Economics of Sanctions

Part 2 — Firm-level Adjustment

Prof. Dr. Julian Hinz — Bielefeld University & the Kiel Institute for the World Economy

PSE Summer School — June 2026

Why focus on firms?

- Macro counterfactuals (Part 3) tell us **aggregate welfare**: Russia -2.6%, EU -0.1% in 2022 (Crozet et al., 2025).
- But the **adjustment is heterogeneous**: a few hundred firms drive most of the lost trade, and the firms that exit do not come back.
- Granular customs data let us see **margins of adjustment**, **compliance vs. evasion**, and **collateral damage** that the GE model averages away.

Source: IATRC keynote frame 2; Crozet et al. (2025) for the macro figures.

Roadmap — six blocks, 25 frames

1. Sanctioning side — **extensive margin**: who exits? (Crozet et al., 2021)
2. **Estimation & gravity block** — PPML, LPM, triple-diff (5 frames, contiguous).
3. Sanctioning side — **intensive margin**: Friendly Fire (Crozet and Hinz, 2020).
4. Target side — AHÖ, Nigmatulina, Miromanova, Görg et al.
5. Frontier — circumvention (Scheckenhofer et al., 2025; Chupilkin et al., 2026; Fisman et al., 2025) and finance (Drott et al., 2024; Avdeenko et al., 2026).
6. Bridge to the **Colombia–Venezuela exercise**.

Why firm-level matters

Why effects show up at home

Standard macro intuition: sanctions are a tax on trade with the target. Why should firms in the *sanctioning* country be hurt beyond the standard welfare triangle?

- **Weaponized prior dependence** — existing relationships embody sunk costs (Eaton et al., 2011).

  → a firm that exits Russia does not just lose a customer, it loses a search investment.

- **Costlier alternatives** — substitution is partial; some products have no near substitute.
- **Fewer varieties** on the sender side — imports of Russian inputs (gas, metals, fertilisers) re-priced.

Source: IATRC keynote frame 7.

Four channels for self-inflicted damage

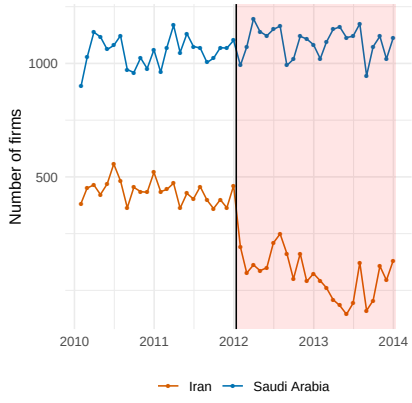
Beyond the formal embargo, firms face four overlapping channels:

- **Consumer/investor boycott** — reputational pressure (Hart et al., 2024; Biermann and Leromain, 2025).
- **Trade finance** — letters of credit, correspondent banking, insurance (Crozet and Hinz, 2020; Drott et al., 2024).
- **Country risk** — ruble volatility, war risk, contract enforceability (Biermann and Leromain, 2025).
- **Compliance cost** — legal review, dual-use screening, end-user certificates.

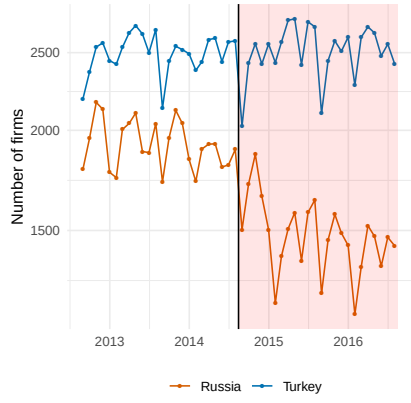
Source: IATRC keynote frames 7–8 and Crozet et al. (2025), §4.

Extensive margin in the sanctioning country

Number of French exporters — Iran 2012 & Russia 2014



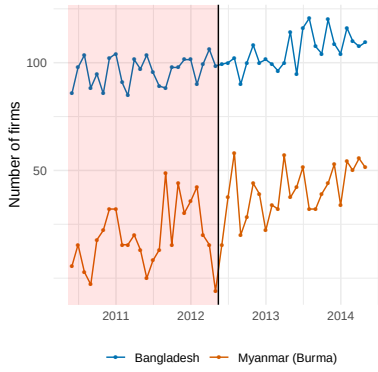
Iran sanctions tightened mid-2012



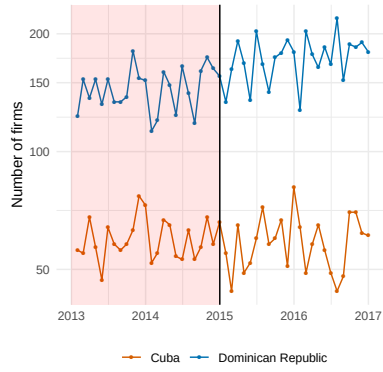
Russia sanctions July 2014

Source: Crozet et al. (2021), French customs (SIREN × NC8 × dest. × month).

Lifting sanctions is *not* symmetric — Myanmar vs. Cuba



Myanmar: $+1/3$ exporters after 2012 lifting



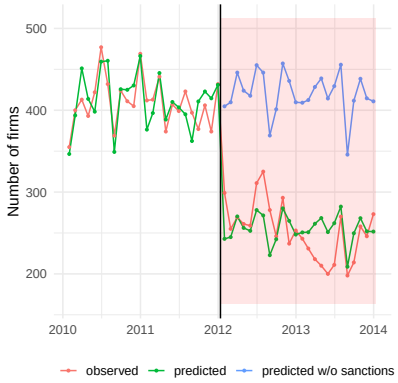
Cuba: essentially flat after Obama 2014 thaw

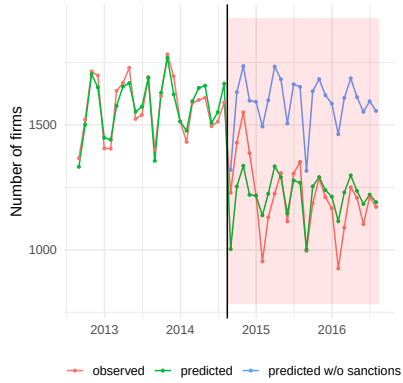
Source: Crozet et al. (2021). The **asymmetry** motivates the Colombia–Venezuela design.

Crozet, Hinz, Stammann & Wanner (2021) — research design

- Setting — monthly French customs 2009–2016, $\approx$ 150k firms, $>$ 200 destinations.
- Question — once sanctioned, do firms *exit* or just *shrink*?
- Design — 3-way fixed-effects **probit** on the entry/continuation indicator, with **bias correction** (Crozet et al., 2021).
- Three specifications:
  - $\rightarrow$ baseline — $\Pr(X_{fdt} > 0) = \Phi(\delta\, \text{Sanction}_{dt} + \theta_f + \theta_d + \theta_t)$.
  - $\rightarrow$ with prior experience — interact with lagged exporting indicator.
  - $\rightarrow$ with firm characteristics — size, productivity, trade-finance intensity.

Counterfactual number of exporters



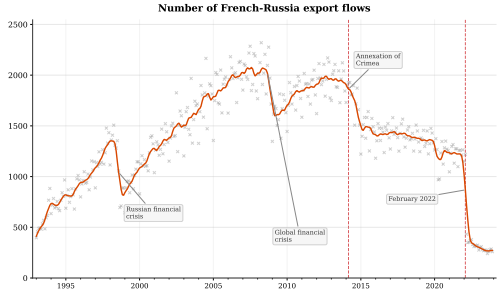


Iran: −40% exporters in counterfactual peak. Russia: −23%. Firms that exit **do not return**. *Source:* Crozet et al. (2021).

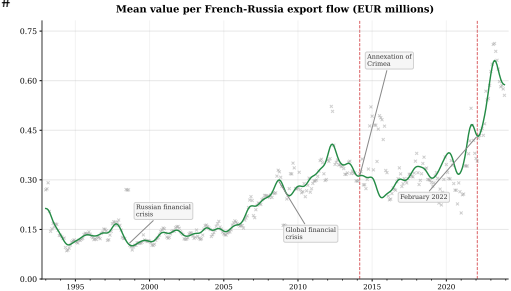
Estimating margins of adjustment

Frame 4a — trade as X_{ij}: the margin decomposition

Aggregate bilateral exports decompose as $X_{ij,t} = \underbrace{N_{ij,t}}_{\#\text{ active flows}} \cdot \underbrace{\bar{v}_{ij,t}}_{\text{mean flow value}}$



$N_{ij,t}$ — number of French export flows to Russia



$\bar{v}_{ij,t}$ — mean value per flow

2022: N collapses (1200 $\rightarrow$ 300), $\bar{v}$ *rises* (composition). **The extensive margin does the heavy lifting.** *Source:* Crozet et al. (2025), §5, Figs. 9b–c.

Frame 4b — PPML for the intensive margin

Gravity in multiplicative form:

$$X_{fpdt} \;=\; \exp\!\big(\beta\,\text{Treat}_{dt} + \theta_{fpd} + \theta_{fpt}\big)\cdot \varepsilon_{fpdt}.$$

- **Why PPML over log-OLS?** (Santos Silva and Tenreyro, 2006)

  $\rightarrow$ log-OLS drops zeros; PPML uses the full panel.

  $\rightarrow$ log-OLS estimates of β are biased under heteroskedasticity ($\mathrm{Var}(\varepsilon \mid \cdot)$ depends on covariates).

  $\rightarrow$ PPML uses the moment $\mathbb{E}[X \mid \cdot] = \exp(\cdot)$ — consistent under standard regularity.

- **Conditional-mean interpretation:** $\hat{\beta}$ is the elasticity of the *expected value* of X_{ij}, *not* of $\log X_{ij}$ (Santos Silva and Tenreyro, 2006). The -74.6% on frame 4e is $\exp(\hat{\beta}) - 1$ from $\hat{\beta} = -1.369$.

Frame 4b — PPML for the intensive margin (cont.)

- **Fixed-effect choice** (review-paper §5.1):
  - → firm × product × destination (θ_{fpd}) — absorbs the gravity-pair-product baseline.
  - → firm × product × time (θ_{fpt}) — absorbs aggregate firm-product shocks.
- **Relation to 4d:** the PPML structure and the triple-diff on frame 4d are *nested*, not parallel — the PPML becomes the triple-diff once treatment varies on the product dimension (destination × time × sanctioned-product status), distinguishing sanctioned from non-sanctioned HS6 codes within (d, t).
- Estimator — `fixest::fepois()` in R; the Colombia exercise uses exactly this command.

Frame 4c — LPM / probit for the extensive margin

Define the entry/continuation indicator $y_{fpdt} = \mathbf{1}\{X_{fpdt} > 0\}$. Two routes:

- **Linear probability model** (LPM):

$$y_{fpdt} = \gamma \, \text{Treat}_{dt} + \theta_{fpd} + \theta_{fpt} + u_{fpdt}.$$

  Fast, handles high-dimensional FE; coefficients are average partial effects.

- **3-way fixed-effects probit** (Crozet et al., 2021): incidental-parameter bias is *not* negligible with three FE dimensions.

  $\rightarrow$ **Incidental-parameters problem** (Neyman and Scott, 1948): nonlinear ML estimators with high-dimensional FE are biased of order $O(1/T)$. The Stammann (2019) / Fernández-Val and Weidner (2016) **analytical correction** subtracts the leading bias term and restores consistency.

Frame 4c — LPM / probit for the extensive margin (cont.)

- **Software, honestly:**

  → In R, the bias-corrected probit lives in `alpaca::feglm()` — `fixest`'s analytical bias correction is implemented for *Poisson* only, not for probit.

  → The Colombia exercise uses `fixest::femlm` for PPML (works) and *falls back to plain LPM* for the extensive margin (no bias correction needed because LPM is linear).

- Trade-off: LPM is robust and transparent; probit handles non-linearities and is what Crozet et al. (2021) use to identify entry costs.

Frame 4c.5 — the (non-trivial) balanced-panel step

The students-always-ask question: **what about the zeros?**

- PPML on the intensive margin (frame 4b) is run on the *sparse* flow panel — one row per observed positive shipment. PPML eats zeros where they exist, but does not invent them.
- The LPM (and probit) on $\mathbf{1}\{X_{fpdt} > 0\}$ needs the **balanced** firm $\times$ product $\times$ destination $\times$ year frame — every potential cell, with 0 where no shipment was observed.
- In R: `data.table::CJ(firms_products, destinations, years)` cross-joins the dimensions. On Colombian DIAN this gives $\approx$ 150k firms $\times$ thousands of HS6 codes $\times$ 35 destinations $\times$ 10 years — typically **10–20M rows**.
- Pass `mem.clean = TRUE` to `fixest::feols/femlm`: clears the auxiliary objects between FE projections so the regression fits in 16 GB of RAM.
- Pedagogical point: a naive LPM run on the *flow* panel (positives only) is wrong — the dependent variable is then identically 1.

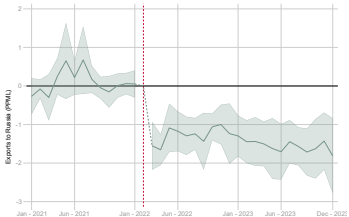
Frame 4d — triple-difference identification

Review paper (Crozet et al., 2025) §5.1 specification:

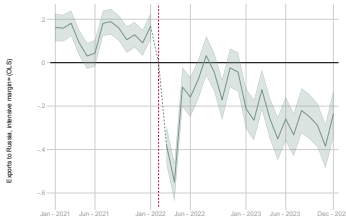
$$Trade_{ikdt} = \alpha\, Treatment_{dt} + \underbrace{\theta_{ikt}}_{\substack{\text{firm}\times\text{product}\\ \times\text{time}}} + \underbrace{\theta_{ikd}}_{\substack{\text{firm}\times\text{product}\\ \times\text{destination}}} + \varepsilon_{ikdt}$$

- θ_{ikt} absorbs the **firm's time-varying global demand for product** k — related to, but distinct from, country-level outward multilateral resistance.
- θ_{ikd} absorbs **firm-product-pair gravity** — structural distance / preference between firm-product and destination.
- $Treatment_{dt}$ **varies in three dimensions**: destination, time, and (interacted with sanctioned-product status) HS code — hence **"triple"**-diff.
- Identification — compares treated (d, t) cells to other destinations *within the same firm-product-time*.
- Run as PPML on total value, OLS on $\log(X)$ for intensive, LPM on $\mathbf{1}\{X > 0\}$ for extensive.

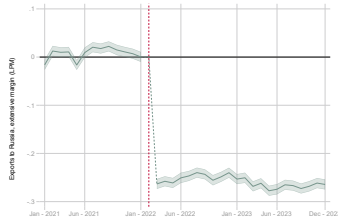
Frame 4e — bringing it together: French triple-diff, 2022 Russia



PPML — total (−74.6%)



OLS log — intensive (−25.4%)



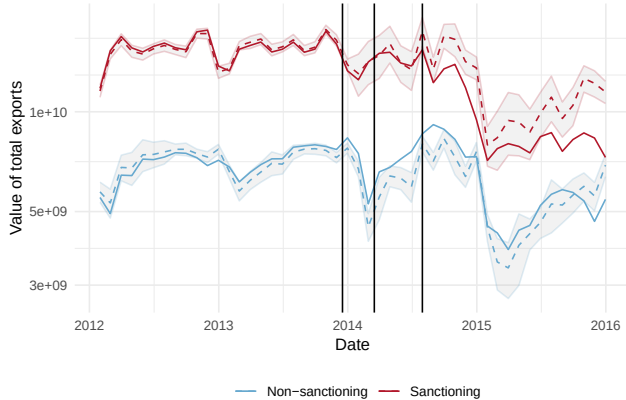
LPM — extensive (−75.9% of baseline 0.34)

- Flat pre-trends; sharp, persistent break at Feb 2022; extensive margin does *not* recover.
- **Handoff:** after the break we replicate this on **Colombian** customs around the 2014–2017 Venezuela collapse — DIAN microdata, PPML + LPM, placebos to Ecuador / Peru / Mexico.

Source: Crozet et al. (2025), Figs. 12a–c.

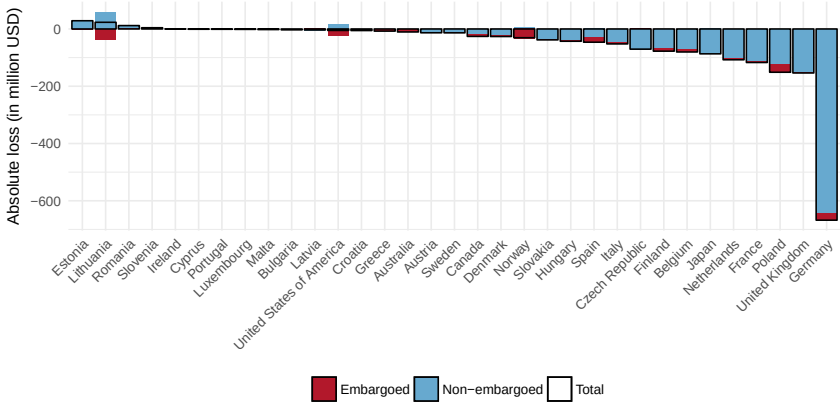
Intensive margin: Friendly Fire

Crozet & Hinz (2020) — predicted vs. observed



Gravity counterfactual: post-2014 sender exports fall **far below** the predicted baseline; most of the gap is in *non-embargoed* goods. *Source:* Crozet and Hinz (2020), monthly gravity, treatment window 2014m8 onwards.

Lost trade by sender — the bar chart



Average monthly export loss (USD m). Germany and the Netherlands lead in absolute terms; small open economies (Lithuania, Finland) lead in share of bilateral exports. *Source:* Crozet and Hinz (2020).

Which channel? — trade-finance interaction

Loss is concentrated in *non-embargoed* goods ⇒ the channel is **not the embargo per se** but financial / risk frictions.

Outcome (PPML on flow value)	Products	Firms
Treatment × post-2014	-0.41^{***}	-0.37^{***}
Treatment × post-2014 × **LC-share**	-0.62^{***}	-0.58^{***}
Firm × product × destination FE	yes	yes
Firm × product × time FE	yes	yes

Coefficients on the triple interaction are **more negative** for goods/firms with high letter-of-credit reliance — consistent with the **trade-finance channel** (Crozet and Hinz, 2020; Drott et al., 2024).

Source: Stylised version of IATRC frame 21 / Crozet and Hinz (2020), Table 5.

Effects on the target

Aytun, Hinz & Özgüzel — the Su-24 embargo

Nov 2015: a Turkish F-16 downs a Russian Su-24. From 1 Jan 2016 Russia embargoes **17 Turkish products** (mostly fresh produce); lifted product-by-product through 2017.

Three-way FE PPML: **embargo** ≈ -13 **log points** on flow value; diversion / circumvention rows track whether lost exports re-appear elsewhere.

	Two-way	Two-way with est. FE	Three-way	Three-way with global data
Embargo x period imposition	-14.36***			
	(0.6491)			
Embargo x period lifting	-0.7000***			
	(0.0837)			
Diversion x period imposition	0.0831			
	(0.0529)			
Diversion x period lifting	-0.2351***			
	(0.0567)			
Circumvention x period imposition	-0.4435***			
	(0.0520)			
Circumvention x period lifting	-0.2090***			
	(0.0537)			
Est. destination × product × time FE				
Observations	1,185,212	1,114,179	1,179,861	13,085,742
Origin × product × time FE	yes	yes	yes	yes
Origin × destination × product × month FE	yes	yes	yes	yes
Destination × time FE	no	no	yes	no
Destination × product × time FE	no	no	no	yes

Source: Aytun et al. (2025); IATRC keynote frames 27–31.

Aytun, Hinz & Özgüzel — the Su-24 embargo

Nov 2015: a Turkish F-16 downs a Russian Su-24. From 1 Jan 2016 Russia embargoes **17 Turkish products** (mostly fresh produce); lifted product-by-product through 2017.

Three-way FE PPML: **embargo** ≈ -13 **log points** on flow value; diversion / circumvention rows track whether lost exports re-appear elsewhere.

	Two-way	Two-way with est. FE	Three-way	Three-way with global data
Embargo x period imposition	-14.36***	-12.93***		
	(0.6491)	(0.7108)		
Embargo x period lifting	-0.7000***	-0.1752**		
	(0.0837)	(0.0672)		
Diversion x period imposition	0.0831	0.1729***		
	(0.0529)	(0.0478)		
Diversion x period lifting	-0.2351***	-0.0488		
	(0.0567)	(0.0450)		
Circumvention x period imposition	-0.4435***	-0.4077***		
	(0.0520)	(0.0471)		
Circumvention x period lifting	-0.2090***	-0.1058*		
	(0.0537)	(0.0476)		
Est. destination × product × time FE		0.8567***		
		(0.0161)		
Observations	1,185,212	1,114,179	1,179,861	13,085,742
Origin × product × time FE	yes	yes	yes	yes
Origin × destination × product × month FE	yes	yes	yes	yes
Destination × time FE	no	no	yes	no
Destination × product × time FE	no	no	no	yes

Source: Aytun et al. (2025); IATRC keynote frames 27–31.

Aytun, Hinz & Özgüzel — the Su-24 embargo

Nov 2015: a Turkish F-16 downs a Russian Su-24. From 1 Jan 2016 Russia embargoes **17 Turkish products** (mostly fresh produce); lifted product-by-product through 2017.

Three-way FE PPML: **embargo** ≈ -13 **log points** on flow value; diversion / circumvention rows track whether lost exports re-appear elsewhere.

	Two-way	Two-way with est. FE	Three-way	Three-way with global data
Embargo x period imposition	-14.36***	-12.93***	-13.62***	
	(0.6491)	(0.7108)	(1.042)	
Embargo x period lifting	-0.7000***	-0.1752**	-0.1518	
	(0.0837)	(0.0672)	(0.0981)	
Diversion x period imposition	0.0831	0.1729***	0.0607	
	(0.0529)	(0.0478)	(0.0683)	
Diversion x period lifting	-0.2351***	-0.0488	-0.0977	
	(0.0567)	(0.0450)	(0.0653)	
Circumvention x period imposition	-0.4435***	-0.4077***	0.0813	
	(0.0520)	(0.0471)	(0.0832)	
Circumvention x period lifting	-0.2090***	-0.1058*	0.5076***	
	(0.0537)	(0.0476)	(0.0887)	
Est. destination × product × time FE		0.8567***		
		(0.0161)		
Observations	1,185,212	1,114,179	1,179,861	13,085,742
Origin × product × time FE	yes	yes	yes	yes
Origin × destination × product × month FE	yes	yes	yes	yes
Destination × time FE	no	no	yes	no
Destination × product × time FE	no	no	no	yes

Source: Aytun et al. (2025); IATRC keynote frames 27–31.

Aytun, Hinz & Özgüzel — the Su-24 embargo

Nov 2015: a Turkish F-16 downs a Russian Su-24. From 1 Jan 2016 Russia embargoes **17 Turkish products** (mostly fresh produce); lifted product-by-product through 2017.

Three-way FE PPML: **embargo** ≈ -13 **log points** on flow value; diversion / circumvention rows track whether lost exports re-appear elsewhere.

	Two-way	Two-way with est. FE	Three-way	Three-way with global data
Embargo x period imposition	-14.36***	-12.93***	-13.62***	-13.05***
	(0.6491)	(0.7108)	(1.042)	(0.6618)
Embargo x period lifting	-0.7000***	-0.1752**	-0.1518	-0.2994**
	(0.0837)	(0.0672)	(0.0981)	(0.1024)
Diversion x period imposition	0.0831	0.1729***	0.0607	0.6815***
	(0.0529)	(0.0478)	(0.0683)	(0.0807)
Diversion x period lifting	-0.2351***	-0.0488	-0.0977	0.2474***
	(0.0567)	(0.0450)	(0.0653)	(0.0717)
Circumvention x period imposition	-0.4435***	-0.4077***	0.0813	-0.0090
	(0.0520)	(0.0471)	(0.0832)	(0.0982)
Circumvention x period lifting	-0.2090***	-0.1058*	0.5076***	0.1572
	(0.0537)	(0.0476)	(0.0887)	(0.1030)
Est. destination × product × time FE		0.8567***		
		(0.0161)		
Observations	1,185,212	1,114,179	1,179,861	13,085,742
Origin × product × time FE	yes	yes	yes	yes
Origin × destination × product × month FE	yes	yes	yes	yes
Destination × time FE	no	no	yes	no
Destination × product × time FE	no	no	no	yes

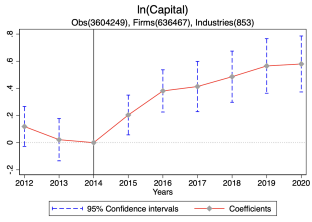
Source: Aytun et al. (2025); IATRC keynote frames 27–31.

Embargo bites beyond exports — employment at home

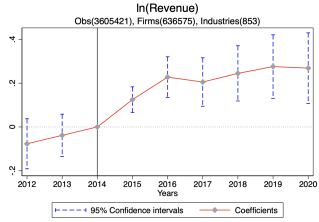
Dependent Variable:	log(total workers)		
Model:	(1)	(2)	(3)
Embargo × period imposition	-0.1085**	-0.0989**	-0.1108**
	(0.0419)	(0.0425)	(0.0426)
Embargo × period lifting	-0.1161**	-0.1159**	-0.1132**
	(0.0498)	(0.0498)	(0.0510)
Non-Russia × period imposition		0.0522	
		(0.0460)	
Non-Russia × period lifting		0.0298	
		(0.0500)	
Non-embargo × period imposition			-0.0114
			(0.0486)
Non-embargo × period lifting			0.0230
			(0.0602)
Observations	88,553	88,553	88,553
R^2	0.92214	0.92216	0.92215

Treated Turkish firms lose ≈ 11% of monthly establishment employment during imposition; the effect **persists** after lifting. *Source:* Aytun et al. (2025), employment regressions.

Nigmatulina — “smart” sanctions backfire on the target



Capital of sanctioned firms



Revenue of sanctioned firms

- 600k Russian firm balance sheets, 2014–2020. Targeted firms gain $+32\%$ capital, $+20\%$ revenue as state procurement & subsidies are redirected to them; aggregate TFP loss $\approx 1.1\%$ (Nigmatulina, 2022).
- Compare: Miromanova (2023) (Russia 2014, ext. + int. bind, unit values $\uparrow$); Görg et al. (2024) (Germany 2022, heterogeneous by size); Ahn and Ludema (2020) (Russia 2014 target side, -25% rev., -50% assets, strategic firms shielded).

Source: Nigmatulina (2022); IATRC keynote frames 38–40.

Frontier: circumvention and finance

Scheckenhofer, Teti & Wanner (2025) — military goods (+20 pp)

- Data — UN Comtrade HS6 annual, 2021–2023; 44 HS6 "Common High-Priority" military codes (EU/G7 Oct 2023 list).
- Two triple-DiDs:
  - $\rightarrow$ Pr(export to RUS) $= \beta_1$ after$_t \cdot$ friends$_i \cdot$ RUS$_j +$ FEs $\Rightarrow \hat{\beta}_1 = +20$ **pp**.
  - $\rightarrow$ Pr(export to friends) $= \beta_2$ after$_t \cdot$ allies$_i \cdot$ friends$_j +$ FEs $\Rightarrow +4$ pp.
- "Friends" — AM, AZ, CN, GE, KZ, KG, MD, RS, TR, UZ; FE structure absorbs general diversion.
- Re-export DiD (Georgia / Moldova / Uzbekistan): $+7.6$ pp evasion of military goods to Russia.

Headline policy take: **enforcement is the binding constraint**, not the bans themselves. *Source:* Scheckenhofer et al. (2025), CESifo WP 11743 / AEA P&P 2025.

Eurasian Roundabout & the Undoing of Sanctions

- **Eurasian Roundabout** (Chupilkin et al., 2026)

  $\rightarrow$ bill-of-lading + customs from Caucasus and Central Asia; sanctioned-good imports from EU/G7 *into* AM/KZ/KG up 100–200%.

  $\rightarrow$ same products re-appear in those countries' exports *to* Russia; price wedge $+20$–40%.

- **The Undoing of Economic Sanctions** (Fisman et al., 2025)

  $\rightarrow$ conflict-zone trade and platform-mediated illicit rechanneling; sanctions get *undone* rather than evaded openly.

- Common point — the relevant counterfactual is not "no trade" but "traded through an intermediary, at a markup".

Financial sleeve — TARGET2 and online platforms

- Drott et al. (2024) — TARGET2 microdata, Russian banks

  → SWIFT exclusion shows up as a sharp, lasting break in payment flows of designated banks.

  → spillovers: non-designated Russian banks rerouted via designated correspondents.

- Avdeenko et al. (2026) — online intermediaries on platforms

  → sanctioned-country sellers and buyers maintain commercial presence via marketplace pivots.

  → stigma raises prices but does not kill the channel; cross-border listings shift to neutral hubs.

- Berthou (2023) — sanctions risk slowly tilts **invoicing currencies** away from the dollar.

Bridge to Exercise 1

Colombia–Venezuela — data architecture

- Setting — 2014–2017 **collapse of Venezuelan demand**: a sudden, exogenous (to Colombian firms) shut-down of one of the two largest export markets.
- **Important disclaimer:** the 2014–2017 Venezuela episode is a *demand collapse + foreign-exchange-control regime*, *not* a Western sanction. We use it as a sanction analogue because (a) the firm-level response margins are identical, and (b) Colombian DIAN is the cleanest customs micro-panel publicly available.
- Data — DIAN customs, raw monthly NIT $\times$ HS6 $\times$ destination $\times$ value; we **aggregate to the firm-HS6-destination-year level** for tractability (monthly $\times$ balanced LPM panel blows up RAM).
- Pre-shipped: `00-setup.R`, `01-download.R`, `02-clean.R`. Students start from a clean panel.

Colombia–Venezuela — data architecture (cont.)

- Treatment — Venezuela $\times$ post-2014; placebo destinations Ecuador, Peru, Mexico, USA.
- Triple-diff at the *firm-HS6* level (review-paper §5.1, mapped to the available FE dimensions):

$$X_{fpdt} = \alpha\, \text{Treat}_{dt} + \theta_{fp} + \theta_{ft} + \theta_{pdt} + \varepsilon_{fpdt}.$$

- Firm-product, firm-year, and product-destination-year FEs — identification off within-firm variation across destinations *and* sanctioned vs. placebo products.

What you will run — `03-estimate.R` + `04-output.R`

- **PPML for the intensive margin** (Santos Silva and Tenreyro, 2006):

  ```
  fepois(value_usd ~ sanction | nit^hs6 + nit^year + hs6^destination^year,
                                data)
  ```

- **LPM for the extensive margin** (run on the *balanced* firm × HS6 × dest × year panel built via `CJ()`; pass `mem.clean = TRUE`):

  ```
  feols(exporting ~ sanction | nit^hs6 + nit^year + hs6^destination^year,
                               balanced)
  ```

- **Probit with bias correction** (Crozet et al., 2021) — shown for reference; *not* run in class. The exercise stops at LPM (see frame 4c on `alpaca`).

- Event-study plot, margins decomposition, comparison table. Compare to Crozet and Hinz (2020) and Aytun et al. (2025).

```
cd exercises/01-colombia-venezuela && make
```

Take-aways

Take-aways — Part 2

- Sanctions act **mostly through the extensive margin**, and the exit is **persistent** (Crozet and Hinz, 2020; Crozet et al., 2021).
- Costs accrue at home through **trade finance, country risk, and private compliance**, not just the formal embargo.
- On the target side, **"smart" sanctions get diluted** by state shielding (Nigmatulina, 2022; Ahn and Ludema, 2020); embargo episodes hit **employment** (Aytun et al., 2025; Görg et al., 2024).
- The 2022 frontier is **enforcement**: military-goods evasion $+20$ pp (Scheckenhofer et al., 2025); Eurasian roundabout (Chupilkin et al., 2026); finance (Drott et al., 2024).
- Methods to take home: **PPML + LPM + 3-way FE** with bias correction; **triple-diff** with θ_{fpd} and θ_{fpt}.

References

References i

- Ahn, Daniel P. and Rodney D. Ludema (2020). **“The Sword and the Shield: The Economics of Targeted Sanctions”.** In: *European Economic Review* 130, p. 103587. DOI: 10.1016/j.euroecorev.2020.103587.
- Avdeenko, Alexandra, Maximilian Kaiser, Krisztina Kis-Katos, and Leonie Reher (2026). **“Sanctions, Sales, and Stigma: Intermediary Online Firms’ Market Role in Sustaining Trade”.** In: *Journal of International Economics* 159, p. 104197. DOI: 10.1016/j.jinteco.2025.104197.
- Aytun, Ugur, Julian Hinz, and Cem Özgüzel (2025). **“Shooting Down Trade: Firm-Level Effects of Embargoes”.** In: *Journal of Economic Behavior & Organization* 231, p. 106821. DOI: 10.1016/j.jebo.2024.106821.
- Berthou, Antoine (2023). ***International Sanctions and the Dollar: Evidence from Trade Invoicing*.** Tech. rep. Working Paper 924. Banque de France. URL: https://ideas.repec.org/p/bfr/banfra/924.html.

References ii

- Biermann, Marcus and Elsa Leromain (2025). **"The Ripple Effect: Trade Linkages and the Stock Market Response to the Russia–Ukraine War".** In: *Review of World Economics* 161.4, pp. 1637–1660. DOI: 10.1007/s10290-025-00594-4.
- Chupilkin, Maxim, Beata Javorcik, and Alexander Plekhanov (2026). **"The Eurasian Roundabout: Trade Flows into Russia through the Caucasus and Central Asia".** In: *European Economic Review* 187, p. 105340. DOI: 10.1016/j.euroecorev.2026.105340.
- Crozet, Matthieu and Julian Hinz (2020). **"Friendly Fire: The Trade Impact of the Russia Sanctions and Counter-Sanctions".** In: *Economic Policy* 35.101, pp. 97–146. DOI: 10.1093/epolic/eiaa006.
- Crozet, Matthieu, Julian Hinz, Amrei Stammann, and Joschka Wanner (2021). **"Worth the Pain? Firms' Exporting Behaviour to Countries Under Sanctions".** In: *European Economic Review* 134, p. 103683. DOI: 10.1016/j.euroecorev.2021.103683.

References iii

- Crozet, Matthieu, Julian Hinz, and Patrik Šváb (2025). ***Trade Sanctions*.** Tech. rep. Kiel IfW / Paris-Saclay / VŠE Prague. Working paper (R&R, Oxford Research Encyclopedia of Economics and Finance). URL: https://julianhinz.com/research/trade_sanctions/.
- Drott, Constantin, Stefan Goldbach, and Volker Nitsch (2024). **"The Effects of Sanctions on Russian Banks in TARGET2 Transactions Data".** In: *Journal of Economic Behavior & Organization* 219, pp. 38–51. DOI: 10.1016/j.jebo.2023.12.030.
- Eaton, Jonathan, Samuel Kortum, and Francis Kramarz (2011). **"An Anatomy of International Trade: Evidence from French Firms".** In: *Econometrica* 79.5, pp. 1453–1498. DOI: 10.3982/ECTA8318.
- Fernández-Val, Iván and Martin Weidner (2016). **"Individual and Time Effects in Nonlinear Panel Models with Large *N*, *T*".** In: *Journal of Econometrics* 192.1, pp. 291–312. DOI: 10.1016/j.jeconom.2015.12.014.

References iv

- Fisman, Raymond, Giovanna Marcolongo, and Meng Wu (2025). **"The Undoing of Economic Sanctions: Evidence from the Russia–Ukraine Conflict".** In: *Journal of Public Economics* 249, p. 105470. DOI: 10.1016/j.jpubeco.2025.105470.
- Görg, Holger, Anna Jacobs, and Saskia Meuchelböck (2024). **"Who Is to Suffer? Quantifying the Impact of Sanctions on German Firms".** In: *Journal of Economic Behavior & Organization* 228, p. 106767. DOI: 10.1016/j.jebo.2024.106767.
- Hart, Oliver D., David Thesmar, and Luigi Zingales (2024). **"Private Sanctions".** In: *Economic Policy* 39.117, pp. 203–268. DOI: 10.1093/epolic/eiad041.
- Miromanova, Anna (2023). **"Quantifying the Trade-Reducing Effect of Embargoes: Firm-Level Evidence from Russia".** In: *Canadian Journal of Economics* 56.3, pp. 1121–1160. DOI: 10.1111/caje.12667.
- Neyman, Jerzy and Elizabeth L. Scott (1948). **"Consistent Estimates Based on Partially Consistent Observations".** In: *Econometrica* 16.1, pp. 1–32. DOI: 10.2307/1914288.

References v

- Nigmatulina, Dzhamilya (2022). ***Sanctions and Misallocation: How Sanctioned Firms Won and Russia Lost.*** Tech. rep. CEP Discussion Paper 1886. Centre for Economic Performance, LSE. URL: https://cep.lse.ac.uk/_NEW/publications/abstract.asp?index=9710.
- Santos Silva, J. M. C. and Silvana Tenreyro (2006). **"The Log of Gravity".** In: *Review of Economics and Statistics* 88.4, pp. 641–658. DOI: 10.1162/rest.88.4.641.
- Scheckenhofer, Lisa, Feodora A. Teti, and Joschka Wanner (2025). ***Dodging Trade Sanctions? Evidence from Military Goods.*** Tech. rep. Working Paper 11743. CESifo. URL: https://www.ifo.de/en/cesifo/publications/2025/working-paper/dodging-trade-sanctions-evidence-military-goods.
- Stammann, Amrei (2019). ***Fast and Feasible Estimation of Generalized Linear Models with High-Dimensional k-Way Fixed Effects.*** arXiv preprint 1707.01815v3. arXiv. DOI: 10.48550/arXiv.1707.01815. URL: https://arxiv.org/abs/1707.01815.