Geopolitical Risk, Firm Expectations, and Supply-Chain Propagation

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The views expressed in this presentation are those of the authors and do not necessarily represent the official views of the Central Bank of the Republic of Türkiye.

A geopolitical shock reaches firms through different doors

Imported inputs

Risk in **supplier** countries

⇓

higher costs, delayed inputs, difficult substitution

⇓

price and inflation expectations rise

Export markets

Risk in **destination** countries

⇓

weaker demand, disrupted market access

⇓

sales and activity expectations fall

The same geopolitical environment can be:

⇒ **inflationary through sourcing, and**

⇒ **contractionary through demand.**

Research questions

1. Does geopolitical risk generate a **stagflationary response** in firms' expectations?
2. Does the channel depend on whether risk arrives through **import suppliers** or **export destinations**?
3. Are expectation revisions reflected in **realized sales, purchases, exports, and imports**?
4. Does geopolitical risk propagate through **domestic supplier–customer networks**?
5. Are the cost-versus-demand patterns visible around a sharp event: the **February 2026 Iran war**?
6. Which firms are most vulnerable? **Trade-intensive firms, SMEs, and highly leveraged firms?**

Spoiler - Four facts to remember

Impact on Expectations

1. **Geopolitical risk is stagflationary at the firm level.**
   $\Rightarrow$ Nominal expectations rise while real-activity expectations fall.

Spoiler - Four facts to remember

Impact on Expectations

1. **Geopolitical risk is stagflationary at the firm level.**
2. **The source of exposure determines the channel.**
   $\Rightarrow$ Import-side risk works through costs and procurement; export-side risk through foreign demand.

Spoiler - Four facts to remember

Impact on Expectations

1. **Geopolitical risk is stagflationary at the firm level.**
2. **The source of exposure determines the channel.**

Impact on Realized Outcomes

3. **Expectation revisions are reflected in realized outcomes.**
   $\Rightarrow$ Largest effects: purchases and imports (import-side); sales and exports (export-side).

Spoiler - Four facts to remember

Impact on Expectations

1. **Geopolitical risk is stagflationary at the firm level.**
2. **The source of exposure determines the channel.**

Impact on Realized Outcomes

3. **Expectation revisions are reflected in realized outcomes.**

Network Propagation

4. **Geopolitical risk propagates through domestic production networks.**
   $\Rightarrow$ Supplier exposure transmits cost pressures; customer exposure transmits demand weakness.

What this paper adds

1. Measurement

Country-specific GPR combined with firm-country trade shares

- Distinguishes **sourcing** from **demand** exposure
- Moves beyond aggregate GPR to **firm-specific** exposure

2. Outcomes

Monthly firm-level expectations matched to realized administrative outcomes

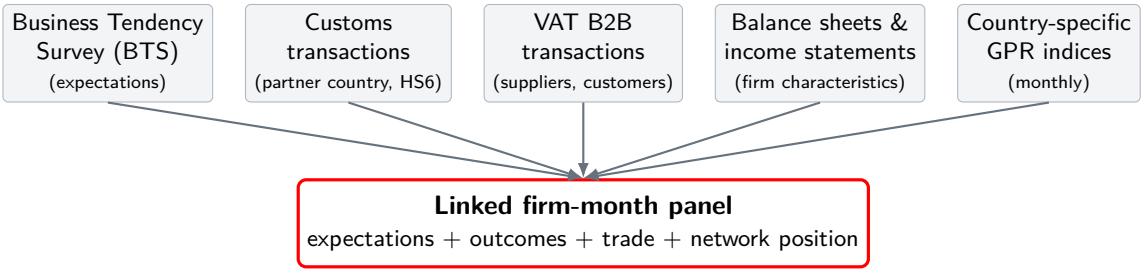
- **Expected:** inflation, prices, costs, investment, outlook
- **Expected and realized:** sales, employment
- **Realized:** purchases, exports, imports

3. Propagation

Direct foreign exposure carried through domestic B2B links

- **Upstream** supplier channel
- **Downstream** customer channel

One linked firm-month panel

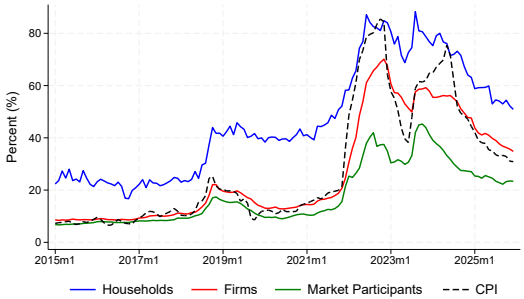


1,800–2,200
BTS firms per month

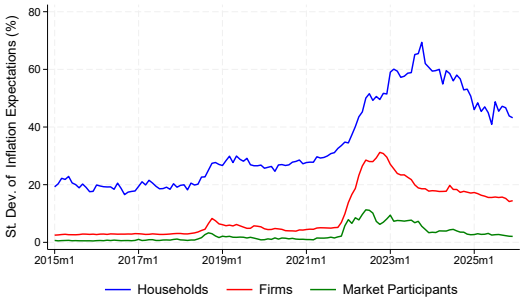
239,162
firm-month observations

2009–2025
baseline panel

Why firm expectations matter in this setting



Inflation expectations and realized CPI

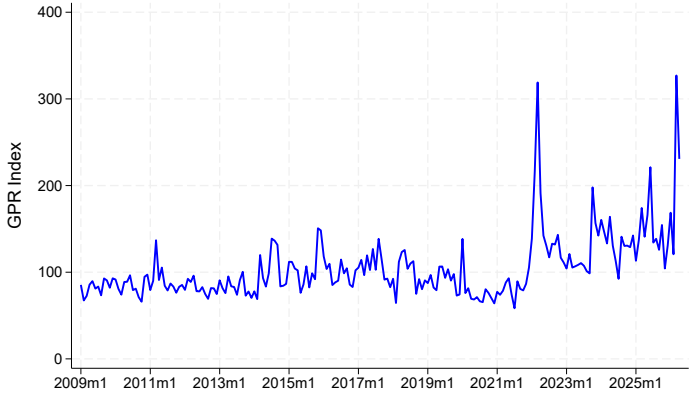


Disagreement in inflation expectations

The BTS provides:

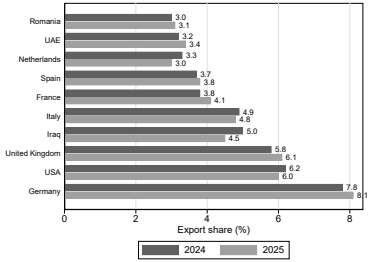
- **Numerical:** 12-month-ahead CPI and PPI inflation forecasts
- **Qualitative (1–3 scale):** own price, unit cost, sales, investment, employment, macroeconomic outlook

Global geopolitical risk over the sample period

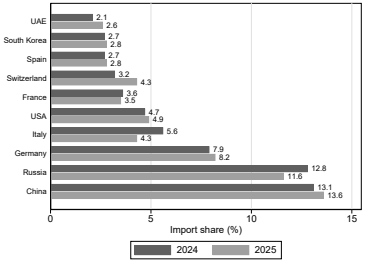


- Global Geopolitical Risk Index of Caldara and Iacoviello (2022), normalized to an average of 100 over 1985–2019.
- Firm exposure uses the country-specific indices, weighted by trade shares.

Türkiye as an example of variation in trade partners



Top 10 export destinations (share of total exports, %)

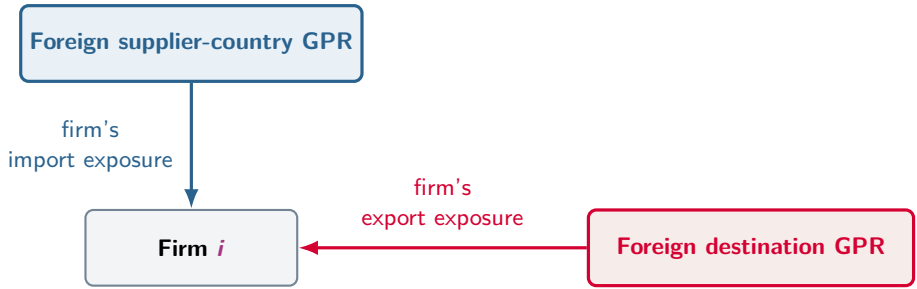


Top 10 import origins (share of total imports, %)

Source of variation

- Imports come mainly from **China and Russia**; exports go mainly to **Germany, the US, and the UK**.
- A firm's **cost-side** (import-weighted) and **demand-side** (export-weighted) GPR exposure can therefore differ, and both vary across firms.

Measuring direct geopolitical risk exposure



- Two firms in the same month can face very different geopolitical risk because their foreign partners differ.

Direct exposure: same month, different foreign geography

Import-side exposure

$$GPR^{M}_{i,t} = \sum_{c} s^{M}_{ic,y-1}\, GPR_{c,t}$$

$s^{M}_{ic,y-1}$: share of country c in firm i's **imports**, year $y-1$

$GPR_{c,t}$: **geopolitical risk** in source country c, month t

Higher value $\Rightarrow$ riskier **input** geography

Export-side exposure

$$GPR^{X}_{i,t} = \sum_{c} s^{X}_{ic,y-1}\, GPR_{c,t}$$

$s^{X}_{ic,y-1}$: share of country c in firm i's **exports**, year $y-1$

$GPR_{c,t}$: **geopolitical risk** in destination country c, month t

Higher value $\Rightarrow$ riskier **demand** geography

Compare firms in the same sector, province, and month with different partner mixes.

Empirical design: composition-based exposure

$$Y_{i,t} = \alpha_i + \delta_{s,t} + \phi_{p,t} + \beta_M GPR^M_{i,t-1} + \beta_X GPR^X_{i,t-1} + \Gamma' Z_{i,y-1} + \varepsilon_{i,t}$$

- Monthly GPR varies by country
  - $GPR^M_{i,t-1}$: Import-side GPR
  - $GPR^X_{i,t-1}$: Export-side GPR
- **Predetermined exposure:** partner-country shares come from year $y-1$
- **Identification:** compare firms in the same sector, province, and month with different foreign geography
  - differential exposure to country-level GPR, not aggregate GPR alone.
- **Fixed effects:** firm, sector $\times$ time, and province $\times$ time fixed effects, and lagged firm controls.

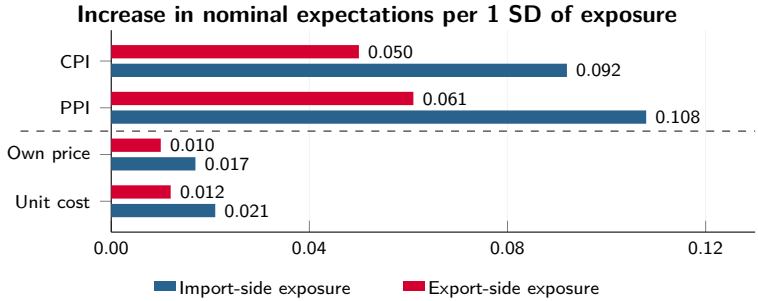
Facts 1–2

Impact on Expectations

Fact 1 Geopolitical risk is stagflationary at the firm level.

Fact 2 The source of exposure determines the channel.

Nominal expectations: larger import-side response

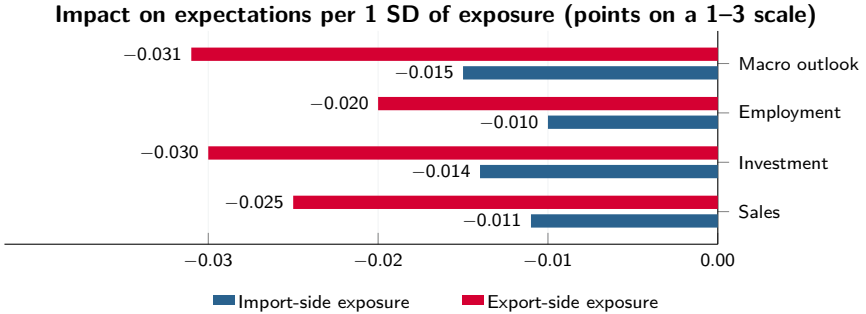


- **Fact 1 (sign):** Both exposures **raise** nominal expectations.
- **Fact 2 (size):** **Import-side** effects are **larger** than **export-side** effects
  - for both aggregate and own prices.

Note: CPI and PPI (in percentage points)

own price and unit cost (on a 1–3 scale)

Real-activity expectations: larger export-side response



- **Fact 1 (same sign):** Both exposures **lower** real-activity expectations
  - So, the response is **stagflationary**.
- **Fact 2 (different size):** **Export-side** effects are about **twice** the **import-side** effects.

Table 2: Direct effects on expectations

A: Nominal expectations	CPI	PPI	Own price	Unit cost
Import-side GPR	**0.092*****	**0.108*****	**0.017*****	**0.021*****
	(0.025)	(0.030)	(0.005)	(0.006)
Export-side GPR	0.050**	0.061**	0.010**	0.012**
	(0.022)	(0.026)	(0.004)	(0.005)
B: Real-activity expectations	Sales	Investment	Employment	Macro outlook
Import-side GPR	-0.011^{**}	-0.014^{***}	-0.010^{**}	-0.015^{***}
	(0.005)	(0.005)	(0.004)	(0.005)
Export-side GPR	**−0.025*****	**−0.030*****	**−0.020*****	**−0.031*****
	(0.006)	(0.007)	(0.006)	(0.007)
Observations: 239,162				

- **Fact 1 (same sign):** Both exposures **raise** nominal and **lower** real-activity expectations.
- **Fact 2 (different size):** The larger response is:
  - **Import-side**: Dominates **nominal / cost** expectations
  - **Export-side**: Dominates **real activity** expectations

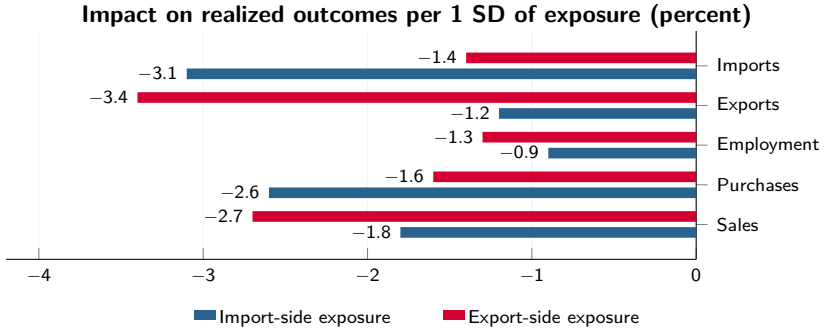
  $\Rightarrow$ import-side risk works through **costs/supply**, export-side risk through **demand**.

Fact 3

Impact on Realized Outcomes

Fact 3 **Expectation revisions are reflected in realized outcomes.**

Fact 3: The same asymmetry appears in realized outcomes



- Both exposures **lower** all five realized outcomes.
- **Import-side** exposure **reduces imports (3.1%)** and **purchases (2.6%)** the most;
- **Export-side** exposure **reduces exports (3.4%)** and **sales (2.7%)** the most.

Table 4: Direct effects on realized outcomes

	Exports	Sales	Employment	Imports	Purchases
Import-side GPR	−0.012**	−0.018***	−0.009**	**−0.031*****	**−0.026*****
	(0.005)	(0.006)	(0.004)	(0.008)	(0.007)
Export-side GPR	**−0.034*****	**−0.027*****	**−0.013*****	−0.014**	−0.016**
	(0.008)	(0.007)	(0.005)	(0.006)	(0.007)
Observations			239,162		
Firm FE			Yes		
Sector × year-month FE			Yes		
Province × year-month FE			Yes		

- Same pattern as for expectations:
  ⇒ **Input margins** (purchases, imports) respond more to **import-side** risk;
  ⇒ **Demand margins** (sales, exports) respond more to **export-side** risk.

The asymmetry reveals the economic channel

COST / PROCUREMENT

Import-side GPR matters **more** for:

- **CPI and PPI** inflation expectations
- **own-price and unit-cost** expectations
- realized **purchases and imports**

FOREIGN DEMAND

Export-side GPR matters **more** for:

- **sales and investment** expectations
- **employment** and **macroeconomic outlook**
- realized **sales and exports**

Supplier-country risk raises cost pressure, while destination-market risk weakens demand.

Which firms respond most strongly? - Heterogeneity

- **Trade-intensive firms:** stronger responses to the relevant trade channel
  - **Import-intensive** → stronger **import-side** GPR effects
  - **Export-intensive** → stronger **export-side** GPR effects

- **SMEs:** larger revisions in nominal expectations and larger declines in expected and realized activity
  - Import GPR → CPI expectations: **0.101 pp** vs. 0.074 pp for larger firms

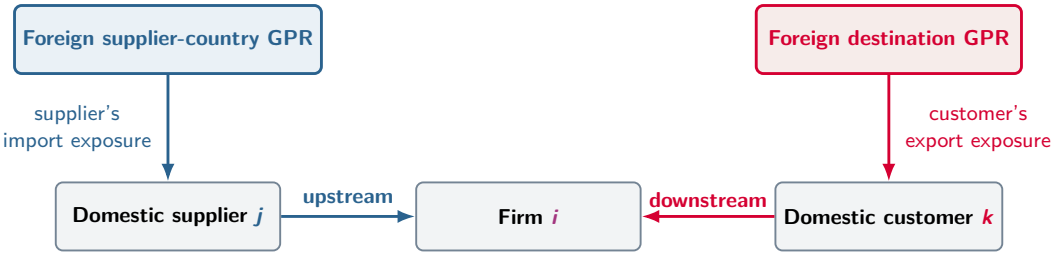
- **Highly leveraged firms:** stronger cost and price responses and larger real-side contractions
  - Export GPR → investment expectations: $-$**0.045** vs. $-$0.024 for low-leverage firms

Fact 4

Network Propagation

Fact 4 **Geopolitical risk propagates through domestic production networks.**

From direct exposure to production-network exposure



- **Upstream:** firm *i*'s suppliers are exposed through their imports ⇒ cost pressure.
- **Downstream:** firm *i*'s customers are exposed through their exports ⇒ demand weakness.

Measuring risk embedded in domestic relationships

Upstream supplier exposure

$$GPR^{U}_{i,t-1} = \sum_{j \in \mathscr{S}_i} \omega^{U}_{ij,y-1}\, GPR^{M}_{j,t-1}$$

$\omega^{U}_{ij,y-1}$: share of supplier ***j*** in firm ***i***'s domestic **purchases**, year $y-1$

$GPR^{M}_{j,t-1}$: **import-side GPR** of supplier ***j***

Prediction: higher expected costs

Downstream customer exposure

$$GPR^{D}_{i,t-1} = \sum_{k \in \mathscr{C}_i} \omega^{D}_{ik,y-1}\, GPR^{X}_{k,t-1}$$

$\omega^{D}_{ik,y-1}$: share of customer ***k*** in firm ***i***'s domestic **sales**, year $y-1$

$GPR^{X}_{k,t-1}$: **export-side GPR** of customer ***k***

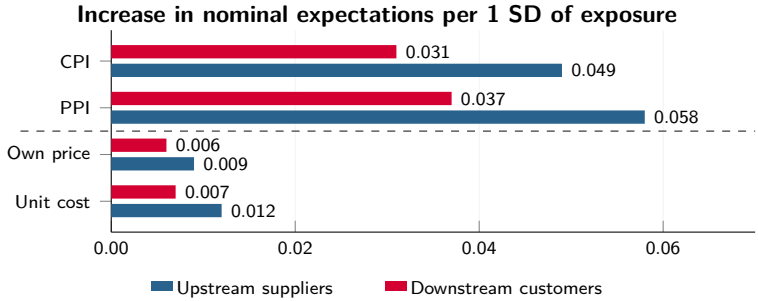
Prediction: weaker expected demand

Supply-chain propagation: specification

$$Y_{i,t} = \alpha_i + \delta_{s,t} + \phi_{p,t} + \beta_M GPR^M_{i,t-1} + \beta_X GPR^X_{i,t-1} + \theta_U GPR^U_{i,t-1} + \theta_D GPR^D_{i,t-1} + \Gamma' Z_{i,y-1} + \varepsilon_{i,t}$$

- θ_U: geopolitical risk transmitted through **suppliers**.
- θ_D: geopolitical risk transmitted through **customers**.
- Direct import- and export-side exposure is included simultaneously.
- Network weights are predetermined, using lagged $(y-1)$ B2B transaction shares.

Fact 4: Supplier risk transmits nominal pressure

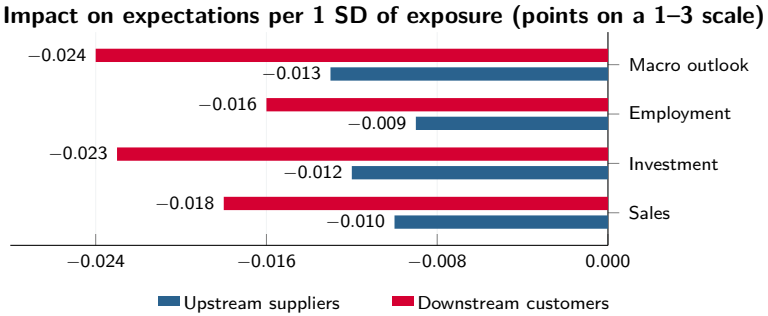


- Both network exposures **raise** nominal expectations.
- **Upstream** effects exceed **downstream** effects and are roughly **half** the direct import-side effects $\Rightarrow$ (e.g., CPI: **0.049** vs. **0.092**).

Note: CPI and PPI (in percentage points)

own price and unit cost (on a 1–3 scale)

Fact 4: Customer risk transmits demand weakness



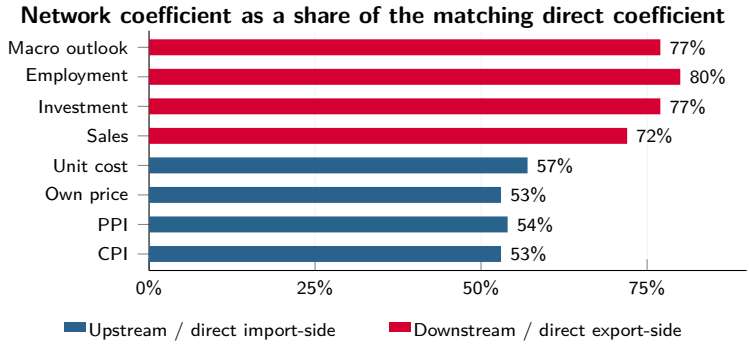
- Both network exposures **lower** real-activity expectations.
- **Downstream** (customer) effects exceed **upstream** effects for all four outcomes ⇒ (e.g., investment: **−0.023** vs. **−0.012**).

Network effects on realized outcomes

	Exports	Sales	Employment	Imports	Purchases
Upstream supplier GPR	−0.007*	−0.012**	−0.006*	**−0.022*****	**−0.020*****
	(0.004)	(0.005)	(0.003)	(0.007)	(0.006)
Downstream customer GPR	**−0.026*****	**−0.020*****	**−0.009****	−0.009*	−0.011**
	(0.007)	(0.006)	(0.004)	(0.005)	(0.005)
Observations			239,162		
Direct import- and export-side GPR			Included		
Firm FE			Yes		
Sector × year-month FE			Yes		
Province × year-month FE			Yes		

- **Upstream GPR** mainly reduces **purchases and imports**: disruption to input supply.
- **Downstream GPR** mainly reduces **sales and exports**: weaker demand from customers.
- Both upstream and downstream exposure reduce **employment**.

Network effects are economically meaningful



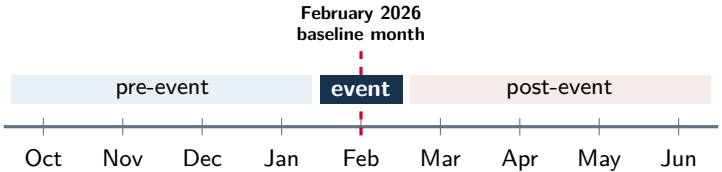
- **Upstream** nominal effects are about **half** the direct import-side effects;
- **Downstream** real effects are about **three-quarters** of the direct export-side effects.

Event study

The February 2026 Iran War

Does the same cost-versus-demand pattern appear around a sharp geopolitical shock?

A sharp-event check: the February 2026 Iran war



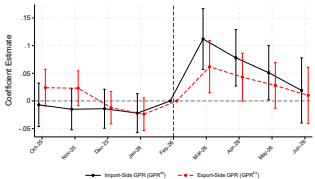
- **Predetermined exposure:**

$$GPR^{IM}_{i,2025} = \sum_{c} s^{M}_{ic,2025}\,\overline{GPR}_{c,2025}$$

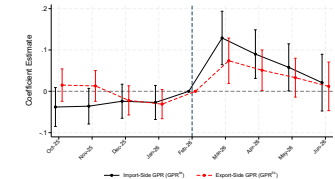
  - $GPR^{EX}_{i,2025}$ uses export shares;
  - Both are standardized and interacted with $Post_t$.
- **Identifying assumption:** parallel trends within sector, province, and month.
- **Not only an energy shock:**
  - Sector $\times$ month and province $\times$ month FE absorb **common oil-price and energy-cost shocks.**
  - **Export-side** exposure lowers **demand** expectations, which energy costs alone cannot explain.

Event study: nominal price and cost expectations

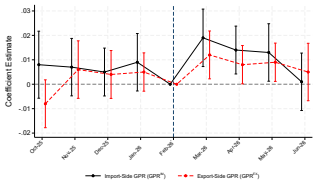
(a) CPI inflation expectations (pp)



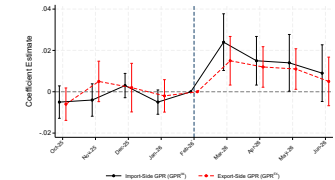
(b) PPI inflation expectations (pp)



(c) Own-price expectations (1–3 scale)



(d) Unit-cost expectations (1–3 scale)

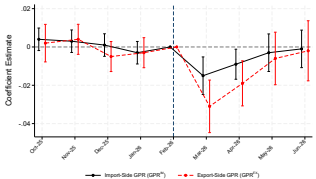


Import-side exposure Export-side exposure Bars: 95% confidence intervals

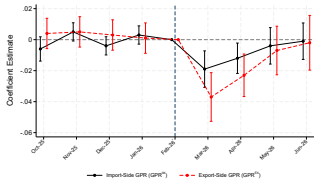
- **Import-side** exposure ⇒ increases across all nominal price and cost expectations after the war.

Event study: real activity and macroeconomic outlook

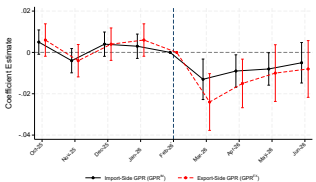
(a) Sales expectations (1–3 scale)



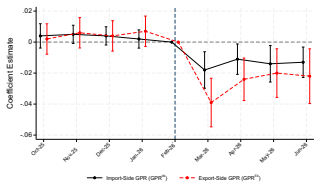
(b) Investment expectations



(c) Employment expectations



(d) Macroeconomic outlook



Import-side exposure Export-side exposure Bars: 95% confidence intervals

- **Export-side** exposure ⇒ declines across all real activity expectations and overall macro outlook.

What the event study additionally says

- **Timing:** differential responses emerge after a salient geopolitical escalation.
- **Pre-trends:** pre-event coefficients are close to zero, with no systematic differential movement before February 2026.
- **Mechanism:** the short-window response reproduces the **import-cost** / **export-demand** asymmetry.
- **Bottom line:** the event study corroborates Facts 1 and 2 around a salient geopolitical shock.

Conclusion

Implications and Takeaways

What do the findings imply for macroeconomics and policy?

Why the findings matter for policy

Monetary policy

- **Stagflationary trade-off**
- **De-anchoring risk:**
  - Foreign shocks ⇒ domestic price beliefs
- **Asymmetric shock:**
  - Cost-push (imports) vs. demand drag (exports)

Surveillance & stability

- **Supply-chain spread:**
  - Spillover to non-traders
- **Directional signals:**
  - Upstream flags costs
  - downstream flags demand
- **Vulnerability:** SMEs and leveraged firms

Monitoring B2B linkages shows where inflation pressures and real vulnerabilities will emerge.

Takeaways

1. **Stagflationary at the firm level:** nominal expectations rise as real expectations weaken.
2. **Source determines the channel:** import-side risk is cost-push; export-side risk is foreign demand.
3. **Reflected in realized outcomes:** purchases and imports versus sales and exports.
4. **Network propagation:** **suppliers** transmit cost pressures; **customers** transmit demand weakness.

Geopolitical risk is not confined to directly exposed firms: it spreads through trade and production networks.

Thank you

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Questions and comments welcome





Outcome definitions (backup)

Group	Outcome	Measurement
Numerical expectations	CPI, PPI inflation	12-month-ahead percentage forecast
Qualitative expectations	Own price, unit cost	1 decrease; 2 unchanged; 3 increase
Qualitative expectations	Sales, investment, employment	1 decrease; 2 unchanged; 3 increase
Qualitative expectations	Macroeconomic outlook	1 deterioration; 2 unchanged; 3 improvement
Realized outcomes	Sales, purchases, employment	B2B (sales, purchases) and administrative (employment) records, logs
Realized trade	Exports, imports	Monthly customs records, logs

- Baseline sample: January 2009–December 2025.
- Exposure measures are standardized (mean 0, SD 1).
- Firms without imports (exports) in year $y-1$ receive zero import-side (export-side) exposure; specifications control for trading status.

Baseline and network specifications (backup)

Direct exposure

$$Y_{i,t} = \alpha_i + \delta_{s,t} + \phi_{p,t} + \beta_M GPR^M_{i,t-1} + \beta_X GPR^X_{i,t-1} + \Gamma' Z_{i,y-1} + \varepsilon_{i,t}$$

Direct and indirect exposure jointly

$$\begin{aligned} Y_{i,t} = \alpha_i + \delta_{s,t} + \phi_{p,t} + \beta_M GPR^M_{i,t-1} + \beta_X GPR^X_{i,t-1} \\ + \theta_U GPR^U_{i,t-1} + \theta_D GPR^D_{i,t-1} + \Gamma' Z_{i,y-1} + \varepsilon_{i,t}. \end{aligned}$$

- α_i: firm fixed effects.
- $\delta_{s,t}$: sector $\times$ year-month fixed effects.
- $\phi_{p,t}$: province $\times$ year-month fixed effects.
- $Z_{i,y-1}$: lagged size, age, leverage, profitability, exporter and importer status, and foreign-currency exposure.
- Standard errors clustered at the firm level.

Network effects on expectations (backup)

Panel A: Nominal expectations	CPI	PPI	Own price	Unit cost
Upstream supplier GPR	0.049***	0.058***	0.009***	0.012***
	(0.016)	(0.019)	(0.003)	(0.004)
Downstream customer GPR	0.031**	0.037**	0.006**	0.007**
	(0.014)	(0.017)	(0.003)	(0.003)
Panel B: Real-activity expectations	Sales	Investment	Employment	Macro outlook
Upstream supplier GPR	−0.010**	−0.012**	−0.009**	−0.013**
	(0.004)	(0.005)	(0.004)	(0.005)
Downstream customer GPR	−0.018***	−0.023***	−0.016***	−0.024***
	(0.005)	(0.006)	(0.005)	(0.006)
Observations			239,162	
Direct import- and export-side GPR			Included	

Table 6, Panel A. CPI/PPI: percentage points. Other outcomes: 1–3 scale. Four standardized exposures enter jointly with lagged firm controls; firm, sector × year-month, and province × year-month FE; direct coefficients in Appendix B. Firm-clustered standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Event-study difference-in-differences (backup)

	CPI	PPI	Price	Unit cost
Panel A: Inflation and price expectations				
$Post_t \times GPR^{IM}_{i,2025}$	0.112^{***}	0.129^{***}	0.019^{***}	0.024^{***}
	(0.028)	(0.033)	(0.006)	(0.007)
$Post_t \times GPR^{EX}_{i,2025}$	0.062^{***}	0.074^{***}	0.012^{***}	0.015^{***}
	(0.024)	(0.028)	(0.005)	(0.006)
	Sales	Investment	Employment	Macro outlook
Panel B: Real-activity expectations				
$Post_t \times GPR^{IM}_{i,2025}$	-0.015^{***}	-0.019^{***}	-0.013^{***}	-0.018^{***}
	(0.005)	(0.006)	(0.005)	(0.006)
$Post_t \times GPR^{EX}_{i,2025}$	-0.031^{***}	-0.037^{***}	-0.024^{***}	-0.039^{***}
	(0.007)	(0.008)	(0.007)	(0.008)
Observations	14,532			

Table 10. October 2025–June 2026 window; February 2026 is the omitted baseline month; $Post_t = 1$ for March–June 2026. Firm, sector-month, and province-month FE and post-interacted firm characteristics. Firm-clustered standard errors in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Robustness and amplification (backup)

Exposure construction

- Replace weighted-average exposure with GPR of each firm's top import origin / export destination.
- The cost-versus-demand asymmetry is preserved, with larger magnitudes (e.g., CPI: 0.118 vs. 0.092) (Appendix C).

Distinct margins and heterogeneity

- Direct and network exposures retain their expected signs and significance when entered jointly (Appendix B).
- Matching trade intensity amplifies the relevant channel.
- SMEs and highly leveraged firms respond more.

Propagation results are not driven by directly exposed firms being connected to other directly exposed firms.

A compact production-network interpretation (backup)

Cost propagation

$$\widehat{mc}^{e} = \chi_M (I - A\Lambda)^{-1} \widetilde{GPR}^{M}$$

$$(I - A\Lambda)^{-1} = I + A\Lambda + (A\Lambda)^2 + \cdots$$

First term: own direct import-side shock.
Second term: first-order upstream exposure.

Demand propagation

$$\widehat{y}^{e} = -\chi_X (I - B)^{-1} \widetilde{GPR}^{X} - (I - B)^{-1} \Sigma \widehat{p}^{e}$$

$$(I - B)^{-1} = I + B + B^2 + \cdots$$

First term: own direct export-side shock.
Second term: first-order downstream exposure.

The four empirical exposure measures arise as first-order terms of a standard production-network system.

Appendix D. A: input-cost shares; B: customer sales shares; Λ: pass-through; Σ: demand elasticities; spectral radii of $A\Lambda$, B below one. Tildes scale exposure by import (export) intensity.

Model-to-measure mapping (backup)

Cost side

$$\widehat{mc}^{e} = A\Lambda\widehat{mc}^{e} + \chi_M \widetilde{GPR}^{M}$$

$$\widehat{mc}^{e} = \chi_M (I - A\Lambda)^{-1} \widetilde{GPR}^{M}$$

First-order upstream term for firm i:

$$\chi_M \sum_j a_{ij}\lambda_j \widetilde{GPR}^{M}_{j,t}.$$

Demand side

$$\widehat{y}^{e} = -\chi_X \widetilde{GPR}^{X} + B\widehat{y}^{e} - \Sigma\widehat{p}^{e}$$

$$\widehat{y}^{e} = -\chi_X (I - B)^{-1} \widetilde{GPR}^{X} - (I - B)^{-1}\Sigma\widehat{p}^{e}$$

First-order downstream term for firm i:

$$-\chi_X \sum_k b_{ik} \widetilde{GPR}^{X}_{k,t}.$$

With common partner pass-through and trade intensity, these terms are proportional to GPR_i^U and GPR_i^D up to the firm's domestic input (sales) share; otherwise they are first-order proxies.

Appendix D. $\widetilde{GPR}_i^{M} = m_i GPR_i^{M}$ and $\widetilde{GPR}_i^{X} = x_i GPR_i^{X}$, where m_i is the imported-input share of variable cost and x_i the export share of sales. Spectral radii of $A\Lambda$ and B below one.

Position in the literature (backup)

Geopolitical risk

Caldara and Iacoviello (2022) and subsequent work on financial markets, investment, capital structure, bank lending, trade, and supply-chain resilience.

Our margin: firm-specific source and destination exposure.

Firm expectations

Coibion et al. (2018, 2020); Candia et al. (2024): dispersion, information, and effects on firm decisions.

Our margin: geopolitical risk as a source of nominal and real belief revisions.

Production networks

Acemoglu et al. (2012); Barrot and Sauvagnat (2016); Boehm et al. (2019); Carvalho et al. (2021).

Our margin: geopolitical risk propagating through observed domestic B2B links.

The paper connects expectations and realized behavior to direct and indirect exposure within one linked microdata environment.