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The role of pricing and export diversification in global value chains resilience: Evidence from Russian manufacturing firms under dual shocks

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Abstract

This study investigates the impact of pricing and export diversification on the resilience of Russian manufacturing firms within global value chains (GVCs) during two consecutive shocks: the COVID-19 pandemic and the sanctions of 2022. The research examines how pricing affects firms' ability to sustain exports in times of crisis and analyzes the role of product and geographic diversification in mitigating disruptions. The findings reveal that market-controlled pricing and export diversification significantly enhance GVC resilience, enabling firms to adapt to disrupted supply chains and shifting market conditions. In contrast, rigid pricing controls, including government interventions, undermine export continuity. Single-product firms demonstrate less resilience to external shocks, highlighting the importance of export diversification in enhancing adaptability within GVCs. This study points out the critical role of flexibility and adaptability in pricing and export diversification for navigating external shocks. It provides useful insights for managers and policymakers, emphasizing the balance between resilience and efficiency in maintaining competitiveness. The results contribute to a broader understanding of GVC resilience, with implications for firms in other emerging economies facing similar challenges.

Keywords: global value chains, resilience, export pricing, export diversification, Russian manufacturing, COVID-19, sanctions.
JEL classification: D22, F14, F23, L22.

1. Introduction

In recent years, growing uncertainty in the global economy and the increasing frequency of shocks disrupting global value chains (GVCs) have highlighted the limited theoretical and empirical understanding of exogenous shocks and

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their impact on GVCs (Chatterjee et al., 2024; Klarin et al., 2024). Notably, there is a significant demand for research into the factors that make GVCs more or less resilient (Suder et al., 2024).

The literature remains divided on the resilience of firms in GVCs when faced with external shocks. On the one hand, firms embedded in GVCs are often considered more resilient, as multinational corporations (MNCs) operating across numerous markets and regularly facing a range of environmental, economic, societal, geopolitical, and technological risks have long worked to develop the capacity to resist, absorb, and effectively respond to sudden shocks (Ambulkar et al., 2015). This includes adapting the configuration of GVC activities, particularly with respect to their spatial distribution and strategic management (Ali et al., 2022; Altay et al., 2018; Kano et al., 2020).

On the other hand, firms within GVCs may exhibit greater vulnerability due to their dependence on strategic partnerships and susceptibility to supply chain disruptions (Borino et al., 2024; Criscuolo and Timmis, 2017; Quoreshi and Stone, 2019; Arriola et al., 2020). Additionally, the adverse effects of external shocks can ripple through MNC networks, potentially impacting subsidiaries in countries not directly affected by the shock (Bena et al., 2022).

A notable limitation of existing studies on GVC resilience is their predominant focus on the actions and impacts on MNCs, often overlooking the organizational characteristics of non-lead firms within GVCs (Gereffi and Lee, 2016). This gap is evident in both empirical and theoretical research, which frequently neglects suppliers' strategies for improving their positions within GVCs (Humphrey, 2020; Sako and Zylberberg, 2019). Specifically, prior studies fail to adequately address the distribution of value added and power within GVCs beyond MNCs, as well as the resilience of non-lead firms (Choksy et al., 2022; Pla-Barber et al., 2021; Suder et al., 2024). These aspects, however, are critical to understanding overall GVC resilience (Sako and Zylberberg, 2019). Currently, the majority of literature examines the impact of the COVID-19 pandemic, given its global scope and wide-ranging economic impact. A number of studies have evaluated how firms worldwide responded to the pandemic's disruptions (Ghobadian et al., 2022; Hasan et al., 2023). Despite this, much less research has been conducted on other external shocks such as sanctions and trade wars, which tend to have a more specific impact on some regions or sectors (Le and Bach, 2022).

Our contributions address two key research gaps: pricing and export diversification as factors of resilient GVCs. First, it's the factor of export pricing due to its significance as critical company's capability (Tan and Sousa, 2011) and a fundamental determinant of success in export activities (Hofer et al., 2019). In contrast to existing studies that emphasize the degree of integration into GVC, government support (Gereffi et al., 2022a), technological cooperation, or innovation activity (Dilyard et al., 2021; Orlando et al., 2022), we consider pricing for analyzing GVC resilience. Export pricing is usually examined outside of shock periods, emphasizing its role in enhancing foreign market performance (Hofer et al., 2019). The research on pricing during shock periods remains limited, usually focusing on pricing to increase exporter flexibility (Gupta, 2023). The present study contributes to the understanding of how distinct pricing mechanisms affect the resilience of global value chains — production cost control, market control, buyer control, and governmental control.

Second, we point out diversification as a factor influencing firm resilience under external shocks, considering both product and geographic diversification. While most studies focus on product (Choksy et al., 2022) and geographic diversification (Cos et al., 2019), the uniqueness of our approach lies in the combined analysis of both types of diversification based on survey data. This allows for a more comprehensive assessment of firm resilience. Rather than introducing a new parameter for testing, we demonstrate the significance of established diversification factors in the context of two distinct external shocks — the COVID-19 pandemic and sanctions — using a unified sample. While export diversification contributes to both firm profitability (Wagner, 2014) and export performance (Boehe and Jiménez, 2016), its impact under external shocks remains unclear. Considering the increasing frequency of external shocks globally, the purpose of this study is to examine the role of geographic and product diversification in periods of external shocks. While the impact of diversification during the pandemic has been partially studied, its role under sanctions remains insufficiently explored. Thus, our study fills a critical gap in empirical research by exploring how export pricing and a firm's GVC participation influence export persistence.

This study is unique in its examination of GVC resilience through the lens of Russian manufacturing firms during two distinct shocks: the COVID-19 pandemic and the 2022 sanctions shock. Both the pandemic and the international sanctions, triggered by escalating geopolitical conflicts, have received significant attention in recent years (see reviews and discussions on the pandemic's impact in Bacchetta et al., 2021; Borino et al., 2024; Kersan-Škabić, 2022, and on sanctions in Cheratian et al., 2023; Huynh et al., 2023; Meyer et al., 2023).

Focusing on Russian manufacturing firms is particularly compelling for several reasons. First, despite the dire initial forecasts regarding the impact of international sanctions — affecting nearly half of Russia's export and import flows — researchers have concluded that the Russian economy has demonstrated resilience under external pressure, including maintaining its participation in GVCs (Bruno et al., 2023; Gaur et al., 2023; Galbraith, 2024; Tsouloufas and Rochat, 2023). However, the effects of sanctions have been highly heterogeneous among firms, influenced by a wide range of internal factors such as firm size, state or foreign ownership, degree of internationalization, use of digital technologies (Gaur et al., 2023; Golikova and Kuznetsov, 2017b; Simachev et al., 2023), and adaptation strategies (Fedyunina and Simachev, 2023; Kuzyk and Simachev, 2023). Second, the Russian economy experienced two consecutive shocks within a short time frame (2020–2022), providing a unique opportunity to analyze the impact of both on GVC resilience using the same sample of firms. This allows for direct comparisons of the results across the two shocks.

This article builds on the GVC framework, examining the impact of GVC organization on the resilience of non-lead firms. Specifically, we focus on the roles of pricing, product, and geographic export diversification as factors shaping GVC organization and resilience to pandemic and sanctions shocks. To achieve this, we formulate and test hypotheses on how different pricing within GVCs — market-controlled, governmental-controlled, production cost-controlled, and buyer-controlled — affect the resilience of non-lead firms. Our approach aligns closely with that of Staritz et al. (2023), who emphasized the role

of price-setting into the analysis of governance within global value chains, and builds on supplier agency perspectives in GVC analysis, highlighting inter-firm structures and relationships (Choksy et al., 2022; Humphrey, 2020). Additionally, we test hypotheses on how product and geographic export diversification influence firms' GVC resilience.

Reflecting on our findings, this study enriches the existing empirical evidence on GVC resilience by highlighting organizational factors such as pricing and export diversification (Boehe et al., 2016; Oliveira et al., 2024). These insights enhance the understanding of the Russian economy's resilience to external shocks. Given that Russia shares similarities with other emerging economies (Gaur et al., 2023; Meyer et al., 2023), the findings on GVC resilience factors are relevant and potentially beneficial for them as well.

The article is structured as follows: Section 2 introduces the hypotheses and conceptual evaluation model; Section 3 describes the data and estimation methodology; Section 4 presents the empirical results, while Section 5 discusses key findings and their implications for managers and policymakers.

2. Development of hypotheses and conceptual framework for the study

2.1. The impact of export pricing on GVC resilience

The method of price formation within GVCs significantly influences firms' resilience. Common pricing includes production cost-controlled, market-controlled, buyer-controlled, and governmental-controlled approaches, each representing distinct models for managing costs and mitigating risks across supply chains. The impact of price controls on GVC resilience can be analyzed through several lenses within International Business (IB) theory.

Transaction Cost Economics (TCE) highlights how price control models influence transaction costs within GVCs. Stabilizing input prices — a key transaction cost — through production cost controls enables firms and suppliers to operate under more predictable conditions, facilitating better planning and coordination of production activities (Williamson, 1989). However, such mechanisms may reduce firms' flexibility to respond to market dynamics, a critical factor during external shocks characterized by sharp price fluctuations. Conversely, market-controlled pricing enhances adaptability by exposing firms to global price signals but increases vulnerability to external volatility (Coe and Yeung, 2015). This aligns with insights from the Dynamic Capabilities Framework (DCF), which emphasizes firms' ability to navigate price controls in volatile environments. Firms under production cost controls must develop operational efficiencies, while those operating under market-controlled pricing regimes need strategic agility to manage fluctuating prices (Teece et al., 1997).

Resource Dependence Theory (RDT) offers another perspective, focusing on firms' reliance on external actors for pricing decisions. Buyer-controlled pricing often reflects asymmetric power dynamics within GVCs, where dominant buyers dictate terms that non-lead firms must accept (Pfeffer and Salancik, 2015). While such arrangements may improve coordination and efficiency, they constrain supplier autonomy and limit strategic decision-making, which can be particularly problematic during external shocks and supply chain disruptions. Governmental

price controls, meanwhile, highlight firms' dependence on regulatory frameworks. These controls can stabilize market conditions in the short term but may distort competition and discourage innovation in the long term (Rodrik, 2008).

Empirical evidence underscores the importance of examining price controls in the context of GVC resilience, though findings are mixed. For example, production cost-controlled pricing, commonly used in resource-intensive sectors, reduces vulnerability to raw material price fluctuations but may stifle innovation and product differentiation (Gereffi et al., 2005). Market-controlled pricing, while promoting competitiveness, leaves firms exposed to global demand shocks, necessitating diversification of export portfolios to mitigate risks (Taglioni and Winkler, 2016). Buyer-controlled pricing enhances efficiency through coordination but exacerbates power imbalances, particularly for suppliers in subordinate GVC roles. Research in the apparel industry shows that buyer-controlled pricing often pressures suppliers to minimize costs, sometimes at the expense of environmental and social standards (Humphrey and Schmitz, 2002; Tokatli, 2013). Similarly, governmental price controls, while stabilizing markets in the short term, can discourage private investment and long-term innovation (Rodrik, 2008).

Given the ambiguous theoretical and empirical evidence regarding the role of price-setting in firm performance and resilience — and considering that this study focuses exclusively on manufacturing firms in the Russian economy, which is characterized by weak institutional efficiency and the tendency for growth among firms that learn to 'bargain' with inefficient institutions (Golikova and Kuznetsov, 2017) — we propose the following hypotheses:

H1: Market pricing increases the probability of firm' GVC resilience.

H2: Government price controls reduce the probability of firms' GVC resilience.

2.2. The impact of export diversification on GVC resilience

Geographic diversification of exports strengthens firms' resilience within GVCs by mitigating risks associated with external shocks and market-specific vulnerabilities. According to TCE, engaging with multiple markets helps firms manage risks associated with opportunism, asset specificity, and environmental uncertainties. Operating in diverse markets provides flexibility, enabling firms to better manage supply chains and optimize governance-related costs (Williamson, 1985; Rugman and Verbeke, 2001). Institutional theory highlights that firms operating across diverse regulatory environments are better positioned to handle political and institutional risks, allowing for continued operations across varying conditions (Meyer et al., 2011). Operating in multiple regulatory environments enhances firms' flexibility and resilience, enabling them to absorb shocks more effectively. This concept aligns with the idea that firms can buffer against adverse conditions by leveraging experience in different markets, gaining superior knowledge, and adjusting their strategies and operations in response to various shocks (Essuman et al., 2023; Smorodinskaya et al., 2021). From the economies-of-scale perspective, foreign diversification spreads overhead costs and reduces unit operating costs (Puhr and Müllner, 2022; Fariborzi et al., 2022).

Empirical studies confirm the resilience benefits of geographic diversification. While firms with broader geographic reach may exhibit short-term vulnerability

to both demand and supply shocks, their diversified operations enable them to recover more quickly and adapt to changing conditions (Cui et al., 2024; Santos Silva et al., 2014). Companies with diverse export networks report higher revenues, profitability, and reduced dependence on any single market (Schwens et al., 2018; Wagner, 2014). Export diversification increases the number of buyers, average sales volume, and resilience to supply chain disruptions (Boehe et al., 2016). These factors support firms' ability to reorient exports and sustain GVC resilience during natural disasters, pandemics (Ayadi et al., 2022; Kano and Oh, 2020; Kersan-Škabić, 2022; Matous and Todo, 2017), and trade wars (Bove et al., 2023; Esfahani and Rasoulinezhad, 2017; Liu et al., 2023). Based on these findings, we hypothesize that geographic diversification has contributed to the resilience of Russian manufacturing firms and propose the following hypothesis:

H3: Geographic diversification of exports increases the probability of firms' GVC resilience.

Product diversification strengthens GVC resilience by spreading risk across multiple product lines, thereby reducing reliance on a single product category. Furthermore, different products may serve different value chains, so the ability to switch between GVCs can enhance firms' resilience. According to the Resource-Based View (RBV), firms with a diverse product portfolio can leverage their unique resources and capabilities to adapt to shifts in demand and competitive pressures (Barney, 1991). The Dynamic Capabilities Framework (DCF) further highlights firms' ability to reconfigure resources and develop new products in response to changing market conditions (Teece et al., 1997). From the risk management perspective, diversification across product lines allows firms to reduce overall risk and optimize operations (Kogut, 1993; Smorodinskaya et al., 2021). By spreading investments across various products, firms are less likely to experience simultaneous failures, as each product faces distinct market dynamics, thus providing a buffer against volatility in any one market.

Empirical studies emphasize the role of product diversification in boosting GVC resilience, though they provide limited evidence. The importance of product diversification in GVCs and a dual-strategy approach with different buyers is especially significant for non-lead firms. This strategy helps reduce dependency on the lead firm in the GVC, which may exclude suppliers from the design stage, limiting their profit margins and growth opportunities (Gereffi et al., 2022b; Murphree and Breznitz, 2020). Adaptive governance within GVCs offers suppliers requirements for product pricing and quality, which can be critical during external shocks. This allows suppliers to maintain their performance by streamlining processes and diversifying into new products (Choksy et al., 2022; Islam and Chadee, 2024). Furthermore, diversified product portfolios enhance supply chain resilience by reducing dependency on specific inputs, ensuring that firms can maintain production continuity during disruptions (Tang and Tomlin, 2008).

Given these theoretical arguments and the limited empirical evidence, we hypothesize that product diversification contributes to the GVC resilience of Russian manufacturing firms, whereas specialization in a single product weakens GVC resilience. Therefore, we propose the following hypothesis:

H4: Specialization in a single product reduces the probability of firms' GVC resilience.

2.3. Conceptual model

The model incorporates control variables based on prior research, which suggests that the impact of external shocks and the GVC resilience of firms is influenced by several key factors, including firm size, age, ownership structure, and government connections (Cheratian et al., 2023; Gopalan and Reddy, 2023; Huynh et al., 2023; Simachev et al., 2023). Other important factors include firm affiliation with a holding company (Kano et al., 2020; Ghauri et al., 2023), access to credit resources (Fauceglia, 2015; Gopalan and Reddy, 2023), possession of international quality certifications (Ponte and Gibbon, 2005), technological capabilities, and innovation activities (Gupta, 2023; Shahi and Sinha, 2020; Pereira et al., 2022; Subramaniam et al., 2021). Furthermore, participation in GVCs has been shown to help firms develop specific capabilities that enhance resilience (Cattaneo et al., 2010; Doan, 2024; Lamorgese et al., 2024; Lavopa and Zagato, 2022). Previous studies have also highlighted the importance of export characteristics — particularly export product quality and diversification — which are significantly influenced by backward linkages. Accordingly, the variable "backward participation" is included in the model to test hypotheses 3 and 4 (Carrasco and Tovar-García, 2021; Pierola et al., 2018). Additionally, the model includes standard industry and regional dummy variables to account for unobserved effects specific to the GVC resilience of Russian firms in particular sectors or regions. Fig. 1 illustrates the conceptual framework of the present study, outlining the approach for testing the proposed hypotheses.

3. Data and methodology

The empirical analysis is based on the results of the project "Russian companies in Global Value Chains" from the HSE University's Fundamental Research Program, during which a survey of manufacturing company managers was conducted in the end of 2022. The sample contains approximately 1,900 observations and is representative across economic sectors and enterprise size groups. In this study, the GVC resilience of firms is measured using the ex-

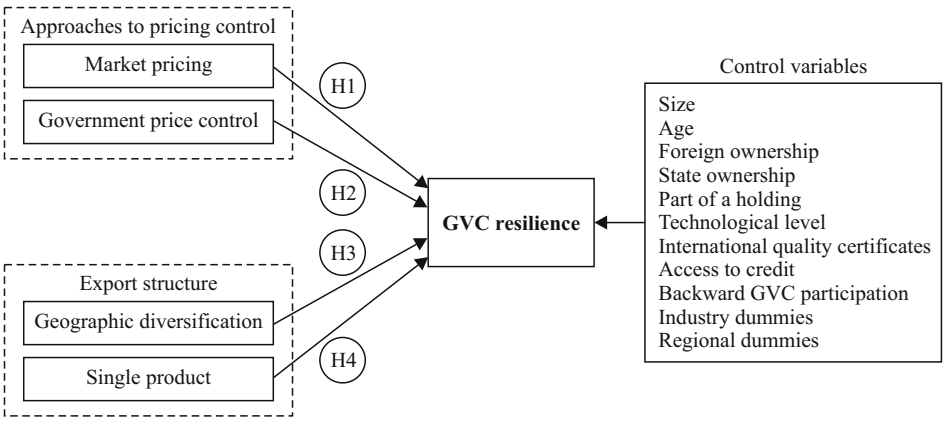

Fig. 1. Conceptual model.

Source: Compiled by the authors.

tensive margin approach, closely following the works by Bricongne et al. (2022); Campi and Dueñas (2022); Martin (2012); Stojčić and Vojinić (2023). Specifically, we measure the export extensive margin as the probability of a firm maintaining its export status (a dummy variable). We propose that the primary criterion for defining a 'mono-product' firm is the generation of the majority of its revenue from a single product or service. The threshold for identifying mono-product firms is set at over 50% of total revenue, which is a widely accepted approach. The definitions and descriptive statistics of all variables are presented in Table 1.

Thus, our empirical model is as follows:

$$\begin{aligned}\text{Logit}(GVCResilience_{irj}) = {} & \beta_0 + \beta_1 \times EPC_{irj} + \beta_2 \times \ln(age_{irj}) + \beta_3 \times \ln(size_{irj}) + \\ & + \beta_4 \times QualityCert_{irj} + \beta_5 \times Ownership_{irj} + \beta_6 \times Holding_{irj} + \\ & + \beta_7 \times CreditAccess_{irj} + \beta_8 \times TechLevel_{irj} + \alpha_r + \mu_j + \varepsilon_{irj}, \end{aligned} \quad (1)$$

$$\begin{aligned}\text{Logit}(GVCResilience_{irj}) = {} & \beta_0 + \beta_1 \times BackwardLinkages_{irj} + \\ & + \beta_2 \times GeographicalDiversification_{irj} + \beta_3 \times SingleProduct_{irj} + \\ & + \beta_4 \times \ln(age_{irj}) + \beta_5 \times \ln(size_{irj}) + \beta_6 \times QualityCert_{irj} + \\ & + \beta_7 \times Ownership_{irj} + \beta_8 \times Holding_{irj} + \beta_9 \times CreditAccess_{irj} + \\ & + \beta_{10} \times TechLevel_{irj} + \alpha_r + \mu_j + \varepsilon_{irj}, \end{aligned} \quad (2)$$

where: $GVCResilience_{irj}$ — the dependent variable representing the ability of company i in region r and industry j to maintain its exporter status during the time period corresponding to an external shock; EPC_{irj} — a variable characterizing the company's export price control; $BackwardLinkages_{irj}$ — a dummy variable indicating whether the company engages in imports, reflecting its downstream participation in GVCs; $GeographicalDiversification_{irj}$ — a variable accounting for the diversity of the company's export markets; $SingleProduct_{irj}$ — a dummy variable equal to one if the company generates the majority of its revenue from the production of a single product; $\ln(age_{irj})$, $\ln(size_{irj})$, $QualityCert_{irj}$, $Ownership_{irj}$, $CreditAccess_{irj}$, $TechLevel_{irj}$ — a set of control variables included in both models; α_r — regional fixed effects controlling for differences across regions; μ_j — industry fixed effects capturing differences across industries; ε_{irj} — the error term.

Given the nature of the dependent variables and the structure of the data, a logit model is an appropriate estimation technique for this study. The dependent variables — whether a firm maintained export status during specific periods (the COVID-19 crisis and sanctions period) — are binary in nature, taking values of 0 or 1. Logit models are specifically designed for situations where the outcome variable is dichotomous, making them ideal for predicting the probability of an event occurring based on a set of independent variables. In this case, the model will estimate the likelihood of a firm maintaining its export status, based on factors such as pricing, geographic and product export structure, and other firm-specific characteristics. Furthermore, the control variables include both continuous (e.g., the number of export destinations) and binary (e.g., firm ownership, credit access) variables, which can be easily accommodated by the logit model. By applying this technique, we can estimate the odds of maintaining export status under different conditions, while accounting for various factors that may influence the likelihood of this outcome.

Table 1
Definitions and descriptive statistics of the variables.

Variable	Operationalization	Mean	SD	Min	Max
Dependent variables					
GVC resilience	Dummy = 1 if a firm maintained export status during the 2019–2020 period (COVID-19 crisis), 0 otherwise	0.25	0.43	0	1
	Dummy = 1 if a firm maintained export status during the 2021–2022 period (sanctions period), 0 otherwise	0.23	0.42	0	1
Independent variables					
Export price control					
Production cost-controlled	Dummy = 1 if a firm determines the price based on the cost of production for each type of product and the desired profitability level, 0 otherwise	0.55	0.50	0	1
Market-controlled	Dummy = 1 if a firm determines the price based on market conditions (supply and demand), 0 otherwise	0.36	0.48	0	1
Buyer-controlled	Dummy = 1 if the price is regulated by the primary buyer in Russia or abroad, 0 otherwise	0.05	0.22	0	1
Governmental-controlled	Dummy = 1 if the price is controlled according to the recommendations of governmental authorities, 0 otherwise	0.04	0.20	0	1
Export structure					
Geographic export diversification	Number of export destinations of a firm in the previous year: This variable considers the number of countries/regions to which the firm exported, including 7 key countries/regions: EAEU, EU, Turkey, China, other Asian countries, the U.S. (including Canada), and other countries	0.45	0.80	0	6
Single product	Dummy = 1 if a firm generates more than 50% of its revenue from a single product, 0 otherwise	0.90	0.28	0	1
Control variables					
Size	Number of employees (in logs)	4.28	1.31	2.30	9.39
Age	Age of company (in logs)	2.87	0.75	0.69	5.71
Foreign owned	Dummy variable = 1 if a firm has foreign ownership, 0 otherwise	0.02	0.16	0	1
State owned	Dummy variable = 1 if a firm has state ownership, 0 otherwise	0.02	0.13	0	1
Part of holding	Dummy variable = 1 if a firm belongs to a holding, 0 otherwise	0.14	0.35	0	1
High technological level	Dummy variable = 1 if the technological level of production of the company's primary product corresponds to the highest standards observed in foreign counterparts, 0 otherwise	0.14	0.34	0	1
Certificates of quality	Dummy variable = 1 if a firm has valid international quality certificates, 0 otherwise	0.14	0.35	0	1
Credit access	Dummy variable = 1 if a firm has credit taken in the previous year, 0 otherwise	0.29	0.45	0	1
Backward linkages	Dummy = 1 if a firm was engaged in import in the previous year of observation, 0 otherwise	0.49	0.50	0	1
Industry dummies	Industries are classified according to the two-digit OKVED (All-Russian Classifier of Economic Activities) codes				
Regional dummies	The regional classification of firms is based on self-reported data provided by them				

Source: Authors' calculations.

Additionally, when working with binary variables, a probit model can be employed (Regis, 2018; Wagner and Gelübcke, 2014). While theoretically similar to the logit regression, it differs in its underlying distribution and has certain limitations. In probit regression, coefficients cannot be directly interpreted as odds ratios, as in logit models. The latter utilize the logistic distribution, which may be more suitable for the current study, whereas probit regression is based on the normal distribution. Moreover, the use of linear probability models (Borino et al., 2024) was also considered but ultimately rejected because of its limitations, such as potential heteroskedasticity of errors and failure to account for the nonlinear nature of probabilities.

3.1. Endogeneity problem

Empirical studies on firms' participation in global value chains and their resilience to external shocks often face significant endogeneity challenges due to the complexity of the issue and the influence of multiple factors. The first source of endogeneity stems from the specific impact of sanctions on different industries. Sanction-related restrictions affected various sectors of the economy with differing degrees of severity. Due to the structural characteristics of GVCs, companies from different industries may have exhibited varying speeds and effectiveness in reorienting towards new markets and supply chains. To account for this industry-specific effect, the model controls for industry fixed effects using industry dummy variables.

The second potential source of endogeneity arises from regional specificities. Firms located in different regions of Russia face heterogeneous business environment. Variations in access to infrastructure, logistical capabilities, and resource availability can significantly influence a company's ability to adapt to changes in the external environment. To address this factor, the model controls for regional fixed effects using regional dummy variables.

Finally, corporate governance may influence the resilience of companies to external shocks. Due to limitations in the data availability, this aspect was not considered in the current study. As evidenced by studies such as Gorynia et al. (2024) that show the effect of corporate governance on firms' adaptability to international markets, corporate governance can play a key role in ensuring export activities remain resilient. This issue cannot be considered in the present study, which is acknowledged as a limitation.

4. Results

The results of econometric testing for Hypotheses 1 and 2 regarding the role of pricing in GVC resilience are presented in Table 2. Columns 1–5 display the results for GVC resilience during the COVID-19 pandemic in 2020, while Columns 6–10 cover the resilience observed during the sanctions shock of 2022. The findings indicate that when product prices are determined by the market, firms are more likely to maintain their exports during both shocks, demonstrating higher GVC resilience. Specifically, such firms have a 6.2–7.3% higher probability of preserving exports, depending on the specification. These results confirm Hypothesis 1. Conversely, when prices are regulated by the state, firms

Table 2
Export price control for firm resilience during external shocks (logit).

Variable	GVC resilience during COVID-19					GVC resilience during sanctions				
	1	2	3	4	5	6	7	8	9	10
Age	0.019	0.020	0.018	0.022*	0.022*	0.017	0.018	0.016	0.020	0.020
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Size	0.055***	0.053***	0.054***	0.053***	0.054***	0.056***	0.054***	0.055***	0.054***	0.055***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Certificates of quality	0.113***	0.114***	0.115***	0.110***	0.109***	0.106***	0.107***	0.107***	0.104***	0.102***
	(0.026)	(0.025)	(0.025)	(0.026)	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Foreign owned	0.072	0.084	0.079	0.092	0.082	0.058	0.070	0.066	0.077	0.068
	(0.061)	(0.060)	(0.062)	(0.061)	(0.061)	(0.061)	(0.060)	(0.062)	(0.060)	(0.061)
State owned	–0.242**	–0.270**	–0.259**	–0.264**	–0.245***	–0.212*	–0.234*	–0.226*	–0.230**	–0.212**
	(0.095)	(0.108)	(0.107)	(0.106)	(0.093)	(0.108)	(0.121)	(0.122)	(0.117)	(0.105)
Part of holding	–0.017	–0.021	–0.019	–0.019	–0.016	–0.002	–0.005	–0.004	–0.004	–0.001
	(0.028)	(0.029)	(0.028)	(0.029)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Credit access	0.075***	0.080***	0.077***	0.082***	0.079***	0.051***	0.054***	0.053***	0.055***	0.053***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.019)	(0.020)	(0.020)	(0.020)	(0.019)
High technological level	0.105***	0.105***	0.104***	0.105***	0.105***	0.090***	0.089***	0.088***	0.089***	0.090***
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.025)	(0.026)	(0.025)	(0.026)	(0.026)
Production cost-controlled	Base	–0.041**				Base	–0.040**			
		(0.019)					(0.019)			
Market-controlled	0.067***		0.073***			0.062***		0.066***		
	(0.021)		(0.020)			(0.021)		(0.020)		
Buyer-controlled	–0.0003			–0.017		0.023			0.008	
	(0.043)			(0.044)		(0.043)			(0.042)	
Governmental-controlled	–0.132***				–0.208***	–0.121***				–0.192***
	(0.034)				(0.065)	(0.033)				(0.062)
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.169	0.160	0.164	0.158	0.163	0.158	0.150	0.153	0.148	0.153
Observations	1,799	1,799	1,799	1,799	1,799	1,800	1,800	1,800	1,800	1,800

Note: Marginal effects are reported for Logit model; Robust standard errors in parentheses; $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.
Source: Authors' calculations.

face a significantly lower likelihood of sustaining exports — by 12.1–20.8%, depending on the specification and the type of shock. This provides support for Hypothesis 2, emphasizing the negative role of government price intervention in GVC resilience.

Our analysis reveals that GVC resilience is positively associated with larger firm size, the possession of international quality certifications, and firms that report higher technological production levels relative to foreign counterparts. These findings align with existing views that more competitive firms are better positioned to build resilient global value chains. Additionally, access to credit appears to enhance GVC resilience, likely due to greater liquidity reserves compared to other firms under equal conditions. Finally, we find that state ownership in a firm's equity structure negatively affects GVC resilience, corroborating Hypothesis 2 that government interference in pricing adversely impacts resilience.

Table 3 presents the econometric testing results for Hypotheses 3 and 4, which focus on the role of export structure in GVC resilience. Columns 1–2 provide results for the COVID-19 shock in 2020, while Columns 3–4 pertain to the 2022 sanctions shock. The results indicate that the number of export markets positively influences GVC resilience. Specifically, an increase of one export market (country or region) raises the probability of maintaining exports during shocks

Table 3
The role of GVC participation characteristics for export resilience (logit).

Variable	GVC resilience during COVID-19		GVC resilience during sanctions	
	1	2	3	4
Age	0.009	0.024*	0.008	0.022
	(0.011)	(0.013)	(0.011)	(0.013)
Size	0.017***	0.052***	0.022***	0.053***
	(0.006)	(0.008)	(0.007)	(0.008)
Certificates of quality	–0.034	0.107***	–0.027	0.101***
	(0.026)	(0.026)	(0.026)	(0.025)
Foreign owned	0.057	0.096	0.041	0.082
	(0.046)	(0.060)	(0.047)	(0.060)
State owned	–0.110	–0.270***	–0.104	–0.234**
	(0.145)	(0.104)	(0.139)	(0.113)
Part of holding	–0.008	–0.021	0.009	–0.005
	(0.023)	(0.029)	(0.024)	(0.028)
Credit access	0.035**	0.081***	0.017	0.054***
	(0.015)	(0.020)	(0.016)	(0.020)
High technological level	0.017	0.102***	0.007	0.086***
	(0.023)	(0.026)	(0.024)	(0.026)
Geographic export diversification	0.227***	0.245***	0.199***	0.218***
	(0.016)	(0.015)	(0.015)	(0.015)
Single product	–0.048**	–0.058*	–0.045**	–0.056*
	(0.021)	(0.032)	(0.021)	(0.032)
Backward linkages	0.078***		0.091***	
	(0.017)		(0.018)	
Regional FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Pseudo R^2	0.430	0.160	0.390	0.150
Observations	1,811	1,811	1,812	1,812

Note: Marginal effects are reported for Logit model; Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: Authors' calculations.

by 19.9–24.5%, depending on the specification. This confirms Hypothesis 3. Moreover, single-product firms are less likely to exhibit GVC resilience under similar conditions, with their probability of maintaining exports being 4.5–5.8% lower during shocks. This finding supports Hypothesis 4.

5. Discussion and conclusion

Until recently, the prevailing concept in the development of GVCs centered on maximizing efficiency and minimizing costs as the cornerstone of competitiveness. However, the COVID-19 pandemic prompted a paradigm shift, underscoring the critical importance of flexibility and adaptability for companies and entire supply chains.

Today, several factors are amplifying risks and reducing predictability in the global economy. These include growing regionalization, escalating trade wars, and the proliferation of sanctions. In this context, evaluating the factors that enhance the resilience of firms within GVCs to external shocks has gained particular importance.

Export resilience is influenced by both price and non-price factors that shape a firm's competitiveness. Non-price factors, such as product quality, technological sophistication, and brand reputation, have a positive impact on the continuation of exports during external shocks. Our findings reveal that Russian firms with advanced production technologies and international quality certifications were more likely to maintain exports during both the 2020 COVID-19 pandemic and the 2022 sanctions period. This aligns with the broader literature on the role of technological capabilities and quality standards in enhancing firms' export performance and resilience to external shocks (see, for instance, Pereira et al., 2022; Regis, 2018).

During crises, when operational conditions are disrupted and costs often rise, access to financing becomes a crucial factor in sustaining competitiveness (Gopalan and Reddy, 2023). Importantly, it is not only the availability of credit during crises that matters, but also whether the firm's business model has historically relied on external financing, which enhances its financial flexibility.

Another key determinant of export resilience is the extent of a firm's integration into GVCs. External shocks often disrupt traditional GVCs, prompting their restructuring and necessitating changes to operational models. Consequently, the adaptability of a firm's GVC participation becomes vital. It is crucial to differentiate between the resilience of individual firms within GVCs and the resilience of the chains themselves. Firm-level resilience hinges on flexibility and adaptability, which can coexist with dynamic and rapidly evolving chain structures, including the emergence and dissolution of their links.

Our analysis of Russian firms from 2019 to 2022 demonstrates that GVC resilience is significantly enhanced by flexible positioning in two areas: pricing decisions and diversification of export destinations, product categories, and subcontracting networks.

Under stable conditions, specialized pricing mechanisms, such as transfer pricing, demonstrate effectiveness within GVCs (Vidal and Goetschalckx, 2001). However, during crises, market-controlled pricing proves more adaptable, as it minimizes disruptions and improves the likelihood of sustaining exports. The results of our study on GVC resilience complement other recent research,

which indicates that flexible pricing mechanisms assist firms in adapting to external shocks (Hofer et al., 2019; Gupta, 2023). Conversely, attempts to pass on rising costs through the chain or reliance on government-imposed price controls diminish export resilience. While government interventions in pricing during crises may aim to mitigate negative impacts on the national economy, such measures often exacerbate imbalances at the firm level, particularly during structural crises caused by external shocks.

Flexibility in export control also provides a significant advantage. Firms that diversify geographicly and across product lines are better equipped to redirect exports when specific markets or links in the chain are disrupted. Multiproduct firms, in particular, enjoy greater adaptability, enabling them to adjust subcontracting chains and leverage alternative markets or products. Additionally, firms engaged in backward GVC activities, which utilize imports in the production of exported goods, demonstrate higher resilience despite challenges in securing inputs. Our study demonstrates that product and geographic diversification contribute to GVC resilience, aligning with research on firm resilience. Prior studies highlight the positive role of export diversification in enhancing firm performance (Boehe and Jiménez, 2016; Choksy et al., 2022) and resilience to external shocks (Wagner, 2014; Xuefeng and Yaşar, 2016; Oliveira et al., 2024).

5.1. Practical implications

Based on the findings, three key practical implications for companies can be drawn. First, during times of crisis, flexibility and adaptability are paramount to a company's resilience. These traits are rooted in the diversity of a firm's involvement in GVCs, which encompasses multiple directions and formats. Abandoning the pursuit of participation in global chains can significantly jeopardize a company's long-term strategic competitiveness. To enhance resilience during crises, firms should invest in diversification within their GVCs. This includes establishing multi-directional trade routes, expanding supplier and customer networks across regions, and adopting flexible production methods that allow for quick shifts in operations.

Second, while the ability of states to influence the export competitiveness of national companies has diminished in the context of the global economy, many governments — especially in the face of external shocks — are likely to intervene in both pricing and the structure of GVCs. Therefore, companies should be adaptable not only to external constraints but also to potential rigidities in government interventions in pricing mechanisms, trade policies, and regulatory requirements, particularly during periods of economic or geopolitical instability. Practical steps include developing compliance frameworks, fostering dialogue with regulatory authorities, and participating in policy-shaping forums to align business strategies with anticipated government actions.

Third, greater flexibility in global value chains often leads to increased costs. Consequently, it is critical for companies to understand the limits of this trade-off — where the additional costs associated with flexibility and adaptability do not reach a level that undermines overall efficiency. To mitigate these expenses, companies should conduct cost-benefit analyses to identify an optimal level of flexibility that preserves efficiency.

5.2. Limitations and future research

We acknowledge that our research has certain limitations, which could serve as opportunities for future studies on the resilience of GVCs during external shocks. First, our data ends in 2022, which provides insights into export continuity among companies only during the first year following the sanctions shock. It is possible that the impact of sanctions may have been delayed for some companies, as the measures were implemented gradually. Second, our study focuses on GVC resilience through the extensive margin, analyzing changes in the number of exporting firms. However, a more comprehensive assessment would include the intensive margin, which measures changes in the volume of exports.

Future research should extend the analysis of GVC resilience over the medium term, considering 2-, 3-, and 5-year time horizons. It could benefit from incorporating new datasets that account for prolonged and evolving impacts of the examined shocks, thereby offering a more nuanced understanding of their effects over time. These databases can provide quantitative data which facilitates more precise measurement of parameters related to management while addressing potential endogeneity issues and deepen management implications. Moreover, incorporating the intensive margin would offer a more complete picture of the factors affecting GVC resilience and the nuanced impact of external shocks on companies' participation in such chains. Despite certain limitations, we believe our study makes a valuable contribution to the literature on GVC resilience by expanding the thematic scope to include pricing and export diversification, while enabling a unique insight into how companies adjust their strategies over time by analyzing the impacts of two consecutive external shocks on the same sample of firms, which helps to understand how these firms respond to global value chains.

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