services Regulatory Commission.

Note: Since July 1, 2022, households are subject to progressive electricity price dependent on their consumption. The basic tariff (tariff 1) is shown in this table.

consumers (initially defined as those with not more than 50 employees and annual turnover not exceeding 10 mln. EUR) are shielded from the electricity price volatility through operating on the regulated market. **Table 1** presents the regulated prices on dates when the Energy and Water Services Regulatory Commission has been correcting the price. For example, since the onset of 2023, the price for MWh for the small business consumers has been fixed at about 179 EUR/MWh, being about two thirds of the 2022 average on the free market and above the January—May 2023 average of 120 EUR/MWh.

Both energy intensity and energy dependence are high in North Macedonia, which heavily reflects onto firms work and competitiveness. The energy intensity is very high in the country, despite the improvements over the last decade (**Figure 3**). Yet, with about 350 kilograms of oil equivalent per thousand EUR of GDP, the country is still thrice less energy efficient than the EU average (117 in 2021, Eurostat: NRG_IND_EI). This trend has been accompanied with growing energy dependence of the country, whereby more than two thirds of the energy consumption in 2021 has been supplied from import.

Figure 3. Energy intensity and dependence in North Macedonia



Source: State Statistical Office.

3.2. How has the government helped?

Government measures in North Macedonia have been primarily directed towards regulating prices of electricity and depressing prices of some primary food products in order to prevent a more severe erosion of the living standard of households. Only few of the measures were aimed at firms, and part of them already existed even before the crisis started aiming to support the green transition. Earlier, in the winter of 2021/22, the Government declared 'energy crisis' that allowed it to allocate additional funds from the central budget to electricity production and central heating companies. The 'energy crisis' was extended over 2022.

Over 2022, two packages of anti-crisis measures were adopted in a total declared value of 760 mln. EUR. Of the total of 33 measures in the two packages, 16 were aimed at companies (or companies and households), and these are presented in **Table 2**. With the exception of the regulation of the electricity/heating energy price for the small business consumers, which essentially boils down to subsidizing the price of electricity/heating energy by the government, the rest of the measures have been channeled through the Development Bank, and many of them, like the green lines from EBRD, Guarantee Fund etc. existed before, i.e. they ameliorate the effects of the crisis, but cannot be directly attributed to it.

Only two of the measures refer to reduction of the input prices for companies: the one for the reduction of the customs duties on basic food products and raw materials, helping out in depressing the global prices but not their volatility; and the fixation of the electricity price for the food industry in order to stabilize the prices of the basic food product like bread, milk and

Table 2. Government measures aimed at firms

		Targeted towards	Responsible institution
1.	Subsidizing the price of electricity for the regulated market (for households and small business consumers) – enacted at the end of 2021	SMEs	Government through ESM – Electricity production company
2.	Subsidizing the price of heat energy (for households and small business consumers of central heating)	SMEs	Government through ESM – Electricity production company
3.	Change in electricity price setting methodology for households and small business consumers on the regulated market	SMEs	Energy and Water Services Regulatory Commission
4.	Loans for investment in projects for energy efficiency and renewable energy sources, with an interest rate not exceeding 1.6%	SMEs	Development Bank
5.	New line to support the economy through the European Investment Bank for a green transition	SMES	Development Bank
6.	Green financing through the EBRD, the UNDP and commercial banks (for households and SMEs)	SMEs	Development Bank
7.	Financial support through direct lending from the Development Bank to companies	SMEs	Development Bank
8.	Financial support through commercial banks with interest-free loans for working capital	SMEs	Development Bank
9.	Credit line for SMEs to support liquidity	SMEs	Development Bank
10.	Credit line for production, refinement and export of agricultural products	SMEs	Development Bank
11.	Subsidized price of 80 EUR/MWh for food production companies	Large firms	Government / MoE
12.	Use of the Guarantee Fund at the Development Bank	All firms	Development Bank
13.	Subsidizing of contractual interest rate on loans granted by commercial banks to business entities that will reinvest the profit for 2021	All firms	Government / Development Bank
14.	Autonomous measure for the import of basic food products and raw materials that have customs duties from all countries	All firms	MoF / Customs Office
15.	Exemption of VAT in the import of electricity, natural gas, heat energy and cooling energy	All firms	MoF / Customs Office
16.	Consultative support for the development of feasibility studies for energy efficiency and renewable energy projects	All firms	Government / MoE

Source: Authors' compilation based on announcements at www.vlada.mk.

meat. The latter, however, was short-lived as it did not result in significant decline in the final product prices. Hence, overall, no measure was offered by the government that directly and explicitly targeted companies, particularly the large ones which purchased the electricity on the open market and were most heavily exposed to the electricity price increase in 2022. For this reason, we put less emphasis on the government measures in understanding the manner in which companies withstood the crisis.

4. Methodological note

The underlying data collection instrument for this analysis is the Survey on the impact of the crisis induced by the conflict in Ukraine on firms in North Macedonia. The Survey has been administered over a heterogeneous sample of 112 companies in North Macedonia of various sectors, sizes and regions in the country in the course of April and May 2023. In general, there is no sufficiently-developed culture on answering surveys in North Macedonia, which prevents that a fully representative sample is obtained. Data collectors face large non-response rates. In our case, the survey was sent to a large list of over 2,000 companies, of which the response rate was about 6%.

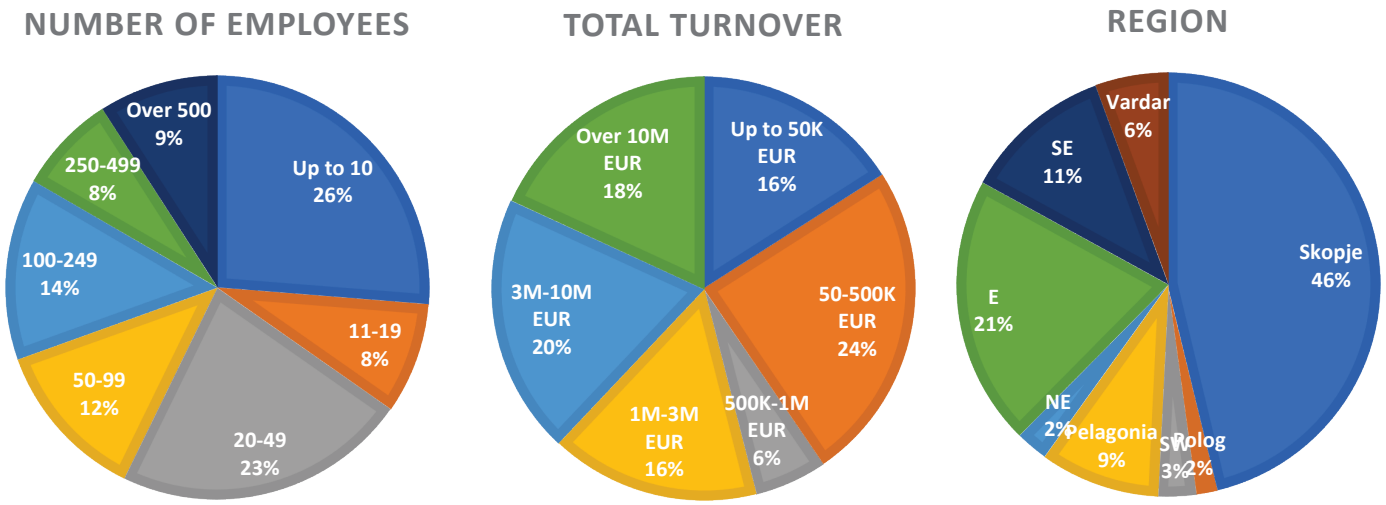
To overcome potential problems with biased sample, we used the national statistics on firms to create weights which we use throughout the entire analysis. Namely, we rely on the number of firms per sector (a total of 13 aggregated sectors are used) from the State Statistical Office of North Macedonia, in order to accordingly weight the firms in our survey and secure satisfactory potential of inference. By equalizing the sectoral distribution of the firms in our sample with that of the national statistics, we obtain the following distribution on three other metrics: seize by employees and turnover, and the regional distribution (**Figure 4**). We observe distributions which sufficiently well reflect the distribution of firms within the national statistics.

The questions in the Survey were divided in a couple of themes:

- The impact of the crisis on the production costs
- Energy use and prices
- Cost of labor
- Cost of services used in the firm
- Demand for firm's product and services
- Observations for the general operations of the firm.

In the following section, we use descriptive tables and graphs to present the answers on various questions in their frequencies and distribution across the observable characteristics of the firm, like sector, size (employees and turnover) and the extent to which a firm is an exporter. It is to be noted that we apply certain aggregation of sectors on agriculture, industry, construction, low-pay services (trade, transport and hotels); medium pay services (administrative, professional and personal services); and high-pay services (finance, insurance, real estate and IT). The latter resonates the idea to which exported were more hit by the price hikes due to their direct exposure to the global developments.

Figure 4. Weighted sample characteristics



Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

Finally, to understand the impact of the crisis for firms' adjustment mechanism and competitiveness, we rely on an ordered probit regression of the following type:

$$P(outcome_i) = \alpha + \sum \beta_j X_i + \sum \gamma_j Z_i + \varepsilon_i$$

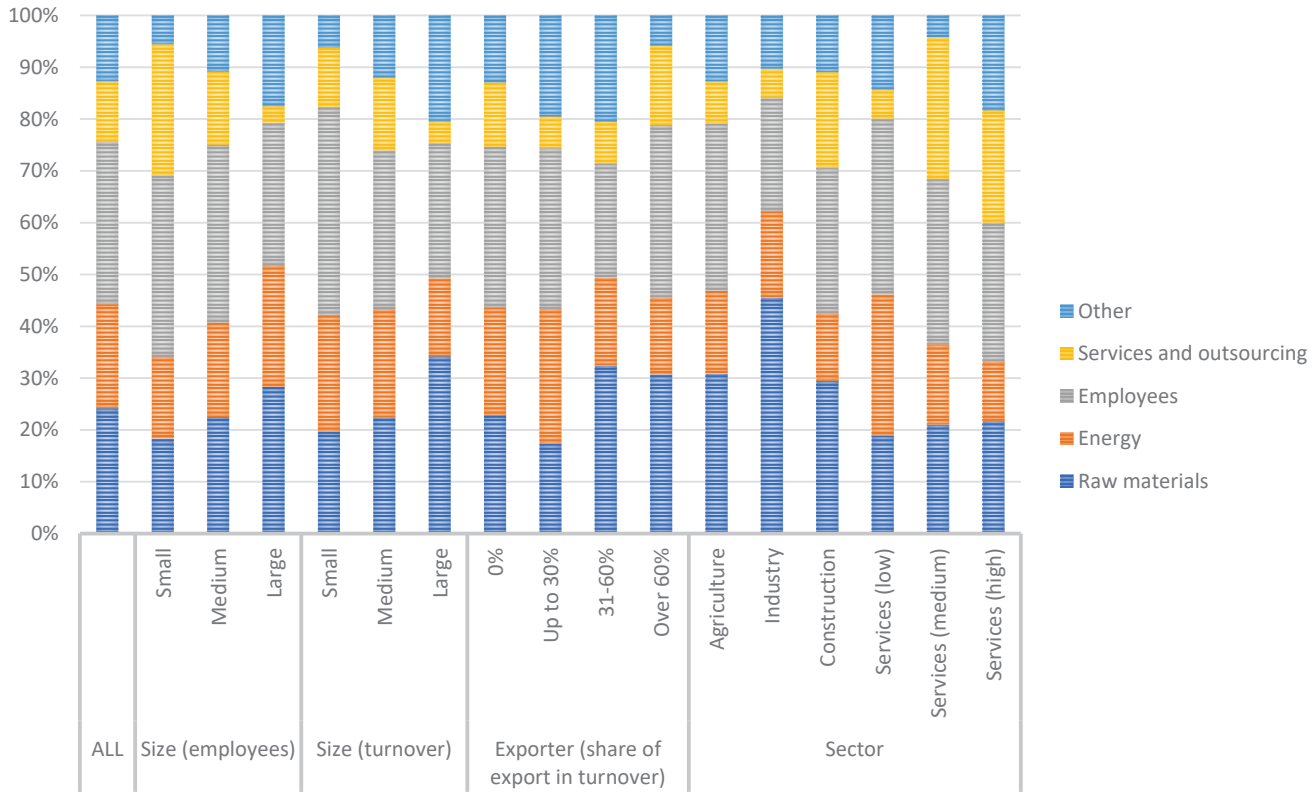
Whereby $P(outcome_i)$ stands for the probability that the firm reported that its final prices increased more than its total cost (a Likert scale 1-5) or that is responded that its competitiveness in 2022 compared to 2021 significantly deteriorated (a Likert scale 1-5); is a vector of observable firm's characteristics: region, sector, size (employees and turnover) and the extent to which a firm is an exporter; is another vector containing variables of our specific interest: the energy intensity of the firm (share of energy cost in total cost); labor intensity (share of labor cost in total cost); self-assessment about the behavior of the demand during the crisis; and a binary indicator signifying that the firm did not undertake any step to combat the increasing costs in raw materials, energy or labor. We estimate the above equation with an ordered probit technique and we comment in a general fashion about the way in which these firm's tenets affected the probability to fare the crisis better or worse.

5. Survey results

5.1. The impact of the crisis on production costs and costs of raw materials

The first set of results refers to the cost structure of the firms and the crisis impact onto the cost of the raw materials. **Figure 5** documents that, on average, the largest share of firms' costs are associated with the employees, 31.3%, followed by raw materials, 24.2% and energy 20.8%. However, there are some structural differences across the firms' categories. The share of raw materials costs is larger for larger firms, which are more frequently exporters belonging to the industry. Interestingly, the share of energy cost is the largest among low-pay service sectors like trade, transport and hotels (27.2%), which were inter-alia the strongest hit by the pandemic. Service and outsourcing cost is the largest among the smallest firms which are more

Figure 5. Structure of firms' operational costs



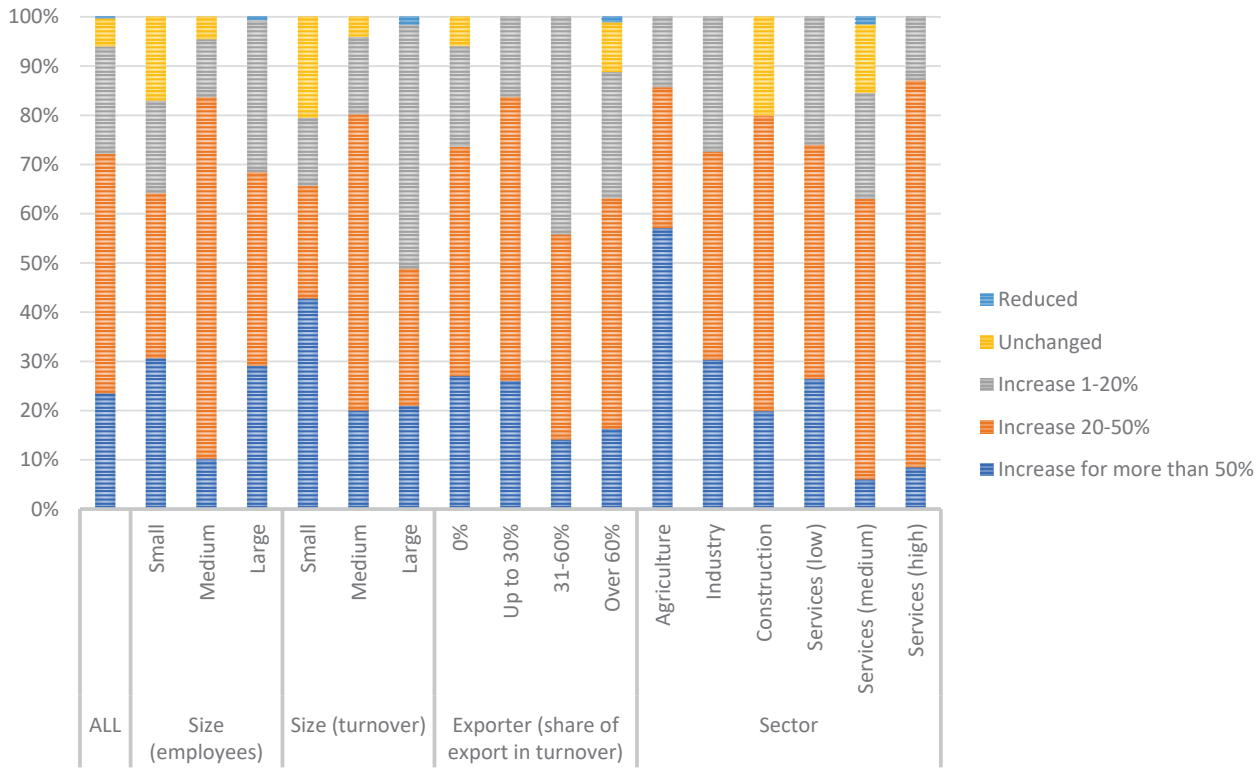
Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

frequently nested among the higher-pay service sectors. There are no stark differences in the share of the personnel cost.

Based on the primary origin of raw material purchases, it was found that in less than half of the cases, firms sourced their raw materials from abroad, with larger exporting firms in the industry sector having a notably higher percentage. This exposes these firms to rapid global economic developments impacting their profit margins and output prices. Interestingly, despite being large industrial exporters, the reported raw material price increases in 2022 were not the highest. Thirty percent of both large and small firms experienced raw material price increases exceeding 50%, with this share even higher among small firms based on turnover. Agriculture had the highest share of firms experiencing significant price increases, followed by industry and low-wage services. This indicates that smaller firms in low-wage sectors faced the heaviest burden of raw material price increases. However, for other segments, the majority reported price increases in the range of 20-50%. Notably, a small fraction of the largest exporters reported a decline in raw material prices.

Table 3 illustrates firms' strategies for managing rising raw material costs. Note that firms were allowed to select multiple options, resulting in a total exceeding 100%. The table uses color-coding to indicate the magnitude of each percentage, with small percentages shown in red and higher percentages in green. The most common strategy reported to cope with increased raw material costs was raising product prices, chosen by 57.6% of firms (Table 3). Additionally, 46.4% of firms implemented cost consolidation strategies across other areas of their cost structure, and 37.6% postponed planned investments. While firms of all sizes increased output prices, larger firms in agriculture, industry, and low-wage services were more likely to focus on cost reduction strategies, reflecting the heavier impact of price shocks in these sectors.

Figure 6. Price change of the key raw material (2022 compared to 2021)



Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

Table 3. Ways of coping with the increased costs of raw materials

	ALL	Size (employees)			Size (turnover)			Exporter (share of export in turnover)			
		Small	Medium	Large	Small	Medium	Large	0%	Up to 30%	31-60%	Over 60%
Did not undertake anything	4.7%	12.4%	0.0%	3.5%	3.7%	6.3%	0.0%	4.1%	0.0%	0.0%	10.1%
Changed / diversified / negotiated with the supplier	20.8%	20.5%	20.7%	21.0%	14.1%	22.1%	21.7%	24.3%	22.0%	0.0%	15.8%
Focused on reducing the other operational costs	46.4%	18.2%	34.9%	71.9%	16.5%	49.3%	61.7%	38.3%	73.4%	28.4%	44.9%
Increased prices of our products (outputs)	57.6%	47.4%	60.4%	61.8%	43.8%	60.1%	60.4%	57.5%	68.8%	55.8%	49.8%
Reduced or stopped production while prices stabilize	5.9%	7.5%	0.0%	9.2%	9.4%	3.0%	13.1%	8.7%	0.0%	14.2%	3.6%
Postponed some planned investment	37.9%	35.7%	31.3%	44.0%	44.6%	35.7%	39.8%	40.3%	36.3%	41.7%	33.7%
Applied other strategy	17.6%	10.4%	10.6%	27.2%	11.2%	12.5%	41.2%	11.8%	25.0%	57.9%	18.5%

	Sector					
	Agriculture	Industry	Construction	Services (low)	Services (medium)	Services (high)
Did not undertake anything	0.0%	1.5%	0.0%	3.3%	13.9%	8.2%
Changed / diversified / negotiated with the supplier	14.3%	23.5%	0.0%	26.8%	20.0%	0.0%
Focused on reducing the other operational costs	100.0%	53.9%	20.0%	50.6%	43.1%	16.5%
Increased prices of our products (outputs)	85.7%	77.4%	60.0%	67.1%	26.1%	75.3%
Reduced or stopped production while prices stabilize	28.6%	3.9%	0.0%	9.7%	0.0%	0.0%
Postponed some planned investment	42.9%	53.9%	60.0%	38.7%	16.9%	4.1%
Applied other strategy	14.3%	11.7%	20.0%	27.8%	7.7%	0.0%

Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

5.2. The impact of the crisis on energy costs

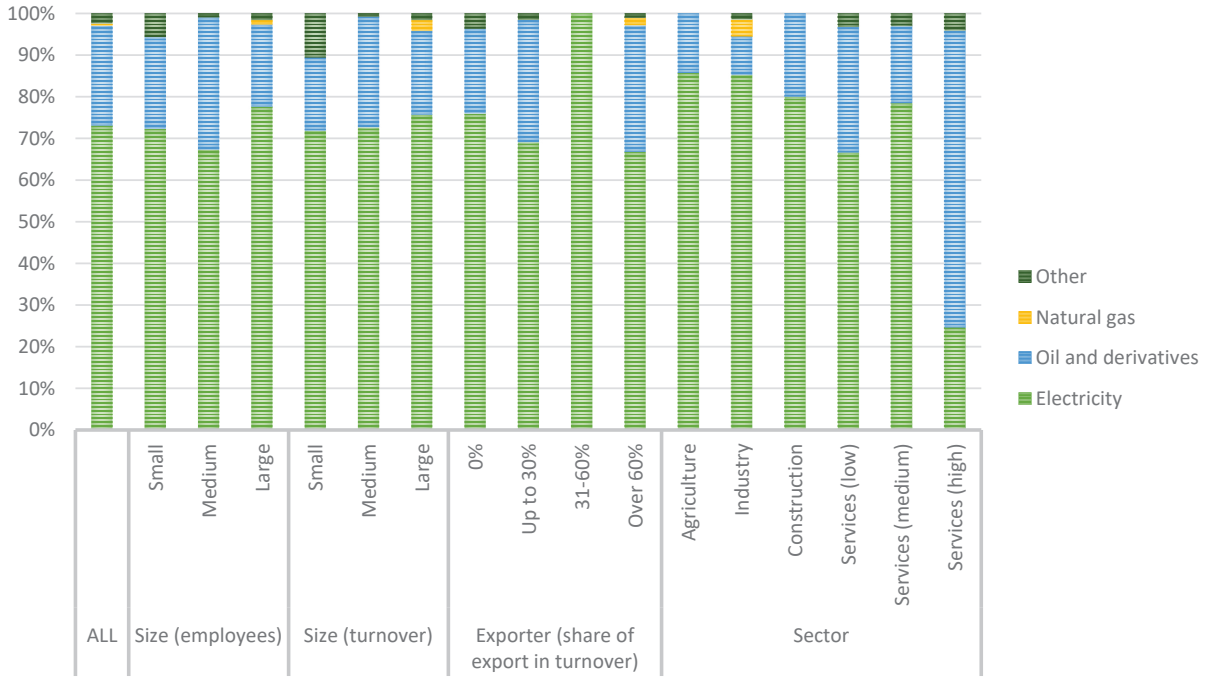
Macedonian firms rely on electricity as the main source of energy, with 73.1% of respondents (**Figure 7**). The next meaningful energy input is oil and derivatives, with 24%. There are no stark differences when firms are observed by size, but only when observed sectorally. The share of electricity in the sources of energy is higher than the average in agriculture and industry, while the share of oil and derivatives is higher than the average in low-pay services (due to transport being part of it) and in high-pay services (despite this may be a reflection of the rather small total consumption of energy in these sectors).

For more than a third of firms (37.6%), the increase in the price of the key energy input ranged twofold to fivefold between 2021 and 2022 (**Figure 8**). This has been more so the case for the large firms which have been purchasing electricity on the open market, including the notion that larger share of them marked increase in this cost larger than fivefold compared to the previous year (30.7% for the firms whose turnover exceeds 10 mln. EUR annually). Sectorally, the increases in the energy cost has been the largest in construction (40% of firms reporting increase more than fivefold), while the lowest in medium-pay services (47.7% reporting increase up to 50%).

The majority of small firms did not take action to address the rising energy costs, possibly due to operating within regulated markets and limited resources to absorb significant cost shocks (Table 4). In contrast, medium and large firms (40% to 50%) reorganized operations to reduce energy consumption and invested in energy-efficient equipment, with larger firms also investing in their own energy production, primarily through photovoltaics. Despite these adjustments, nearly half of larger firms increased prices to offset energy costs, while also implementing cost consolidation measures. Sectorally, energy consumption reduction efforts were more common in agriculture, industry, and low-wage services, with industrial firms leading

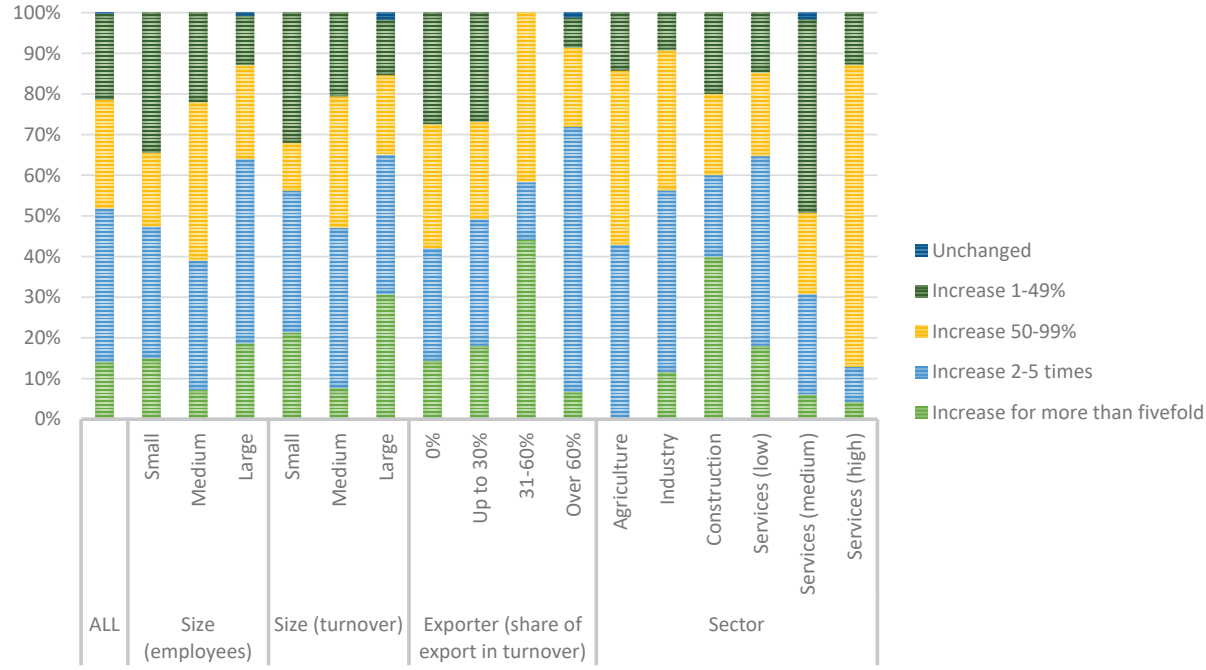
in installing own energy production facilities (43%). Price adjustments in response to energy costs were prevalent in industry, construction, and unexpectedly, high-wage services. Cost consolidation strategies were observed across all sectors.

Figure 7. The main energy input in firms



Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

Figure 8 – Energy cost change (2022 compared to 2021)



Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

Table 4. Ways of coping with the increased costs of energy

	ALL	Size (employees)			Size (turnover)			Exporter (share of export in turnover)			
		Small	Medium	Large	Small	Medium	Large	0%	Up to 30%	31-60%	Over 60%
Did not undertake anything	18.8%	51.5%	9.6%	5.4%	27.5%	17.5%	16.1%	22.8%	9.4%	0.0%	20.2%
Reorganized the work process to reduce energy consumption	37.5%	6.5%	43.3%	52.3%	11.8%	41.2%	46.4%	31.2%	46.3%	42.1%	42.7%
Invested in energy-efficient machines and equipment	14.3%	11.1%	7.3%	21.4%	10.1%	14.0%	18.8%	8.4%	15.6%	14.2%	24.9%
Invested in machines and equipment using alternative energy sources	1.5%	0.0%	0.0%	3.5%	0.0%	2.3%	0.0%	2.9%	0.0%	0.0%	0.0%
Invested in energy-efficient equipment or new buildings/halls	4.8%	0.0%	4.5%	7.9%	0.0%	6.6%	2.6%	6.6%	7.4%	0.0%	0.0%
Invested in own energy production	20.8%	0.0%	9.7%	41.5%	0.0%	23.1%	30.4%	11.1%	23.7%	41.7%	34.8%
Timely purchased energy input, when prices were still favorable	4.9%	0.0%	6.3%	6.8%	0.0%	6.0%	5.0%	3.8%	7.8%	14.2%	3.5%
Increased prices of our products (outputs)	37.8%	19.4%	43.9%	44.7%	30.4%	37.7%	44.8%	38.1%	47.1%	41.7%	30.1%
Reduced the work scope (temporary or permanent lay-offs and/or production reduction in general)	12.3%	26.8%	0.0%	12.3%	37.8%	5.0%	16.2%	16.4%	0.0%	0.0%	14.7%
Focused on reduction of other operational costs	42.9%	7.2%	59.8%	52.6%	21.8%	43.3%	59.4%	38.3%	54.1%	86.3%	38.1%

	Sector					
	Agriculture	Industry	Construction	Services (low)	Services (medium)	Services (high)
Did not undertake anything	0.0%	0.0%	20.0%	18.5%	44.6%	4.1%
Reorganized the work process to reduce energy consumption	57.1%	48.5%	20.0%	43.1%	27.7%	8.2%
Invested in energy-efficient machines and equipment	14.3%	11.7%	0.0%	19.1%	10.8%	4.1%
Invested in machines and equipment using alternative energy sources	0.0%	0.0%	0.0%	3.3%	0.0%	0.0%
Invested in energy-efficient equipment or new buildings/halls	14.3%	0.0%	0.0%	3.3%	0.0%	0.0%
Invested in own energy production	28.6%	43.0%	20.0%	17.3%	26.1%	4.1%
Timely purchased energy input, when prices were still favorable	28.6%	7.8%	0.0%	6.5%	0.0%	0.0%
Increased prices of our products (outputs)	28.6%	67.2%	60.0%	37.2%	10.8%	75.3%
Reduced the work scope (temporary or permanent lay-offs and/or production reduction in general)	14.3%	11.7%	0.0%	17.3%	4.6%	4.1%
Focused on reduction of other operational costs	71.4%	42.2%	40.0%	39.4%	41.5%	71.2%

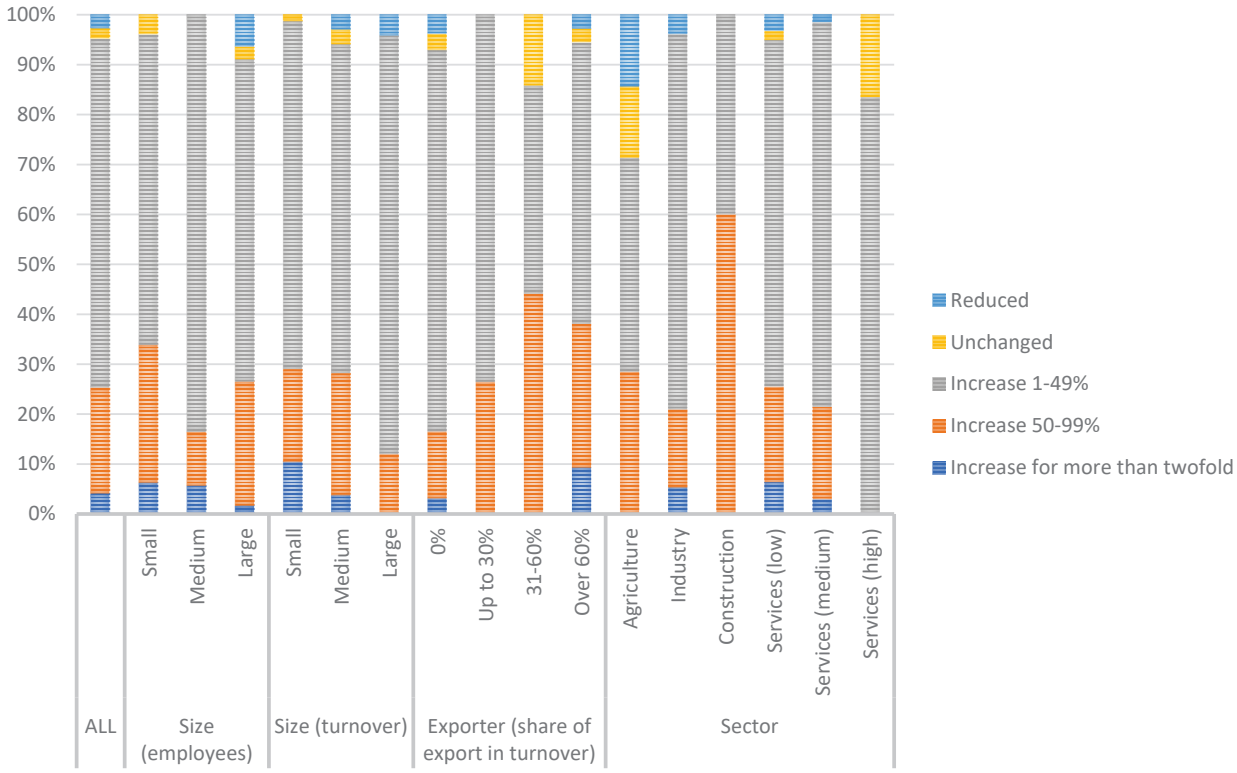
Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

5.3. The impact of the crisis on labor and other services

Labor costs increased mainly up to 50% compared to the year before (**Figure 9**). The burden of the soaring labor costs has been slightly higher on small than compared to larger firms, as well as among exporters. The latter may be due to the labor-market scarcity for medium skills, which have been likewise dragging the wages up. Sectorally, the scarcity of specific occupations is likely pronounced in construction, whereby cases of imported construction workers are known. The labor cost pressure has been the smallest in high-pay services, probably because the wage level there has been already very high.

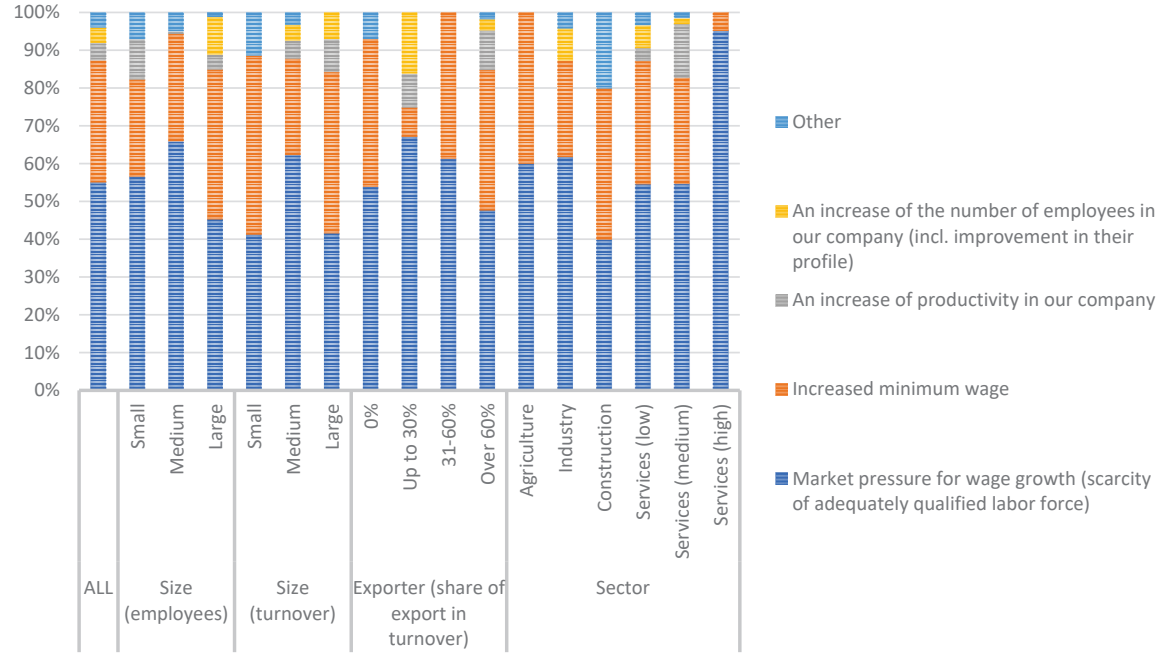
That labor and skill scarcity may be driving the labor cost surge is observed through the notion that 55.1% of firms responded that the main reason for the labor cost increase is the market pressure (**Figure 10**). This pressure is highly reflected in medium-sized local firms of high-pay service profile. It is likely that most of the high-pay service firms are more frequently exposed to global developments, so that the wage increases there are driven by the market forces both

Figure 9. Labor cost change (2022 compared to 2021)



Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

Figure 10. The main reason for the labor cost increase



Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

domestically and globally. Yet, the minimum wage is a significant presser of the labor cost, reported by 32.2% of firms. Small firms are hit most by the minimum wage increases, but the pressure onto the other firms is not strikingly smaller. Low-pay sectors like agriculture, construction and low-pay services (trade, transport, hotels) expectedly suffer most of the minimum wage hikes.

Firms mostly did not react to the elevated labor costs (**Table 5**). This is reported by 35.8% of firms, but the reaction was strongest among small local firms – between half to three fourths reported so. The other two coping strategies have been those who we observed through the coping mechanisms within the other costs surge: transferring of the burden onto consumers through increasing own-product prices and cost consolidation. The other potential coping strategies for the labor costs included reduction of number of workers or hours, using government measure or outsourcing services or processes, but all these were selected by small number of firms. Interestingly, it is only large firms who opted for outsourcing of some processes, including through investing in software, AI etc. and these were usually in industry and construction.

Table 5. Ways of coping with the increased labor costs

	ALL	Size (employees)			Size (turnover)			Exporter (share of export in turnover)			
		Small	Medium	Large	Small	Medium	Large	0%	Up to 30%	31-60%	Over 60%
No reaction, the budget line for these costs remained elevated	35.8%	52.7%	34.6%	26.2%	76.2%	28.3%	27.7%	43.5%	41.6%	14.2%	19.2%
Reduced the number of employees or cut the working hours	11.1%	13.9%	2.2%	15.8%	16.5%	7.9%	17.7%	10.6%	11.3%	44.2%	7.6%
Utilized government measures (e.g. active employment measures) to support the costs	7.0%	5.4%	4.0%	10.3%	8.9%	6.3%	8.0%	0.0%	2.4%	44.2%	19.3%
Outsourced some services which were performed in-house	7.4%	0.0%	10.7%	9.6%	0.0%	6.4%	17.7%	8.1%	7.8%	44.2%	1.1%
Outsourced some processes (incl. with investment in e.g. software, AI etc.)	11.1%	5.7%	2.5%	20.7%	9.4%	8.0%	23.5%	3.8%	17.7%	44.2%	16.3%
Increased prices of our products (outputs)	48.3%	33.8%	61.3%	47.8%	38.4%	51.5%	45.3%	47.2%	52.5%	57.9%	46.1%
Focused on reduction of other operational costs	39.7%	25.7%	41.1%	47.2%	18.8%	44.6%	40.0%	33.1%	29.5%	72.1%	55.5%

	Agriculture	Industry	Construction	Services (low)	Services (medium)	Services (high)
No reaction, the budget line for these costs remained elevated	28.6%	30.4%	40.0%	42.9%	26.1%	12.4%
Reduced the number of employees or cut the working hours	14.3%	15.6%	0.0%	16.7%	4.6%	4.1%
Utilized government measures (e.g. active employment measures) to support the costs	14.3%	3.9%	0.0%	9.0%	3.1%	0.0%
Outsourced some services which were performed in-house	0.0%	0.0%	0.0%	8.3%	1.5%	67.0%
Outsourced some processes (incl. with investment in e.g. software, AI etc.)	14.3%	19.6%	20.0%	9.7%	4.6%	0.0%
Increased prices of our products (outputs)	28.6%	50.0%	40.0%	57.7%	27.7%	75.3%
Focused on reduction of other operational costs	42.9%	40.6%	40.0%	26.4%	55.4%	67.0%

Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

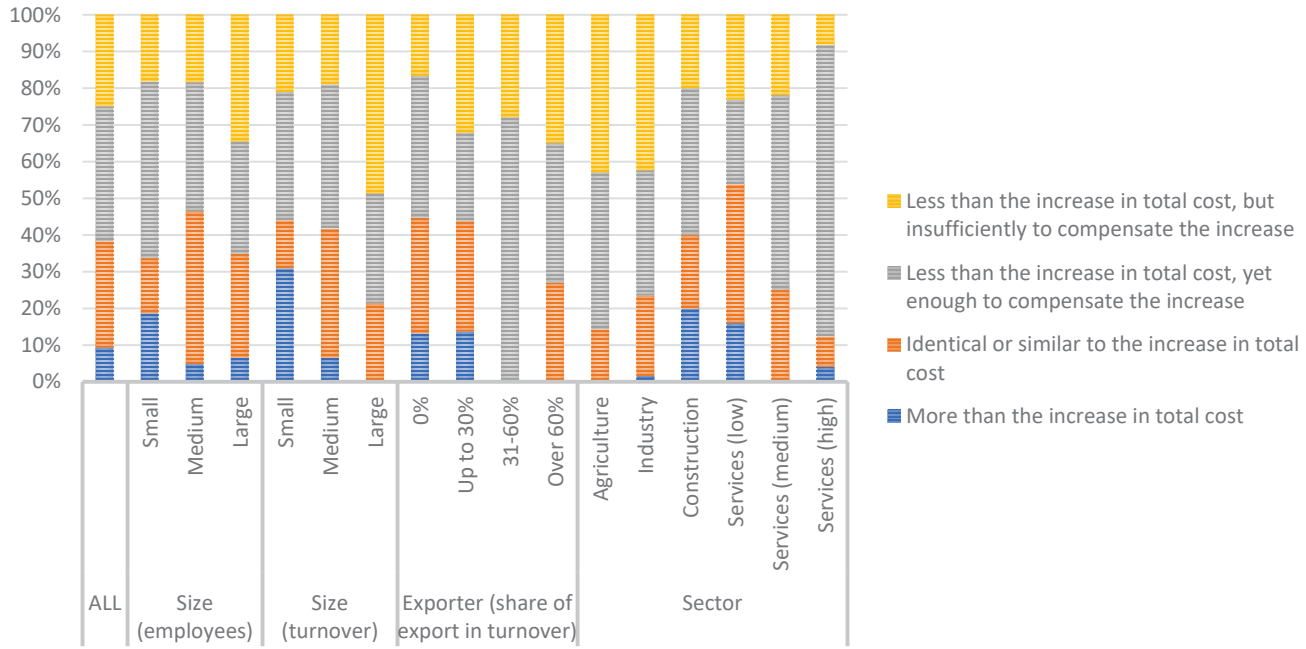
5.4. Firms' specifics and the strength to withstand the crisis induced by the conflict in Ukraine

Macedonian companies have primarily coped with rising costs by passing the burden onto consumers through price increases, as evidenced by the detailed cost analysis in the preceding section. Responses regarding the extent to which increased final prices offset rising input costs vary (**Figure 11**). On average, responses are evenly distributed among those stating that final prices are equal to the total cost increase, less than the increase but sufficient to compensate, and less than the increase and insufficient to compensate. However, there are notable differences across segments. Small firms more frequently succeeded in fully transferring cost increases to prices, particularly in construction and low-wage services, such as trade and hotels, where input cost surges were fully or excessively reflected in output prices. Conversely, many large firms in industry and agriculture were unable to effectively pass on cost increases, with a significant share failing to fully reflect the cost surge in their final prices.

Cost and price structure in firms is determining their competitiveness on the market. The dramatic surge in input costs which then triggered to a significant or large extent conference onto the final prices of own products and services, during the current crisis induced by the conflict in Ukraine, likely affected firms' competitiveness. However, on average, half of the firms (51.3%) reported that their competitiveness has been neither harmed nor improved. For small local firms though, more than for medium-sized ones, the competitiveness worsened. This is the case for agriculture, industry and construction, despite a non-negligible share of firms in industry (19.6%) reported competitiveness enhancement. The higher the skill intensity in services, the lower the worsening of competitiveness perception, whereby in the high-pay services an astonishing 71.2% of firms reported their competitiveness improving.

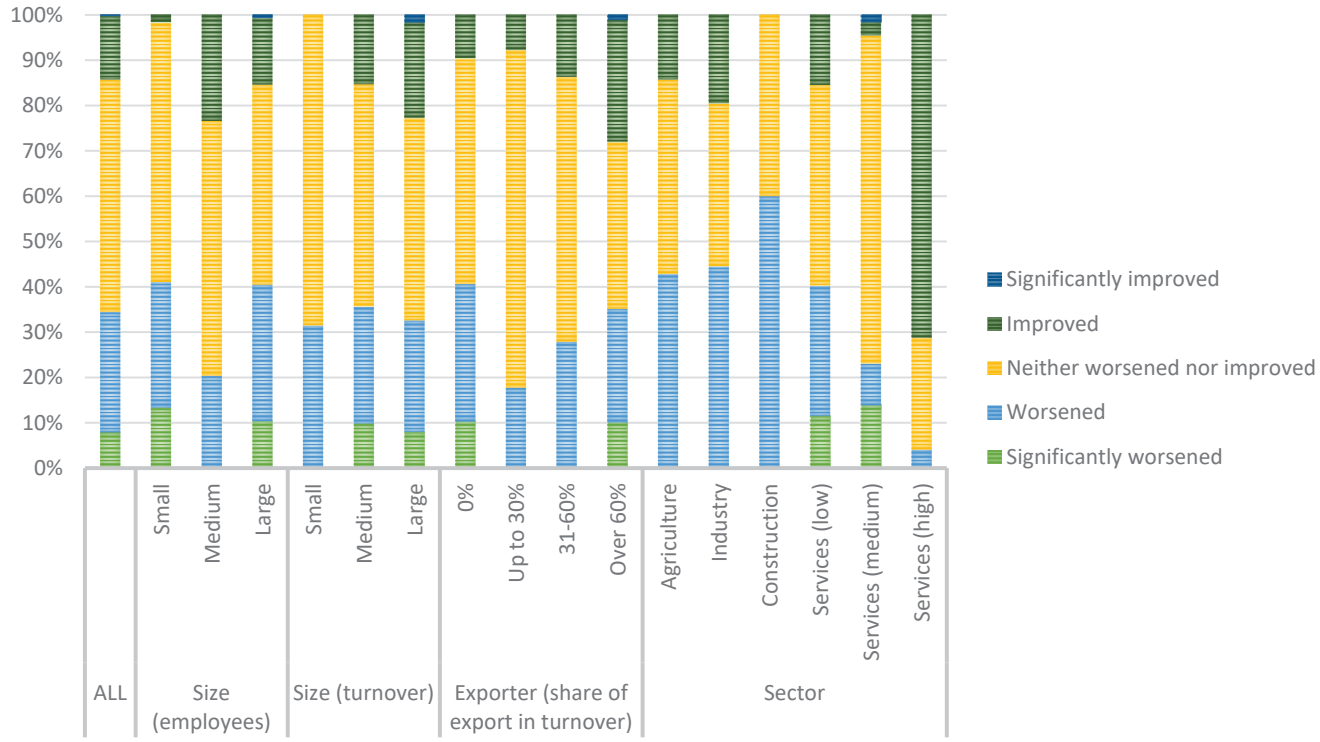
In the final analysis, we examine how the probability of cost surges being passed on to final prices and changes in competitiveness depend on firm characteristics. The results are summarized in **Table 6**, with a focus on significant findings due to space limitations. Note that the number of observations drops to 92 and 94 in the two regressions respectively, mainly due to missing data in the reporting the shares of various costs in total costs by firm. Descriptive statistics of the variables included is provided in the Appendix.

Figure 11. The increase in prices compared to the increases in costs



Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

Figure 12. Perception on the changes in own-firm competitiveness



Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

Significant improvements in competitiveness were observed only in high-wage services amid the crisis induced by the conflict in Ukraine, likely due to increased global demand enhancing their competitiveness. Medium-sized firms also showed improved competitiveness compared to smaller firms, while larger firms were less likely to fully transfer input cost surges to final prices.

Regionally, firms in Polog, Southwest, and Southeast regions were less successful in passing input cost increases to prices compared to those in Skopje, possibly due to a prevalence of low-wage, low-competitive firms with limited market power. Interestingly, firms in the Southwest region experienced declining competitiveness, whereas those in the Southeast region saw an increase compared to Skopje.

Insights from the second part of the Table highlight that higher energy cost shares in total costs were associated with increased input cost transfers to final prices but worsened competitiveness. Labor cost shares did not significantly impact cost transfers or competitiveness, suggesting labor cost surges were market-driven. Increased demand during the crisis correlated with improved competitiveness. Notably, firms that did not take steps to address rising labor costs were less likely to convert input cost surges into higher final prices, highlighting the importance of labor cost management strategies.

Table 6. The probability of cost transferring onto prices and of competitiveness worsening

		Final price reflecting input cost (from more to less)	Competitiveness perception (from worsening to improvement)
Sector (Agriculture is reference category)	Industry	-0.2438	-0.1555
		(0.669)	(0.624)
	Construction	0.0948	-0.0536
		(0.838)	(0.696)
	Low-pay services	-0.6726	-0.1262
		(0.625)	(0.602)
	Medium-pay services	-0.2379	-0.3058
		(0.642)	(0.659)
	High-pay services	0.1821	1.5090**
		(0.659)	(0.763)
Size (Small firms are reference category)	Medium-sized	0.2213	0.7056*
		(0.523)	(0.418)
	Large	1.0930**	0.2095
		(0.525)	(0.562)
Region (Skopje is the reference category)	Polog	0.7832*	0.8537
		(0.451)	(0.546)
	Southwest (SW)	2.3808*	-0.7122*
		(1.320)	(0.382)
	Pelagonia	-0.119	-0.5519
		(0.478)	(0.464)
	Northeast (NE)	0.394	-0.6432
		(1.321)	(0.721)
	East (E)	-0.4939	0.4345
		(0.442)	(0.508)
	Southeast (SE)	1.2807*	1.0589*
		(0.675)	(0.583)
	Vardar	-0.3675	-0.1459
		(0.723)	(0.906)
Exporting, share in turnover (Non-exporters are the reference category)	1-30%	-0.2984	0.8151**
		(0.470)	(0.413)
	31-60%	0.5088	0.887
		(0.412)	(0.549)
	Over 60%	0.0621	0.4012
		(0.278)	(0.523)
Energy cost share		-0.0275***	-0.0123*
		(0.009)	(0.007)
Labor cost share		0.0044	-0.0019
		(0.008)	(0.007)
Demand (from reduction to increase)		-0.2378	0.5974**
		(0.211)	(0.250)
Firms who did not undertake any step for coping with raw material price surge		-0.4517	0.0585
		(0.537)	(0.370)
Firms who did not undertake any step for coping with energy price surge		0.3706	0.0196
		(0.469)	(0.491)
Firms who did not undertake any step for coping with labor cost surge		0.7499*	0.075
		(0.438)	(0.332)
	Observations	92	94

Source: Author's calculations.

*, ** and *** refer to a statistical significance at the 10%, 5% and 1% level, respectively. Standard errors provided in parentheses. Standard errors robust to heteroscedasticity. Weights accordingly used.

5.5. Other costs, demand and the most pressing current challenges

The costs of various services used by firms have generally risen, albeit to a lesser extent compared to raw materials, energy, and labor. Transport costs increased up to 50% in 2022, especially impacting agriculture, industry, and construction. Accounting and IT service costs remained stable for about a third of firms but saw significant increases for others, particularly in agriculture. Bank services and interest expenses rose, with a notable share experiencing more than a doubling of costs, especially affecting agriculture. Maintenance and security service costs also increased up to 50%, although some firms reported no change.

Following the invasion of Ukraine by Russia, the global economy encountered a severe supply shock, contributing to rising uncertainty, declining real incomes, and high costs that suppress demand, leading to recessionary trends. Growth prospects have diminished globally and in North Macedonia, with GDP growth projections halved to around 2-2.5% for 2023, significantly below the economy's potential of 4-4.5%. Despite this, demand remained intact for 57.6% of Macedonian firms, particularly among larger exporting firms in industry and high-pay services. In construction, a third of firms reported increased demand, potentially driving up real estate prices in response to inflationary pressures.

Key challenges faced by firms in North Macedonia include economic uncertainty, environmental uncertainty, and, most significantly, a shortage of qualified labor (**Table 7**). Smaller firms are particularly concerned about economic uncertainty, followed by labor shortages, while medium-sized firms are most affected by labor shortages. Large firms, exposed to volatile market conditions, are equally concerned about high electricity prices and economic uncertainty. In agriculture, high electricity prices are as critical as raw material costs and input services, likely influenced by soaring fertilizer prices due to the Ukraine conflict. Labor shortages are a challenge across industries, particularly affecting industry and other sectors requiring semi- or high-skilled workers. Medium- and high-pay service sectors prioritize economic and policy uncertainty as their main challenge, with labor shortages ranking third.

Table 7. The three most pressing challenges presently

	ALL	Size (employees)			Sector					
		Small	Medium	Large	Agriculture	Industry	Construction	Services (low)	Services (medium)	Services (high)
High price of electricity and energy inputs	39.7%	32.9%	28.0%	52.3%	71.4%	67.2%	20.0%	45.2%	10.8%	16.5%
High price of raw materials and input services	24.2%	37.2%	16.9%	21.5%	71.4%	57.8%	0.0%	24.6%	10.8%	4.1%
Increased uncertainty in the economic environment	41.6%	50.9%	52.8%	27.8%	42.9%	27.4%	80.0%	26.0%	61.6%	83.5%
Shortage of qualified workers	55.3%	44.7%	71.7%	50.0%	28.6%	47.6%	100.0%	55.7%	46.1%	75.3%
High labor costs	28.0%	29.7%	29.0%	26.3%	14.3%	34.4%	40.0%	21.9%	36.9%	8.2%
Supply interruptions	5.4%	7.4%	0.0%	8.1%	14.3%	3.9%	0.0%	9.7%	0.0%	0.0%
Transport and logistics interruptions	3.4%	3.2%	0.0%	5.9%	0.0%	3.9%	0.0%	5.1%	3.1%	0.0%
Access to finance challenges	10.3%	18.3%	8.4%	6.9%	28.6%	7.8%	20.0%	8.3%	7.7%	4.1%
Uncertainty for and increased interest rates	8.6%	1.9%	25.5%	0.5%	0.0%	3.9%	0.0%	9.7%	16.9%	8.2%
Accumulated debt	6.5%	5.7%	4.5%	8.5%	0.0%	3.9%	0.0%	9.7%	0.0%	4.1%
General uncertainty (determined by the unclear moves of economic policies)	42.3%	43.8%	36.4%	45.7%	28.6%	27.4%	0.0%	37.6%	66.2%	79.4%

Source: Survey on the impact of crisis induced by the conflict in Ukraine on firms 2023.

6. Conclusions

The aim of this study was to empirically examine the impact of the crisis induced by the conflict in Ukraine on firms in North Macedonia using data from a survey conducted with 112 firms in April and May 2023. Descriptive statistics and probit regression were employed to analyze the raw data.

Key findings indicate that although larger industrial exporters have higher raw material costs, smaller firms in agriculture and low-pay services were more adversely affected by price increases. All firms, regardless of size, responded to cost pressures by increasing final product prices, while larger firms more frequently implemented cost-reduction strategies compared to smaller firms. Many firms of all sizes also postponed planned investments, with agricultural firms more likely to halt production.

Energy costs, primarily reliant on electricity for production, surged dramatically for large firms purchasing on the open market, particularly in industry and construction. High-pay services experienced more manageable energy cost increases. While all firms passed on energy price shocks to their products and employed cost consolidation, medium and large firms also invested in electricity production facilities and energy-saving processes, mainly in industry, agriculture, and low-pay services. Conversely, many small firms did not adopt specific coping strategies, likely due to operating within a regulated electricity market.

Labor costs increased due to labor and skill shortages, exacerbated by minimum wage hikes, affecting small local firms in low-pay sectors disproportionately. Large industry and construction firms responded with outsourcing and technological investments. Various other costs, including accounting, IT, bank services, and maintenance, rose moderately across sectors, with significant increases noted in agriculture.

Demand for Macedonian firms' products and services remained stable overall in 2022, with increases in industry and construction and decreases in smaller agricultural businesses. Persistent challenges unrelated to the crisis include labor shortages and economic uncertainty, more pronounced among smaller firms and in specific sectors.

Regression results highlight that higher energy cost shares correlate with increased input cost transfers to final prices but worsen competitiveness. Increased product demand during the crisis generally improved competitiveness, while firms not addressing rising costs struggled to convert input increases into higher prices, especially in response to labor cost hikes. This underscores that firms absorbing labor cost hikes without price increases could mitigate cost-push inflation.

This study builds upon a conceptual framework that recognizes the interplay between geopolitical conflicts, economic interdependence, and firm-level responses. By applying insights from conflict studies to the context of North Macedonia, this research enriches our understanding of how global geopolitical events reverberate through interconnected markets. The findings align with previous studies on the economic consequences of armed conflicts, which highlight disruptions in trade routes, supply chains, and energy dynamics as key factors influencing firm behavior. Furthermore, the focus on specific channels of impact, including raw material costs, energy price surges, labor shortages, and demand fluctuations, underscores the relevance of these global events within a localized context. This analysis not only contributes to academic discussions but also informs policymakers and business leaders in North Macedonia and the broader region about effective strategies to navigate and mitigate the economic challenges posed by geopolitical crises.

The conclusions drawn from the study suggest several policy implications that can address critical challenges faced by firms in North Macedonia. Firstly, given the persisting economic and policy uncertainty, the government should prioritize stability by engaging in comprehensive consultations with stakeholders before implementing regulatory changes. This approach will mitigate disruptions caused by abrupt policy shifts, particularly in areas like tax and finance. Secondly, addressing the labor shortage requires activating the unemployed labor force through reskilling and upskilling programs, reducing social support constraints, and considering flexible employment options for students. Thirdly, to manage electricity price volatility, large firms could negotiate with the government for stable pricing models or invest in their electricity production capacities. Additionally, streamlining permit processes and promoting consultation support for renewable energy investments are essential. Lastly, upgrading the electricity transmission network and supporting energy storage solutions will be crucial to sustain the growth of renewable energy production. These policies, coupled with clear communication and accessible financing mechanisms, can foster resilience and growth amid economic challenges.

Despite yielding valuable insights, this study has several limitations that warrant consideration. Firstly, the sample size used in the survey was relatively small, which may limit the generalizability of the findings to the broader population of firms. Additionally, the

study primarily focused on examining the impact of the crisis induced by the conflict in Ukraine on firms within a domestic context. Exploring more complex relationships and considering participation in global value chains (GVCs) could provide a deeper understanding of how external shocks affect firms within a global economic context. Moreover, the study's emphasis on all firm sizes or sectors may have obscured more nuanced variations across different types of firms. By diversifying the sample to include a broader spectrum of firm sizes and sectors, the study could generate more specific and targeted policy recommendations tailored to different segments of the economy. Other generic limitations include potential response biases in the survey data, the reliance on self-reported information, and the inability to establish causal relationships due to the cross-sectional nature of the study. Future research efforts should aim to address these limitations to enhance the robustness and applicability of the findings.

Endnotes

1 They specifically examine topics such as companies' roles in developing innovative weaponry, war financing, and the taxation of war profits.

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Appendix – Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Final price reflecting input cost (from more to less)	107	2.86	0.92	1	4
Competitiveness perception (from worsening to improvement)	111	2.73	0.77	1	5
Sector					
Agriculture	106	0.07	0.25	0	1
Industry	106	0.26	0.44	0	1
Construction	106	0.05	0.21	0	1
Low-pay services	106	0.30	0.46	0	1
Medium-pay services	106	0.24	0.43	0	1
High-pay services	106	0.08	0.28	0	1
Firm size					
Small	111	0.23	0.43	0	1
Medium-sized	111	0.26	0.44	0	1
Large	111	0.50	0.50	0	1
Region					
Skopje	111	0.43	0.50	0	1
Polog	111	0.03	0.16	0	1
SW	111	0.04	0.19	0	1
Pelagonia	111	0.13	0.33	0	1
NE	111	0.03	0.16	0	1
E	111	0.17	0.38	0	1
SE	111	0.11	0.31	0	1
Vardar	111	0.07	0.26	0	1
Share of exports in revenue					
Non-exporter	111	0.47	0.50	0	1
1-30%	111	0.16	0.37	0	1
31-60%	111	0.05	0.21	0	1
Over 60%	111	0.32	0.47	0	1
Energy cost share	100	17.25	19.10	0	100
Labor cost share	100	31.60	21.16	0	99
Demand (from reduction to increase)	109	2.72	0.79	1	4
Firms who did not undertake any step for coping with raw material price surge	111	0.05	0.21	0	1
Firms who did not undertake any step for coping with energy price surge	111	0.13	0.33	0	1
Firms who did not undertake any step for coping with labor cost surge	111	0.36	0.48	0	1