Decoupling, Quality Upgrading, and Geoeconomic Chokepoints*

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Abstract: Trade policy that improves efficiency can generate geoeconomic vulnerability. When trade liberalization induces quality upgrading, firms concentrate their supply networks around specialized suppliers while failing to internalize exposure to hegemonic chokepoints. We establish this mechanism empirically by exploiting a unique sequential setting: Kazakhstan's long-negotiated 2015 WTO accession, which created lower-tariff exceptions to the common external tariff of its economic union with Russia, followed by a major geoeconomic shock, Russia's 2022 invasion of Ukraine. Based on difference-in-differences (DiD) estimation, firms with greater exposure to input tariff reductions responded in 2016–2019 by sourcing higher-value inputs and thinning their supplier networks, leading to gains in sales and productivity. Following Russia's invasion, these same treated firms experienced disproportionate declines in sales and productivity in 2022–2023. These declines were driven by severed trade relationships rather than price or quantity adjustments. Based on contextual evidence, we interpret these results as reflecting hegemonic chokepoints: firms thinned networks toward Western suppliers while remaining dependent on Russian transit infrastructure, so Russia's invasion left limited outside options. Our results provide micro-level evidence for theorized national security externalities: quality upgrading through concentrated supply networks is privately rational but collectively fragile.

Keywords: global value chains, geoeconomics, economic decoupling, chokepoints

JEL codes: F13, F14, F15, F51, L13

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1. Introduction

Growing concerns about geoeconomic vulnerability raise a fundamental question for trade policy: whether liberalization that improves efficiency inadvertently generates such vulnerability through firm-level sourcing decisions. When input tariff liberalization enables firms to source higher-quality, more specialized inputs, it also induces them to concentrate their supply networks around a smaller number of specialized suppliers through relationship-specific investments that make supply relationships sticky (Antràs & Chor, 2022). But what maximizes private efficiency in stable times eliminates the redundancy needed to absorb a geopolitical shock: private firms fail to internalize aggregate geopolitical risks when making sourcing decisions, thereby exemplifying a national security externality (Clayton, Maggiori, & Schreger, 2026). When hegemonic powers weaponize their control over critical nodes in the global network leaving limited outside options (Clayton, Maggiori, & Schreger, 2024), the firms that have optimized their supply chains find themselves caught in a geoeconomic trap. The very policy intended to build resilience generates the vulnerability it was meant to prevent.

The escalating frequency of geopolitical shocks — from the 2018 U.S.–China trade war and the COVID-19 pandemic to Russia's 2022 invasion of Ukraine and the 2025 expansion of U.S. tariff bilateralism — has made understanding such supply chain vulnerabilities more urgent. Policymakers increasingly deploy trade policy to reconfigure global value chains and mitigate geoeconomic risk (WTO, 2023; Hanson, 2025; Mohr & Trebesch, 2025) and avoid coercion (Clayton, Maggiori, & Schreger, 2024). Yet firm-level evidence on whether these reconfigurations deliver resilience once geopolitical frictions bind remains limited.

Our paper provides firm-level evidence for this geoeconomic trap, tracing it from the policy intervention that reshaped sourcing patterns through to the shock that activated the resulting vulnerabilities. The mechanism is broadly relevant to emerging and transition economies. Quality upgrading that tightens trade dependencies is central to their GVC integration, and more such dependencies increase their exposure to competing hegemonic networks in a multipolar world.

Establishing this mechanism empirically requires a rare sequential structure: a policy intervention that reshapes firm sourcing patterns, followed by a geopolitical shock that activates the resulting vulnerabilities, observed at the firm level with sufficient data to trace the chain between them. Most settings either lack the clean policy variation, the subsequent shock, or the micro-level data needed. Kazakhstan provides all three. Its long-negotiated 2015 WTO accession created lower-tariff exceptions to the common external tariff of its economic union with Russia, providing a transparent and plausibly exogenous policy change that differentially affected manufacturing firms based on their pre-existing input structures. Russia's 2022 invasion of Ukraine then activated precisely the hegemonic chokepoints that firm-level optimization had left exposed. This sequential structure, combined with firm-level customs and balance sheet data, allows us to identify the mechanism with unusual clarity. We can assess whether a deliberate trade policy reconfiguration delivered geoeconomic resilience or deepened vulnerability.

To perform our difference-in-differences (DiD) analysis, we identify a treated group of manufacturing firms based on their exposure to industry-level input tariff reductions, following an approach similar to Handley et al. (2025). We link these industry exposures to firm-level balance sheet and customs data from

Kazakhstan's Bureau of National Statistics (BNS, 2025). The treatment assignment is plausibly exogenous to firm outcomes; initial tariff rates were driven by Russia's political economy within the EAEU, while the subsequent WTO reductions reflected a record-length negotiation process shaped by the political economy of Kazakhstan's global trading partners. Supporting this identification strategy, we observe no distinct pre-trends between treated and control firms across our primary outcome variables.

We first evaluate the responses of treated firms during the initial liberalization period (2016–2019). We find that input tariff liberalization induced significant private efficiency gains, characterized by a shift toward quality upgrading and a simultaneous thinning of sourcing networks. Specifically, treated firms realized higher sales and productivity alongside falling markups. These gains were driven by a transition to more sophisticated inputs, evidenced by rising unit values and falling weights. However, this move toward higher-quality inputs was accompanied by a reduction in the extensive margin of trade, as firms concentrated their procurement among a smaller number of specialized global suppliers, consistent with the GVC literature suggesting that quality upgrading often requires more concentrated supply relationships.

Our key results examine how these same treated firms responded to the 2022 invasion of Ukraine. While the 2015 policy successfully incentivized firms to reorient their sourcing toward global markets, this shift toward higher-quality inputs did not result in geoeconomic de-risking. Following the 2022 shock, treated firms experienced disproportionately larger declines in sales and productivity compared to the control group. This vulnerability was driven primarily by the severance of trade relationships, rather than marginal price or quantity

adjustments. The evidence suggests a sequential connection between the two phases of our analysis: the network restructuring induced by the WTO tariff policy generated structural fragility that the 2022 shock then exposed. The post-2022 relationship destruction was disproportionately concentrated among non-Russian suppliers, reflecting the activation of the Western supplier chokepoint that firms had concentrated their sourcing around, and its consequences were amplified by the broad-based network thinning that had already occurred in the post-WTO period.

To interpret our findings, we draw on contextual evidence and the conceptual framework of national security externalities and competing hegemonic chokepoints. Kazakhstan is highly reliant on Russia for physical transit; additionally, its long, open border with Russia makes it a strategic node for parallel imports and sanctions evasion. Consequently, increasing sourcing from the West did not diversify geoeconomic risk or improve resilience. Instead, it created exposure to two distinct hegemonic chokepoints: Russia's control over the transit corridor and the West's control over specialized inputs. While individual firms optimized for private efficiency between 2016–2019 by quality upgrading through thin networks, they did not internalize the resulting systemic risk. In 2022, the downside of this risk was realized when Russia's invasion led to the deepening of Western sanctions and heightened compliance fears among global suppliers, leaving firms with limited outside options.

Our study makes a substantial contribution to the literature on decoupling and supply chain risks. While this field has predominantly focused on macro-level costs in general equilibrium models or U.S.-specific disruptions, Mohr and Trebesch (2025, p. 573) emphasize that rich microdata is the necessary next step to

"better understand the role of geopolitical risk shocks in global trade." We answer this call by combining a distinct trade policy change, a subsequent geopolitical shock, and firm-level customs data. This sequential empirical design allows us to trace how private optimization of firms creates systemic vulnerability.

We advance the extensive literature on input trade liberalization and firm performance (Amiti & Konings, 2007; Kashara & Rodrigue, 2008; Verhoogen, 2008; Khandelwal, 2010; Amiti & Khandelwal, 2013; Halpern et al., 2015). While previous studies document that lower input tariffs allow firms to source higher-quality inputs and increase productivity, we highlight an underappreciated structural consequence: the simultaneous thinning of sourcing networks. By documenting the shift toward highly concentrated, specialized suppliers, we reveal how the very mechanisms that generate private efficiency gains during stable periods create latent, structural fragility. This finding speaks directly to ongoing policy debates about supply chain resilience in emerging and transition economies, where quality upgrading through GVC integration is both a development strategy and a potential source of geoeconomic exposure.

We also contribute to the emerging geoeconomics literature on national security externalities and hegemonic chokepoints (Clayton, Maggiori, & Schreger, 2024, 2026). Our setting uniquely demonstrates how private firm optimization can actively neutralize a state's attempt to build geopolitical outside options. By observing both the firm-level upgrading that creates the national security externality and the subsequent suffering of those same firms when the chokepoints are activated, we provide micro-level evidence for these concepts. The post-2022 relationship destruction being disproportionately concentrated among non-Russian suppliers, the same margin where post-WTO upgrading was

most pronounced, suggests a sequential transmission from policy-induced network restructuring to geopolitical shock exposure. This documents how multipolar chokepoint exposure intensifies the geoeconomic trap at the firm level.

The paper proceeds as follows. Section 2 presents the conceptual framework. Section 3 presents contextual background relevant for identification. Section 4 presents data, measures, and descriptive analysis. Section 5 presents main results from our DiD analyses. Section 6 concludes.

2. Conceptual Framework

This section develops the conceptual foundations for analyzing firm responses to input tariff policy and subsequent geopolitical supply shocks. We link three bodies of literature to organize our empirical analysis: (1) the effects of input trade liberalization on firm-level quality upgrading, relationship-specific investments, and network thinning; (2) the divergence between private optimization and systemic risk through the lens of national security externalities; and (3) the mechanisms of hegemonic coercion and chokepoints during a severe geopolitical shock. Together, these three steps constitute the geoeconomic trap we document empirically.

2.1 Input Trade Liberalization, Quality Upgrading, and Network Thinning

The consensus in the international trade literature holds that reducing tariffs on imported intermediate inputs is a powerful mechanism for enhancing firm-level economic performance. Studies exploiting large-scale trade reforms have established a causal link demonstrating that access to cheaper foreign intermediates often yields a larger positive impact on firm productivity than the

pro-competitive forces resulting from lower tariffs on final goods (Amiti & Konings, 2007; Topalova & Khandelwal, 2011).

In our context, the critical channel for this productivity gain is quality upgrading. Lower input tariffs enable firms to shift their sourcing toward superior, technologically advanced inputs that were previously cost-prohibitive. By integrating frontier-quality foreign intermediates into their production processes, firms can shift their production functions outward, improve the quality of their own output, and increase their competitiveness in both domestic and export markets (Amiti & Khandelwal, 2013; Bas & Strauss-Kahn, 2015).

However, the pursuit of quality upgrading introduces a structural consequence: network thinning. Highly specialized, frontier-technology inputs — such as precision machinery, advanced electronics, or proprietary chemical precursors — are typically produced by a highly concentrated set of global suppliers. Consequently, as firms optimize for quality and cost efficiency following a tariff reduction, they naturally shed redundant, lower-quality suppliers in favor of a narrower set of specialized, high-value nodes.

Crucially, this resulting network rigidity is the rational outcome of firm optimization within global value chains. As emphasized by Antràs and Chor (2022), sourcing customized, frontier-quality inputs cannot be managed through frictionless spot markets. Instead, it requires significant relationship-specific investments — such as tailored tooling, joint R&D, and customized production protocols. To justify these sunk costs and overcome the frictions of incomplete contracting, firms must deeply integrate with a few long-term suppliers. While this relationship-heavy architecture maximizes private efficiency in a stable environment, the massive switching costs inherently generate micro-level lock-in.

Rational quality upgrading thus erodes the network redundancy that constitutes a firm's outside option under stress.

2.2 National Security Externalities and Systemic Risk

Building on the micro-foundations of firm-level optimization, the geoeconomic framework of Clayton, Maggiori, and Schreger (2026) explains how rational sourcing decisions aggregate into profound structural vulnerabilities. At the core of their model is a national security externality: private economic actors make production and sourcing choices that maximize their individual efficiency, but they fail to internalize how their collective reliance on foreign networks exposes their home government to hegemonic coercion.

When a state pursues import tariff liberalization, the nominal geopolitical goal is often to integrate the economy into global markets and build a diversified set of outside options. However, the technological realities of quality upgrading naturally drive firms to make relationship-specific investments that concentrate and thin their supply networks. Because individual firms do not price in the geopolitical risk of relying on a narrow set of foreign nodes, their pursuit of private efficiency can actively neutralize a state's macro-level diversification objectives. This is precisely the dynamic our empirical setting is designed to evaluate.

Consequently, a liberalizing economy may not inherently become more resilient. Instead, it risks collective lock-in to a specialized, inflexible architecture. While a single firm's reliance on a highly specialized foreign input or an external transit corridor is geopolitically negligible, the aggregate reliance of the manufacturing sector transforms these nodes into systemic vulnerabilities. A state's capacity to

resist geopolitical pressure — its outside option — is severely diminished because its private sector becomes deeply inelastic to supply disruptions.

2.3 Hegemonic Chokepoints and Geoeconomic Shocks

The latent systemic vulnerability generated by firm-level optimization is fully realized only in the presence of a geopolitical shock. To model the transmission of such a shock, we rely on the geoeconomic framework of Clayton, Maggiori, and Schreger (2024), which conceptualizes the global economy as a network where central nodes — such as specialized technology, financial infrastructure, or critical transit corridors — are controlled by hegemonic powers. In a stable environment, access to these hegemonic networks is relatively frictionless, allowing firms to optimize their supply chains globally. However, during a geopolitical conflict, a hegemon can weaponize its structural centrality, transforming these critical nodes into geoeconomic chokepoints.

A severe geopolitical shock acts as a catalyst that activates these chokepoints. The shock alters the terms of network access, typically through the imposition of sanctions, export controls, or heightened compliance risks. The hegemon exercises coercion by threatening to sever a firm's or a state's access to its network unless geopolitical alignment or compliance is achieved. The effectiveness of this coercion depends entirely on the availability of viable outside options.

However, the capacity to exercise these outside options is severely constrained by the micro-foundations of global value chains. Because firms previously engaged in network thinning and committed to relationship-specific investments to achieve quality upgrading, their short-run elasticity of substitution is near zero. They cannot frictionlessly pivot to alternative, lower-quality suppliers on the spot

market. Consequently, when a shock activates a hegemonic chokepoint, these firms find themselves with limited outside options. The pursuit of private efficiency has stripped them of the redundancy necessary to weather the disruption.

Our setting illustrates a further dimension of this mechanism: exposure to competing hegemonic chokepoints simultaneously. In a multipolar conflict, firms may find their supply chains traversing competing hegemonic networks, exposing them to simultaneous, distinct chokepoints. Kazakhstan's firms, having shifted sourcing toward Western suppliers through the WTO tariff mechanism, found themselves dependent on two distinct hegemonic nodes at once — Russia's control over the physical transit corridor and the West's control over specialized inputs. When Russia's 2022 invasion triggered deep Western sanctions and heightened compliance fears among global suppliers, both chokepoints were activated together. Firms that had optimized efficiently under stable conditions were left with limited outside options to absorb either disruption. This multipolar chokepoint exposure is a specific application of the hegemonic coercion framework that our empirical setting allows us to document at the firm level.

3. Background

This section details Kazakhstan’s trade policy, macroeconomic landscape, and geopolitical context to provide the necessary foundation for our analysis. First, we outline the trade policy shifts surrounding Kazakhstan's WTO accession, which are essential for defining our research design and addressing potential threats to identification. Second, we review the macroeconomic environment to establish a suitable time frame for the analysis—one that isolates the effects of trade policy from unrelated economic shocks. Finally, we describe the geopolitical context,

which is critical for applying the geoeconomic frameworks used to interpret our findings. Together, these elements characterize the specific environment in which we study firm-level optimization and systemic geoeconomic risk.

3.1 Trade Policy and Identification

Kazakhstan's unique policy structure, defined by a decade of geopolitical balancing, provides a key source of identifying variation for evaluating the effectiveness of trade policy. This structure is characterized by a discriminatory, dual-tariff regime established between its regional Customs Union obligations and its multilateral commitments to the WTO.

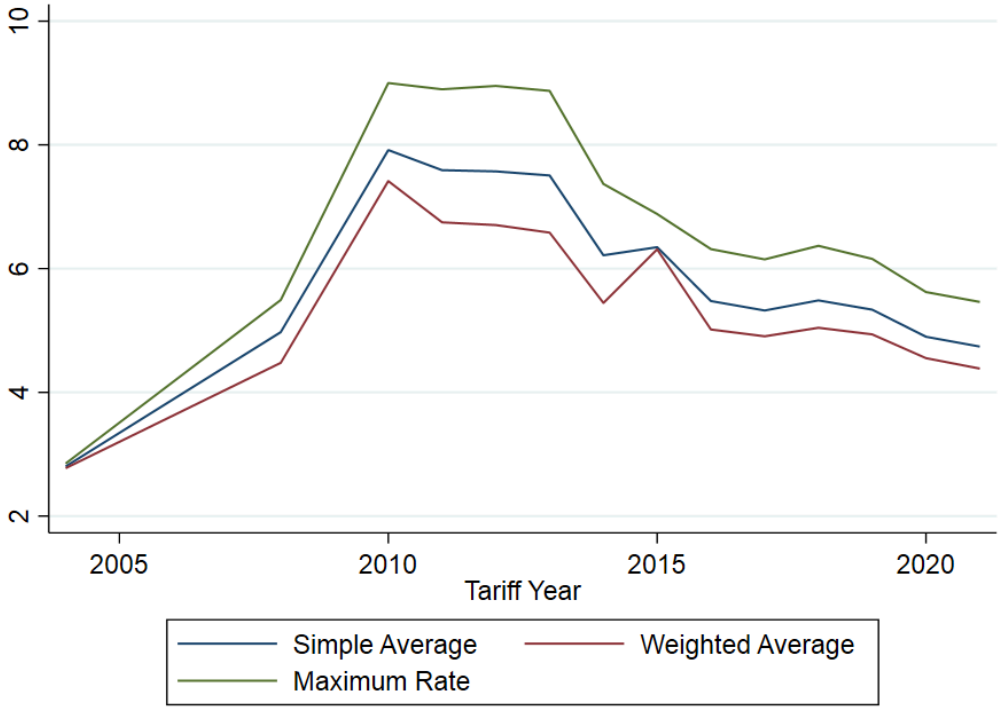
The Dual-Tariff Mechanism. In 2010, Kazakhstan, along with Russia and Belarus, formed the Eurasian Customs Union, which entailed adopting a Common External Tariff (CET). This adoption represented an initial increase in policy friction; Kazakhstan's average applied tariff rate more than doubled between 2005 and 2010, to align with the CET (World Bank, 2012; Carniero, 2013). The union, which expanded to include Armenia and Kyrgyzstan in 2015, has been known as the Eurasian Economic Union (EAEU) since then.

The next critical policy intervention occurred with Kazakhstan's 2015 accession to the WTO, a record-long accession process. Due to the complexities arising from its existing customs union membership, Kazakhstan secured specific exceptions that allowed its multilateral MFN tariff rates for certain goods to be set below the common external tariff of the EAEU (WTO, 2015).

This wedge—where the MFN tariff rate was lower than the CET—created a clear, non-prohibitive economic incentive. For firms in the affected industries, it lowered the cost of sourcing inputs from non-EAEU partners (the Rest of the

World, or RoW), thereby offering a pathway to diversify input supply chains away from the high-tariff, high-risk Russian source. The frustration it generated among its Eurasian Customs Union partners, like Belarus, confirms the economic significance of the commitments (Tengrinews, 2015). Figure 1 shows the evolution in applied tariffs in Kazakhstan between 2004 and 2021, indicating the significant rise up to 2010 and the overall fall thereafter. Declines may include fall in the CET as well as Kazakhstan's WTO exceptions.

Figure 1. Applied tariffs in Kazakhstan (2004-2021), %



Source: Authors' calculations based on the WITS UN Trains applied tariff data.

Plausible Exogeneity of Treatment Assignment. For empirical identification, the assignment of larger tariff cuts to the treated manufacturing sectors must be plausibly exogenous to the internal economic dynamics of those firms, particularly their future responses to geopolitical shocks. The literature on trade

policy often utilizes WTO accession commitments as sources of exogenous tariff variation, drawing parallels to large, externally imposed trade reforms (Topalova & Khandelwal, 2011; Handley & Limão, 2017).

Two key features that reinforce the exogeneity of the treatment assignment. The first is the dominance of Russian political economy. The initial high tariff rates (the CET) and the subsequent constraints on Kazakhstan's WTO schedule were driven largely by the political economy interests of its dominant trade partner, Russia. The determination of sensitive goods lists and exemptions from the CET required consensus within the Customs Union framework, meaning the final CET structure reflected Russia's political and economic priorities rather than Kazakhstan's domestic manufacturing needs.

The second key feature is the protracted, external negotiation process. Kazakhstan's accession process was record-long and structurally complex, requiring its final tariff offers to incorporate the established political-economic concerns of its trading partners. This lengthy, external negotiation process created a separation: the magnitude of the input tariff reduction in any given sector was a function of complex international bargaining and regional political compromises, not a targeted industrial policy designed to reward or anticipate the future performance of specific Kazakh firms.

Therefore, the sectors that received the largest tariff cuts were determined by institutional and geopolitical factors external to the firms' microeconomic outcomes, lending strong credence to the argument that the treatment assignment is plausibly uncorrelated with the unobserved firm-level characteristics that might drive the outcomes studied here.

3.2 Macroeconomic context and period selection

The empirical analysis must be structured around periods of relative macroeconomic stability to isolate the causal impact of the input tariff policy and the subsequent geopolitical shock, mitigating confounding effects from systemic domestic instability. We therefore delineate the analysis across three distinct phases that exclude periods marked by sharp, economy-wide domestic shocks.

The year 2015 is omitted from the analysis because it represented a substantial, non-policy-related domestic shock to the Kazakh economy. In August 2015, the government unexpectedly abandoned its long-standing managed exchange rate regime, allowing the national currency, the tenge, to float freely (IMF, 2023). This decision, driven by external pressures such as falling global crude oil prices and the sharp depreciation of the Russian ruble, led to a sudden and substantial currency devaluation of approximately 23–26% within two days. Such a massive and abrupt depreciation would induce severe volatility across all firms, regardless of their tariff exposure, contaminating the short-term estimates of the policy's effect on firm-level outcomes.

Similarly, the years 2020 and 2021 are excluded due to the macroeconomic fallout from the COVID-19 pandemic. The crisis resulted in a collapse of commodity prices, widespread domestic containment measures, and corresponding lockdowns, leading to a real GDP contraction of 2.8% in the first three quarters of 2020. Industries sensitive to movement restrictions, such as retail trade, transport, and hospitality, were strongly affected (Cusolito et al, 2025). These economy-wide, non-trade-policy-related disruptions make it impossible to cleanly identify the subtle behavioral shifts driven by the discriminatory tariff policy.

By excluding these volatile years, the analysis focuses on three distinct periods characterized by relative stability within each specific trade and geopolitical environment, enabling a clear difference-in-differences (DiD) comparison:

Pre-Policy Period (2012–2014). This phase establishes the baseline before the WTO accession was finalized and implemented. During this time, Kazakhstan maintained moderate, yet relatively stable, economic growth, though the pace had slowed compared to the pre-2008 global financial crisis era. The policy environment was dominated by the Eurasian Customs Union's Common External Tariff, providing a stable pre-treatment benchmark.

Post-Policy, Pre-Shock Period (2016–2019). This phase isolates the short-to-medium-term impact of the discriminatory input tariff liberalization in the absence of a major external shock. The economy continued to grow at a moderate pace, supported by domestic demand. This period allows for the clean identification of the policy's intended economic effects (increased productivity and sales) and any unintended shifts in sourcing patterns (e.g., increased Russian exposure).

Post-Geopolitical Shock Period (2022–2023). This phase captures the consequences of the 2022 Russia–Ukraine invasion, which presented an acute, exogenous geopolitical cost shock. By comparing the outcomes of treated firms (who optimized under the tariff policy) against control firms in this period, the study can assess whether the earlier policy success translated into actual geopolitical resilience, or conversely, amplified vulnerability.

3.3 Geopolitical and Geoeconomic Context

To bridge our theoretical framework with the empirical setting, it is necessary to establish Kazakhstan's structural position within the global trade network. As a landlocked economy positioned between major global powers, Kazakhstan's historical integration into GVCs was heavily predicated on Russian transport infrastructure and institutional alignment. This dynamic created two distinct channels of systemic vulnerability relevant for the national security externality: transit dependence and exposure to secondary sanctions.

Kazakhstan's Transit Dependence on Russia. Prior to the 2022 geopolitical shock, the pursuit of private economic efficiency naturally drove Kazakhstani exporters and importers to rely overwhelmingly on the *Northern Corridor*—established rail and pipeline networks traversing Russian territory, with St. Petersburg serving as the main port. Because these routes offered the lowest transit costs and fastest delivery times to Western markets, firms heavily concentrated their relationship-specific logistics investments along this single geographic axis.

The Trans-Caspian International Transport Route, commonly known as the *Middle Corridor*, is a potential outside option for Kazakhstan, but it was relatively underdeveloped prior to 2022. The Middle Corridor is a highly complex multimodal route—requiring transit across the Caspian Sea to the Caucasus—that is constrained by infrastructural bottlenecks and historically higher costs compared to the Northern Corridor (World Bank, 2023). Prior to 2022, firms in Kazakhstan primarily relied on the Northern Corridor and faced high adjustment costs to utilizing the Middle Corridor. The case of the world's leading uranium exporter, KazAtomProm, exhibits precisely this regularity (DeRemer et al., 2025).

Institutional Proximity and Sanctions Evasion. The second channel of vulnerability stems from Kazakhstan's deep institutional and economic integration with Russia, most notably through the EAEU. While this proximity drastically lowered trade frictions prior to the shock, it subsequently transformed the region's trade architecture into a liability.

Recent literature highlights how this integration complicates the geoeconomic landscape for neighboring states. Research documents the emergence of the *Eurasian Roundabout* (Javorcik et al., 2025), a phenomenon of intermediated trade where goods subjected to Western export controls are re-routed into Russia through Central Asian and Caucasian economies. This dynamic demonstrates that the legacy of pre-shock economic integration creates profound structural stickiness. For Kazakhstan, this proximity creates a dual geoeconomic threat. Not only do domestic firms face the physical disruption of their traditional transit routes, but their shared customs space with the Russian market suddenly exposes them to the severe risk of secondary sanctions and heightened compliance costs from Western regulators.

4. Data and import tariff exposure measures

This section details the DID estimation for the effects of Kazakhstan's 2015 accession to the WTO on firm-level outcomes in the manufacturing sector. As discussed, Kazakhstan's accession to the WTO entailed sizeable reductions in applied import tariffs on non-EAEU partners, reducing the cost of imported intermediate inputs. These tariff cuts lowered the cost of imported intermediate inputs. Because manufacturing industries differed in the types of inputs they used prior to accession, they were differentially affected by these tariff reductions. We exploit this pre-existing heterogeneity to identify the impact of WTO-related input

liberalization. Consequently, we also employ this exposure measure to study firms' resilience during the 2022 war shock.

4.1. Data sources

Our analysis combines administrative firm-level data with publicly available product-level trade and tariff data.

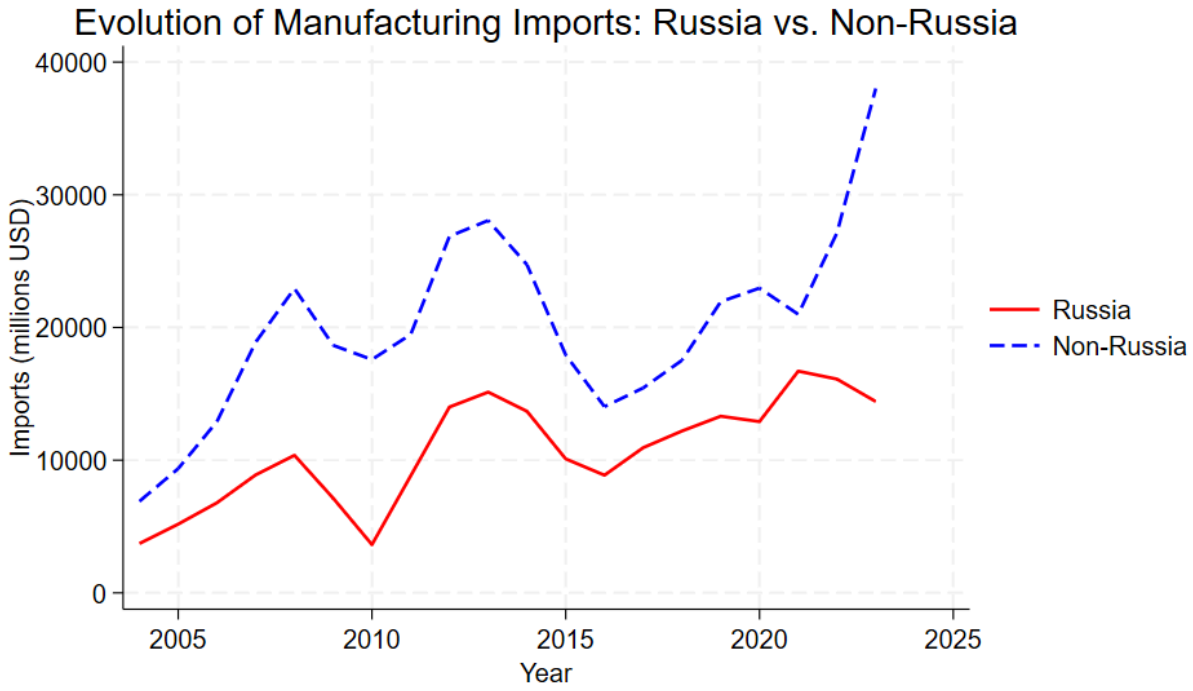
Customs data. We use annual product-level import data from the State Revenue Committee of the Ministry of Finance of Kazakhstan. These data cover Kazakhstan's imports from all trading partners from 2010 to 2023 at the product code (six-digit HS code) level and report annual import values in USD. We employ two alternative pre-accession input structures to construct tariff exposure: (i) the global import shares observed in 2010, and (ii) the average import shares over 2012–2013. Using both baselines enables a robustness check that our exposure measure is not driven by a specific pre-WTO reference year.

We restrict the analysis to manufacturing industries (NACE Rev.2 2-digit 10–33), which account for the bulk of goods imports and are the primary users of imported intermediate inputs, making them the most relevant sector for studying tariff exposure and supply-chain adjustments. Figure 2 provides us with a descriptive picture of the evolution of Kazakhstan's manufacturing imports from Russia and non-Russia partners over 2012–2023. The data pattern is consistent with our prior discussion of relevant theory and the institutional background. Kazakhstan's sourcing of inputs from the rest-of-world declined in the early 2010s as it raised its tariff to Russian levels, and it was further negatively impacted by the 2015 devaluation. Following WTO accession in 2015, imports from the

rest-of-world recovered substantially, with no marked contraction in imports from Russia.

Beginning in 2022, there is sharp divergence consistent with a negative cost shock to Russian imports, while imports from non-Russia partners increase substantially. The post-2022 divergence suggests a marked reorientation of Kazakhstan's sourcing patterns away from Russia and toward alternative suppliers in response to the Russia–Ukraine war and associated disruptions.

Figure 2. Evolution of manufacturing imports, 2012-2023



Tariff data. We merge these trade data with the applied tariff schedules from the World Integrated Trade Solution (WITS) database. The WITS tariff data are provided annually and contain Kazakhstan's applied MFN tariffs on imports from non-EAEU partners at the HS6 product-code level.[1] These tariff schedules allow us

[1] We observe tariffs starting from 2004, then 2008, 2009, 2010 as shown in Appendix Table A1. The absence of tariff data from 2005-2007 is common for trade policy studies of Kazakhstan.

to compute product-level tariff reductions associated with Kazakhstan's WTO accession commitments.

Concordance and Construction of Input Weights. Because tariffs and import values are reported at the HS6 product level, while firms and industries in our balance sheet data are classified under NACE Rev.2, we construct a detailed concordance between HS6 product codes and 4-digit NACE manufacturing industries. We map HS6 product codes to NACE Rev.2 industries using the official correspondence tables from Eurostat's RAMON Classification Database, harmonized to Kazakhstan's product and industry structure. This mapping enables us to aggregate product-level tariffs and import values into industry-level measures. The concordance serves two essential purposes. First, it enables us to assign HS6-level MFN tariff changes to the appropriate manufacturing industry. Second, and more importantly for the construction of our tariff exposure measure, it allows us to compute industry-specific input weights. Using import transactions, we aggregate all HS6 products imported by firms within each NACE industry and calculate the share of each HS6 product in the industry's total imported input bundle. These input-weight shares are then used to translate product-level tariff cuts into industry-level exposure, ensuring that the exposure measure reflects the actual pre-accession input usage patterns of each manufacturing industry.

Firm-level data. Finally, we merge our industry-level input tariff exposure measures with confidential administrative firm-level data obtained from the Bureau of National Statistics of Kazakhstan. These data are based on annual balance sheet reports submitted by medium and large enterprises. Reporting is mandatory for firms with more than 100 employees, and the dataset includes detailed information on firm sales, costs, employment, and other financial

indicators. The firm panel covers the period 2008–2023 and allows us to track the evolution of firm performance before and after Kazakhstan's WTO accession in 2015, as well as during the 2022 Russia–Ukraine war shock. Firms are linked to industries using their primary NACE classification, enabling us to assign each firm the corresponding (time-invariant) input tariff exposure of its 4-digit manufacturing industry.

4.2. Import tariff exposure measures

To quantify the differential impact of Kazakhstan's WTO accession on manufacturing industries, we construct industry-level measures of exposure to import tariff reductions. The key idea is that industries differed in the composition of imported inputs they used prior to accession, and therefore experienced different effective reductions in input costs when Kazakhstan lowered its MFN tariffs. Following the empirical tradition in Amiti and Konings (2007) and Handley et al. (2025), we exploit this pre-determined heterogeneity in input use to build an exogenous measure of tariff-cut exposure.

To construct industry-level input tariff exposure, we begin by recovering the pre-WTO input structure of each manufacturing industry using Kazakhstan's HS6-level import transactions for (i) 2010 and (ii) 2012–2013. For each NACE Rev.2 4-digit industry k, HS6 product p, and partner country c, we aggregate import values to obtain industry–product–country import flows. We then compute each flow's share in the industry's total imported input bundle:

$$w_{pc}^{k} = Imports_{pc}^{k} / \sum Imports_{p'c'}^{k} \qquad \text{(eq. 1)}$$

where p' reflects all HS6 products imported by industry k and c' reflects all countries that industry k imports from. So the denominator is simply total imports of industry k across all products and all partner countries. We sum w_{pc}^{k} across countries to obtain industry-product weights $w_{p}^{k} = \sum w_{pc}^{k}$, which reflect the importance of each HS6 product in the industry's imported input mix. These weights are predetermined, constructed entirely before Kazakhstan's 2015 WTO accession, and they sum to one within each industry. We combine these input weights with product-level MFN tariff shock applied to each HS6 product. Product-level tariff changes are computed as the difference between the average applied MFN tariff in the pre-accession period (the mean over 2012–2014) and the tariff applied in the accession year (2015):

$$\Delta\tau_{p} = \tau_{pre} - \tau_{post}. \qquad \text{(eq. 2)}$$

Positive values of $\Delta\tau_{p}$ therefore indicate larger tariff reductions following WTO accession. We merge these product-level tariff cuts with the pre-WTO industry input weights so that each industry's exposure reflects the tariff reductions applied to the specific HS6 inputs it historically relied upon. The resulting industry-level exposure measure is a weighted average of product-level changes:

$$Exposure_{k} = \sum_{p} w_{p}^{k} \Delta\tau_{p}, \qquad \text{(eq. 3)}$$

which provides a summary measure of how strongly industry k was affected by WTO-related import tariff liberalization. In addition to this continuous measure, we also construct a binary treatment indicator that classifies industries into

high-exposure and low-exposure groups based on whether their exposure value lies above or below the sample median.

Table 1 presents summary statistics, with means and standard deviations in parentheses, for the industry-level tariff exposure measures. The continuous measure $Exposure_k$ captures the weighted average tariff reduction faced by each industry based on its pre-WTO input structure; it ranges from –0.053 to 0.146, with a mean of 0.012, indicating substantial heterogeneity in the depth of tariff cuts across industries. The binary measure simply classifies industries as high- or low-exposure depending on whether their continuous exposure lies above the median, allowing us to compare results across discrete treatment groups as a robustness check.

Table 1. Summary statistics: tariff exposure measure

	Mean	SD	Min.	Max.
$Exposure_k$	0.012	0.028	-0.053	0.146
$Exposure_k$ binary	0.440	0.498	0	1

Notes: Industry-level tariff exposure is constructed using pre-accession input shares computed from 2012–2013 HS6 import data and product-level tariff changes defined as the difference between the average MFN tariff in 2012–2014 and the tariff applied in 2015. The binary exposure indicator equals one if industry exposure is above the sample median.

5. Empirical Analysis

5.1 Results for import tariff exposure after WTO accession

Our empirical analysis integrates the industry-level tariff exposure measures constructed from HS6 import and MFN tariff data with confidential firm-level balance sheet information for Kazakh manufacturing firms. This allows us to examine how reductions in input tariffs associated with Kazakhstan's 2015 WTO accession affected firm performance. We focus on three key outcomes: sales, labor productivity (sales per employee), and price–cost margins.

We use a generalized difference-in-differences (DiD) estimation strategy to assess whether firms operating in industries more exposed to tariff reductions experienced proportionally larger changes in sales, labor productivity, and price–cost margins after WTO accession. In our setting, this corresponds to comparing firm outcomes in the post-accession period (2016–2019) with those in the pre-accession period (2012–2014) as the first difference, while exploiting cross-industry variation in exposure to MFN tariff cuts as the second difference:

$$y_{ikt} = \gamma Exposure_k \times WTO_t + \alpha_i + \lambda_t + \varepsilon_{ikt}, \quad \text{(eq. 4)}$$

where y_{ikt} denotes firm outcomes for firm (i) in industry (k) and year (t). In our analysis, y_{ikt} corresponds to (i) the logarithm of firm sales, (ii) the logarithm of labor productivity (sales per employee), or (iii) the firm's price–cost margin ((sales−variable costs)/sales). The variable $Exposure_k$ is the continuous industry-level input tariff exposure measure, and WTO_t is an indicator equal to 1 in the post-WTO period (2016–2019) and 0 in the pre-WTO period (2012–2014). As discussed earlier, we exclude 2015 to avoid confounding effects from the large

exchange-rate devaluation that year. Lastly, α_i indicates firm fixed effects, λ_t year fixed effects, and ε_{ikt} the error term. The main benefit of the firm-level data is the ability to control for time-invariant firm characteristics. Since the source of variation is exposure at the 4-digit industry level, we cluster standard errors at this level. The coefficient of interest is γ, the average change in the effect of exposure before and after the increase in import tariffs.

Main outcomes: sales, productivity, and markups. In Table 2, we present the coefficient estimates from equation (4). Across all specifications, we find that firms operating in industries with greater exposure to input tariff reductions experienced systematically stronger improvements in performance after WTO accession. Columns (1)–(3) report results using the continuous exposure measure. The interaction coefficient on $Exposure_k \times WTO_t$ is positive and statistically significant for both sales and labor productivity, indicating that firms in more exposed industries expanded sales and became more productive relative to firms in less exposed industries between the pre- (2012–2014) and post-accession (2016–2019) periods.

Results are consistent with prior literature in finding positive effects on sales and productivity and the negative effect on markups. We also observe that price–cost margins (PCM) declined in more exposed industries, with the coefficient in Column (3) being negative and significant. This pattern is consistent with input cost reductions being passed through into lower markups, either through competitive pressures or through more efficient production. Columns (4)–(6) display results using the binary high- versus low-exposure classification. The qualitative patterns remain the same: high-exposure industries exhibit

significantly stronger gains in sales and productivity relative to low-exposure industries, while the effect on PCM is either negative or close to zero.

Table 2. Firm outcomes and import tariff exposure following the WTO accession

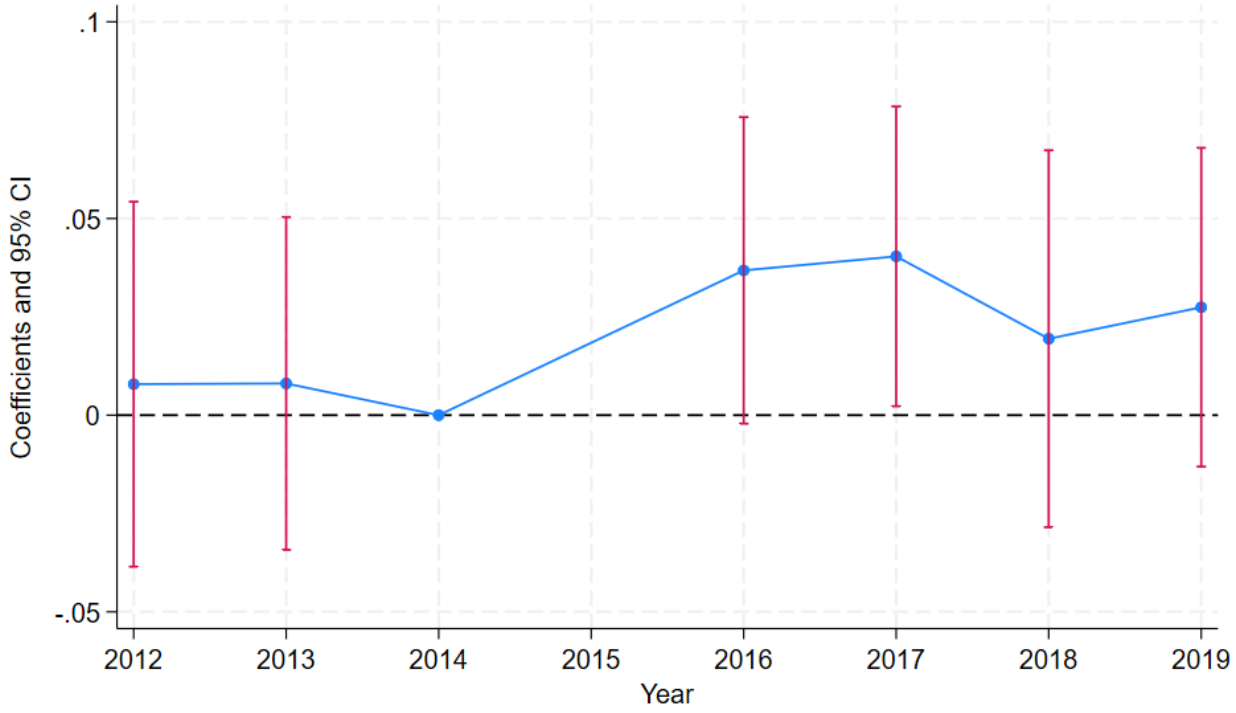
	Continuous Exposure			Binary Exposure		
	Sales	Productivity	PCM	Sales	Productivity	PCM
WTO_t=1 # $Exposure_k$	0.033**	0.029*	-0.019**	0.282***	0.244**	-0.009
	(0.014)	(0.016)	(0.009)	(0.099)	(0.107)	(0.062)
Firm f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.9592	0.8185	0.6558	0.9598	0.8215	0.6504
Observations	1991	1991	1991	1991	1991	1991

Notes: The unit of analysis is firm-years, run from 2012-2019, with the *WTO* indicator defined as 1 for 2016-2019 and 0 for the pre-treatment period of 2012-2014. Each Exposure measure in the table varies at the 4-digit Nace Rev.2 industry level. Standard errors are clustered by 4-digit industry. The reported R-squared includes the variation explained by fixed effects. The *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

The validity of DID depends on the assumption of parallel trends and no anticipation, so we must observe no pre-trends preceding the treatment. To evaluate pre-trends for a continuous treatment variable, we estimate a specification similar to eq. 4 for firm sales, except with the interaction estimated for every year, relative to a base year of 2014. Indeed, in Figure 3 we see no effect of the import tariff exposure for sales prior to 2014, and the estimated declines in

export growth are observable in each year from 2016-2019. Results are similar for the other measures.

Figure 3: Evaluation of pre-trends for firm sales



Mechanisms: quality upgrading and network thinning. Having established that tariff-exposed industries experienced significant gains in sales and productivity following Kazakhstan's WTO accession, we decompose the channels driving this performance. Consistent with our theoretical framework, we test whether these gains were driven by a mere expansion of import volumes or by a structural shift toward higher-quality, specialized inputs that altered the firms' sourcing architecture. Table 3 presents this decomposition, estimating exposure-differential changes across the extensive margin (number of trade relationships), unit values (a proxy for quality), physical weight, and total import value at the industry level.

Table 3. Quality upgrading following the WTO accession

Panel A: Results for non-Russian suppliers

	No. of Trade Relationships	Unit values	Weight	Total import value
WTO_t=1 # $Exposure_k$	-0.361**	0.030***	-0.040**	-0.011
	(0.161)	(0.011)	(0.017)	(0.017)
Industry f.e.	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
R-squared	0.9831	0.9426	0.9591	0.9421
Observations	910	762	762	762

Panel B: Results for all suppliers

	No. of Trade Relationships	Unit values	Weight	Total import value
WTO_t=1 # $Exposure_k$	-0.539**	0.011	-0.058*	-0.058
	(0.194)	(0.014)	(0.034)	(0.039)
Industry f.e.	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
R-squared	0.9806	0.9303	0.9527	0.9316
Observations	961	797	797	797

Notes: The unit of analysis is industry-years, run from 2012-2019, with the *WTO* indicator defined as 1 for 2016-2019 and 0 for the pre-treatment period of 2012-2014. Each Exposure measure in the table varies at the 4-digit Nace Rev.2 industry level. All regressions use the continuous measure of the exposure treatment. Standard errors are clustered by 4-digit industry. The reported R-squared includes the variation explained by fixed effects. The *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

The results for non-Russian suppliers indicate a clear compositional shift. Following the tariff reduction, firms did not simply expand their aggregate import volumes from these markets; instead, total non-Russian import value remained statistically unchanged. Rather than increasing spending, firms upgraded the quality of their inputs while consolidating their supply networks. This is evidenced by a significant increase in the unit values of imported inputs coupled with a significant decline in total physical weight. This pattern—importing lighter, more expensive inputs without increasing overall aggregate spending—is consistent with input upgrading. Crucially, this upgrading was accompanied by substantial network thinning, as the number of active trade relationships with non-Russian partners dropped significantly.

When extending the analysis to all suppliers in Panel B, the network thinning effect remains robust and statistically significant, confirming that tariff exposure led to an aggregate rationalization of sourcing networks. However, the effects on unit values and total import values lose statistical significance in the aggregate sample. This contrast indicates that while the shedding of redundant suppliers was a firm-wide optimization strategy, the intensive-margin quality upgrading was concentrated in non-Russian sourcing.

Altogether, the evidence points away from a simple intensive-margin expansion and strongly supports an extensive-margin network channel. Post-WTO, exposed industries exhibited thinner non-Russian sourcing networks and a compositional shift toward higher value-per-kg goods, consistent with deliberate supplier rationalization and input upgrading rather than expanded import volumes. As theorized in Section 2, this pattern aligns with rational firm-level optimization, where firms shed suppliers while shifting toward more specialized, high-quality

inputs and maximize private productivity. Under this framework, such a shift toward a rigid, more concentrated sourcing structure creates the theoretical conditions for a national security externality, as the aggregate loss of network redundancy may leave the state vulnerable to future disruptions. Whether this latent vulnerability was indeed realized, and how these thinned networks functioned when faced with a catastrophic external shock, is the subject of the empirical assessment in the following section.

5.2 Effects of import tariff exposure on resilience after Russia's 2022 invasion of Ukraine

This section examines whether firms operating in industries that experienced larger tariff reductions during Kazakhstan's 2015 WTO accession were better able to withstand the economic disruptions triggered by the 2022 Russia–Ukraine war.

We use the same continuous industry-level tariff exposure measure, derived from pre-WTO input structures, and combine it with firm-level balance sheet data to examine whether more exposed industries adjusted differently during the 2022 Russia–Ukraine war shock. Our empirical strategy again relies on a difference-in-differences framework, this time comparing firm outcomes in the pre-war period (2016–2019) with the immediate post-war period (2022–2023). We exclude 2020–2021 to avoid confounding effects from the COVID-19 pandemic and associated disruptions. The estimating equation mirrors the structure of Eq. (4):

$$y_{ikt} = \gamma Exposure_k \times WAR_t + \alpha_i + \lambda_t + \varepsilon_{ikt}, \qquad \text{(eq.5)}$$

where WAR_t now indicates the post-war years (2022-2023). All other components, including firm fixed effects, year fixed effects, and the interpretation of γ remain identical to Eq. (4). This specification allows us to assess whether firms operating

in industries with higher pre-WTO tariff exposure experienced systematically different changes in sales, labor productivity, or price–cost margins following the 2022 shock.

Main outcomes: sales, productivity, and markups. Table 4 reports the estimated effects of the 2022 Russia–Ukraine war shock on firm performance, interacted with continuous and binary measures of pre-WTO import tariff exposure. The results show a clear pattern across firm outcomes. Industries with higher pre-WTO tariff exposure experienced significantly larger declines in both sales and labor productivity following the 2022 Russia–Ukraine war shock. This pattern appears consistently across both the continuous and binary exposure measures. The estimates for price–cost margins are small and statistically insignificant, indicating no systematic change in markups during the same period, consistent with limited cost-shock pass through in imperfectly competitive industries (Amiti et al., 2019).

Table 4. Firm outcomes and import tariff exposure following the 2022 invasion

	Continuous Exposure			Binary Exposure		
	Sales	Productivity	PCM	Sales	Productivity	PCM
WAR_t=1 # $Exposure_k$	-0.027**	-0.020*	0.005	-0.215***	-0.231***	-0.161
	(0.012)	(0.010)	(0.009)	(0.072)	(0.077)	(0.132)
Firm f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes	Yes	Yes

R-squared	0.9537	0.8964	0.7850	0.9542	0.8984	0.7882
Observations	1999	1999	1999	1999	1999	1999

Notes: The unit of analysis is firm-years, run from 2016-2023, with WAR indicator defined as 1 for 2022-2023 and 0 defined for 2017-2019. Each Exposure measure in the table varies at the 4-digit Nace Rev.2 industry level. Standard errors are clustered by 4-digit industry. The reported R-squared includes the variation explained by fixed effects. The *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Our main results from Table 4 are then consistent with our preceding theoretical and empirical analysis, such that we can develop a coherent interpretation. Following the WTO accession, firms in Kazakhstan with lower tariff exposure increased sales, productivity, and inputs from the rest of the world, but they did not reduce their exposure to Russian imports. As a result, these firms experienced greater exposure to cost shocks due to the onset of the Russia-Ukraine war, reducing sales and productivity: the reduced tariffs to the rest-of-world did not allow Kazakhstan's economy to decouple or de-risk from Russia.

Mechanisms: destroying trade relationships. Having established that tariff-exposed firms experienced declines in sales and productivity following the 2022 shock, we now investigate the mechanisms of this disruption by examining the destruction of trade relationships and shifts in sourcing patterns. The evidence suggests a sequential connection between the two phases of our analysis: the network restructuring induced by the WTO tariff policy generated structural fragility that the 2022 shock then exposed.

Table 5. Destruction of trade relationships following Russia's invasion

Panel A: Results for non-Russian suppliers

	No. of Trade Relationships	Unit values	Weight	Total import value
WAR_t=1 # $Exposure_k$	-0.390**	0.002	0.006	0.009
	(0.158)	(0.017)	(0.019)	(0.020)
Industry f.e.	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
R-squared	0.9852	0.9563	0.9605	0.9451
Observations	525	440	440	440

Panel B: Results for all suppliers

	No. of Trade Relationships	Unit values	Weight	Total import value
WAR_t=1 # $Exposure_k$	-0.281**	0.013	0.017	0.018
	(0.158)	(0.026)	(0.021)	(0.023)
Industry f.e.	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
R-squared	0.9845	0.9302	0.9722	0.9789
Observations	544	453	453	453

Notes: The unit of analysis is industry-years, run from 2016-2023, with WAR indicator defined as 1 for 2022-2023 and 0 defined for 2017-2019. Each Exposure measure in the table varies at the 4-digit Nace Rev.2 industry level. All regressions use the continuous measure of the exposure treatment. Standard errors are clustered by 4-digit industry. The reported R-squared includes the variation explained by fixed effects. The *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

The results in Table 5 show a statistically significant decline in trade relationships for exposed firms following the invasion. This effect is most pronounced among non-Russian suppliers, where firms saw a sharp contraction in the number of active sourcing relationships. This is the hegemonic chokepoint mechanism in operation: the deepening of Western sanctions and heightened compliance fears among global suppliers severed precisely the specialized non-Russian relationships that firms had built and concentrated their sourcing around in the post-WTO period.

The broader context of post-WTO network restructuring amplifies the significance of this finding. The post-WTO period produced broad-based network thinning across both Russian and non-Russian suppliers, as documented in Table 3. Firms entering the 2022 shock therefore had little redundancy to absorb the disruption. The disproportionate concentration of post-2022 relationship destruction among non-Russian suppliers reflects the specific chokepoint activated by the invasion, but its consequences were made more severe by the overall network thinning that had occurred in the preceding years. Firms that had optimized for efficiency by building thin, specialized sourcing networks were left with no structural slack when those networks came under pressure.

The price dynamics across the two periods further support this interpretation. The post-2022 contraction represents an involuntary network destruction rather than a continuation of the deliberate consolidation observed after WTO accession. During the post-WTO period, unit values rose as firms shifted toward superior, more expensive inputs. Following the 2022 shock, unit values show no significant upward movement despite the disruption in volumes. Firms were not transitioning to higher-quality alternatives — they were losing existing supplier

relationships involuntarily. The absence of a unit value increase, combined with the collapse in the number of relationships, confirms that outside options such as the Middle Corridor were either too costly or too underdeveloped to mitigate the immediate impact of the shock.

In the aggregate sample (Table 5, Panel B), the destruction of trade relationships remains robust, confirming that the shock was systemic rather than isolated to specific geographic corridors. Together, Tables 3 and 5 establish a sequential transmission mechanism: WTO-induced network thinning created the structural conditions for vulnerability, and Russia's invasion activated the Western supplier chokepoint that firms had concentrated their sourcing around. The rigid, specialized sourcing structures that maximized efficiency during the 2010s became the channel through which the 2022 geopolitical shock propagated to firm-level outcomes.

5.3 *Robustness and alternative explanations*

A natural alternative explanation for our findings is that the observed performance dynamics were simply driven by a blunt, aggregate shift in trade volumes—specifically, a geographical reallocation of import spending toward or away from Russia. If tariff exposure merely caused industries to buy significantly more or less from Russia overall, the mechanism would be a standard intensive-margin trade substitution rather than the structural network lock-in we theorize.

To rule out this alternative, we test whether tariff exposure predicts a reallocation of aggregate import spending between Russia and non-Russia. Using DiD specifications for both the WTO and 2022 episodes, we examine changes in total

non-Russian import values, as well as the overall composition of Russian and non-Russian import shares.

As shown in Appendix Table 2a, the evidence for intensive-margin reallocation in the post-WTO period is highly limited. While point estimates suggest a modest decline in non-Russian import values and a small shift in composition toward Russia, these effects lack uniform statistical precision and are highly sensitive across different definitions of exposure. More importantly, Appendix Table 2b demonstrates that following the 2022 shock, we find no robust exposure-differential changes in either total non-Russian import values or overall import shares. Across both distinct episodes, the results do not indicate a large, stable reorientation of aggregate import spending between Russia and the rest of the world.

The lack of robust exposure-differential changes in aggregate import volumes and shares is informative for our theoretical framework. It is consistent with the performance fluctuations we observe—the productivity gains post-WTO and the severe losses post-2022—were not driven by a simple intensive-margin expansion or contraction of overall trade with Russia. Instead, it points to the extensive-margin network channel. Firms were exposed to the 2022 geopolitical shock not because they shifted all their aggregate spending to Russia, but because their earlier pursuit of efficiency led to the structural thinning and concentration of their specialized supply chains. It was this shift toward an inflexible, more concentrated sourcing structure—rather than a change in total import volumes—that created the latent vulnerabilities activated by the conflict.

6. Conclusion

Kazakhstan's 2015 WTO accession and Russia's 2022 invasion of Ukraine offer a rare sequential opportunity to examine whether trade policy that improves efficiency can inadvertently generate geoeconomic vulnerability. We find that it can. The state's effort to integrate globally via import tariff reductions during its WTO accession successfully spurred private economic gains. Productivity improvements were driven by firms upgrading inputs and consolidating supplier relationships, consistent with more relationship-specific sourcing. While this network thinning maximized efficiency and competitiveness during a period of geopolitical stability, it reduced redundancy in supplier relationships, limiting the ability to absorb shocks.

When the 2022 invasion of Ukraine disrupted regional trade corridors, the latent fragility of this optimized network became apparent. Treated firms suffered larger contractions in supplier breadth and productivity post-2022, and were incapable of smoothly pivoting to alternative routes like the Middle Corridor. The post-2022 relationship destruction was disproportionately concentrated among non-Russian suppliers, reflecting the activation of the Western supplier chokepoint that firms had concentrated their sourcing around, and its consequences were amplified by the broad-based network thinning of the post-WTO period. Drawing on contextual evidence, we interpret this trajectory through the hegemonic chokepoint framework: by shifting sourcing toward Western suppliers while remaining dependent on Russian transit infrastructure, firms had left themselves with limited outside options when Russia's invasion exposed both simultaneously. This provides micro-level evidence consistent with the national security externality theorized in geoeconomic theory. Rational private actors optimized for private

efficiency but failed to internalize the geopolitical tail risks of concentrating their supply chains around nodes vulnerable to weaponization.

The mechanism we document reflects a broader structural tension that any emerging or transition economy faces when integrating into global value chains in a multipolar world. Quality upgrading through GVC integration is a well-established development strategy, but it generates network concentration as a byproduct. As geopolitical fragmentation intensifies through expanding export controls, investment screening, and weaponized financial infrastructure (Farrell & Newman, 2023; Mohr & Trebesch, 2025), the nodes around which firms have concentrated their supply chains are increasingly liable to become chokepoints. The traditional metrics of trade liberalization success, productivity gains, quality upgrading, and export competitiveness, may therefore need to be complemented by assessments of geoeconomic exposure that conventional trade indicators do not capture.

These findings speak directly to the growing policy effort to build supply chain resilience through trade policy. Among major economies, this effort is most developed and consequential in Europe, where the strategic autonomy agenda has prompted reshoring, friend-shoring, and supply chain diversification across critical sectors (Aiyar et al., 2023). Our results establish that firm-level optimization can neutralize a state's attempt to build geopolitical outside options, generating a market failure that policy must address. However, the appropriate policy response is not straightforward. The economics literature cautions that private incentives for resilience may fall short of social benefits without government intervention, but that the design of such intervention is far from obvious, because diversification mandates and reshoring requirements carry real

costs and may simply relocate rather than eliminate chokepoint exposure (Grossman, Helpman, & Lhuillier, 2021). The supply chain management literature reinforces this caution, arguing that static redundancy is often an inferior strategy to flexibility and dynamic capabilities, and that increasing the number of backup suppliers can paradoxically weaken resilience by diluting the relationship-specific investments that make supply chains function (Thakur-Weigold & Miroudot, 2024). Our findings establish the nature and origin of the market failure more clearly than they resolve the policy design question. What they do suggest is that policies focused purely on sourcing geography — friend-shoring, reshoring, diversification mandates — may be insufficient if they do not also address the firm-level incentives that drive network concentration in the first place.

For developing and transition economies on the periphery of major power blocs, the policy implications are more acute. These economies face the greatest exposure to competing hegemonic networks while having the least capacity to maintain redundant outside options. Kazakhstan's experience suggests that conventional trade liberalization, even when explicitly designed to build geopolitical outside options, can be neutralized by firm-level optimization if not accompanied by investment in the infrastructure that makes outside options viable. Developing alternative transit corridors, such as the Middle Corridor that Kazakhstan has pursued more aggressively since 2022 (World Bank, 2023), may be a more tractable complement to tariff liberalization than attempting to mandate sourcing diversification directly, since infrastructure investment changes the cost structure that firms face rather than requiring them to sacrifice efficiency.

Our results answer calls for micro-level evidence to inform resilience policy by confirming a distinct and underappreciated market failure: the national security externality that arises when private firms optimize sourcing decisions without internalizing their collective geopolitical consequences. Whether the appropriate policy response emphasizes flexibility, dynamic capabilities, infrastructure investment, or some combination thereof remains an open and important question. What our results establish is that the market failure is real, that it operates through the specific mechanism of quality upgrading and network thinning, and that it can be activated by geopolitical shocks in ways that impose significant costs on firms and economies.

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Appendix

Table A-1. Average tariffs, by year

Year	Simple Average	Weighted Average	Maximum Rate
2004	0,028	0,028	0,028
2008	0,050	0,045	0,055
2010	0,079	0,074	0,090
2011	0,076	0,067	0,089
2012	0,076	0,067	0,090
2013	0,075	0,066	0,089
2014	0,062	0,054	0,074
2015	0,063	0,063	0,069
2016	0,055	0,050	0,063
2017	0,053	0,049	0,061
2018	0,055	0,050	0,064
2019	0,053	0,049	0,062
2020	0,049	0,046	0,056
2021	0,047	0,044	0,055

Table A-2a. Post-WTO Changes in Non-Russian Import Values and Import Shares

	Continuous Exposure		Binary Exposure	
	Non-Russian import values	Non-Russian import share	Non-Russian import values	Non-Russian import share
WTO_t=1 # $Exposure_k$	-0.061 (0.039)	-0.301 (0.185)	-0.008 (0.005)	-0.041 (0.026)
Industry f.e.	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
R-squared	0.9326	0.9324	0.8705	0.8702
Observations	797	797	797	797

Table A-2b. Post-war Changes in Non-Russian Import Values and Import Shares

	Continuous Exposure		Binary Exposure	
	Non-Russian import values	Non-Russian import share	Non-Russian import values	Non-Russian import share
WAR_t=1 # $Exposure_k$	0.014 (0.019)	0.005 (0.128)	0.003 (0.003)	-0.017 (0.025)
Industry f.e.	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
R-squared	0.9744	0.9743	0.9068	0.9069
Observations	453	453	453	453

Notes: The unit of analysis is industry-years. Each Exposure measure in the table varies at the 4-digit Nace Rev.2 industry level. Standard errors are clustered by 4-digit industry. The reported R-squared includes the variation explained by fixed effects. The *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.