Foreign Political Risk and Technological Change

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Does foreign political risk spur innovation?

- Foreign political risks and geopolitics shape productivity and well-being
- Growing interest in modeling optimal responses to foreign risks
- Little empirical evidence showing how firms and countries react in practice
- One prominent possibility: innovation and technological change

Explaining why the rise of the US private rocket industry coincided with democratic backsliding in Russia and the rise of Putin: "In light of Russia's de facto annexation of Ukraine's Crimea region and the formal severing of military ties, the Atlas V cannot possibly be described as providing assured access to space [...] when supply of the main engine depends on President Putin's permission."

–Elon Musk, 2014 Senate Hearing

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European Defense Depends on Tech

President Trump's threats are a wake-up call: Europe must build up its own defenses, learning from Ukraine's use of drones and satellites.

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Main Questions

1. Does innovation respond systematically to foreign political risk?
2. If so, what are the mechanisms and broader economic consequences?

Summary and main findings

Theory: firm-level model of foreign risk, innovation, and trade [*in the paper*]

- Prediction 1: greater *sector-level* risk $\rightarrow$ more innovation
- Mechanism: driven by mid-innovation-intensity firms innovating for "insurance"
- Prediction 2: greater innovation response to risk $\rightarrow$ less input reliance

Data and measurement: combine data on sector-level technology development (patents, R&D) and trade patterns with country-year level data on political risk

Main results: foreign political risk shapes technology development:

- Sector-level foreign political risk exposure $\nearrow$ innovation
- Particularly strong when risk emanates from geopolitical adversaries
- Technological response mediates economic consequences of political risk

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Data and Measurement

Data and measurement

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- Data from PatentsView on tech class, inventor location/characteristics, citations
- Linked to individual minerals via text search & NAICS 6-digit sectors using 'Algorithmic Links with Probabilities' (Goldschlag et al., 2020)
- Alternative source: R&D investment from COMPUSTAT

Political Risk: measured using the International Country Risk Guide (ICRG)

- Yearly measure of political risk for 147 countries since 1984
- Index includes potential expropriation risk, conflict risk, religious tension, etc.
- *Validation*: firm-level measure from Hassan et al. (2019) and news-based measure from Caldara & Iacoviello (2022)

Political alliances: measured using the Correlates of War Project & UN voting data

Trade data from UN Comtrade database and **mineral deposits data** from USGS

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Data and measurement

- Measure political risk exposure (PRE) combining data on changes in foreign country-level political risk with heterogeneous exposure across sectors:

$$\text{PRE}_{it} = \sum_{c} \text{PoliticalRisk}_{ct} \cdot (\text{Exposure}_{ic})^2$$

  where i indexes sectors, t indexes years, and c indexes countries EU
- Analysis of minerals: Exposure_{ic} is deposit shares
- Main analysis across all sectors: Exposure_{ic} is import shares
- For most of the analysis, fix Exposure_{ic} at the start of the period (pre-2000), but also explore allowing for changing trade patterns
- *Validation*: $\text{PRE}_{it} \nearrow$ reduces contemporaneous profits and capital investments

Foreign Political Risk and Innovation

Case Study: Political Risk and Innovation in Minerals

- Minerals are central inputs to many modern technologies (e.g., semiconductors, green tech), and concentrated in politically volatile regions (e.g., the DRC)
- Does mineral-level innovation response to political risk? Estimating equation is:

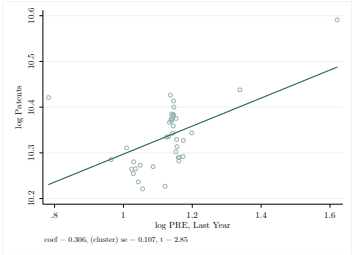
$$y_{it} = \beta \cdot \log \text{PRE}_{it}^{\text{Min}} + \alpha_i + \delta_t + \epsilon_{it}$$

where i indexes minerals (e.g., aluminum, lithium), t indexes years, and

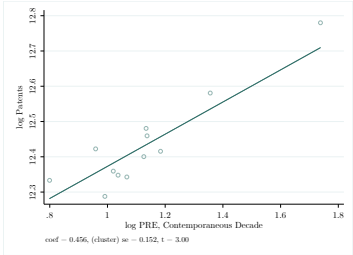
$$\text{PRE}_{it}^{\text{Min}} = \sum_c \text{PoliticalRisk}_{ct} \cdot (\text{DepositShare}_{ic})^2$$

- All specifications include mineral (α_i) and year or decade (δ_t) fixed effects
- y_{it} is a measure of patenting related to mineral i and year t
- β captures the response of innovation to foreign political risk

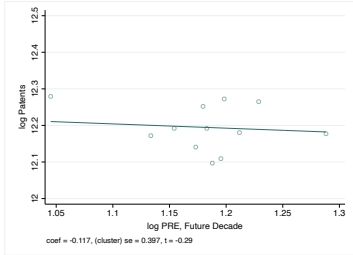
Case Study: Political Risk and Innovation in Minerals



(a) Patents (Annual)



(b) Patents (Decadal)



(c) Patents (Pre-Trend)

- 1 SD increase in foreign political risk exposure $\implies$ 27% increase in innovation
- Similar results for *citation-weighted* patenting

Main Empirical framework: cross-sector estimates

- Does a similar relationship exist across all tradable sectors?
- Analogous main estimating equation:

$$y_{it} = \beta \cdot \log \text{PRE}_{it} + \alpha_i + \delta_t + X'\Gamma + \epsilon_{it}$$

where i indexes minerals (NAICS sectors), t indexes years, and

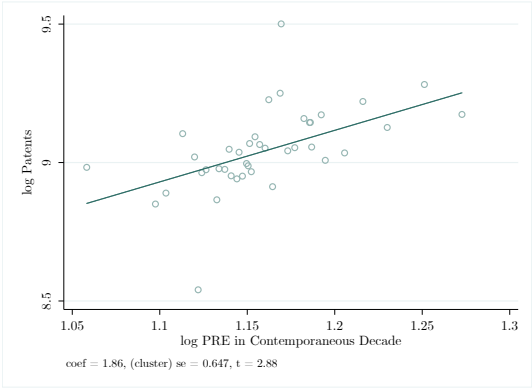
$$\text{PRE}_{it} = \sum_c \text{PoliticalRisk}_{ct} \cdot (\text{ImportShare}_{ic})^2$$

- All specifications include sector (α_i) and year (δ_t) fixed effects
- y_{it} is a measure of innovative activity in sector i and year t
- β captures the response of innovation to foreign political risk

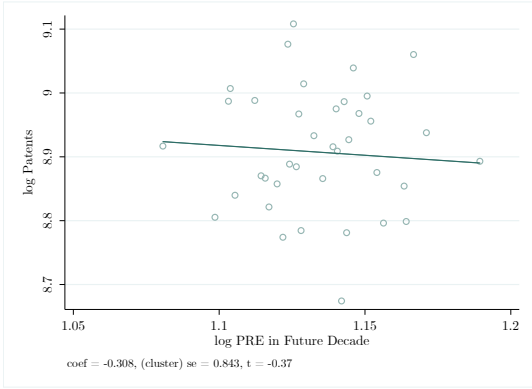
Foreign political risk increases innovation

Dependent Variable:	(1) log Patents	(2) Patents	(3) log Fwd Citations	(4) log Patent Value	(5) log Patent Importance	(6) log New Firms	(7) log Patents per Firm
Panel A: Risk Measure Using Contemporaneous Import Shares							
log PRE, First Lag	0.326	0.323	0.229	0.334	0.311	0.047	0.257
	(0.163)	(0.141)	(0.083)	(0.158)	(0.140)	(0.126)	(0.128)
log HHI, First Lag	-0.061	-0.063	-0.090	0.002	-0.139	0.033	-0.087
	(0.153)	(0.129)	(0.101)	(0.172)	(0.143)	(0.143)	(0.093)
Mean Dep. Var.	2.31	173	3.74	4.02	2.27	4.19	-2.89
Observations	13926	15432	12092	12788	11144	13822	13916
Panel B: Risk Measure Using Pre-Period Import Shares							
log PRE, First Lag	0.336	0.433	0.277	0.246	0.208	0.299	0.035
	(0.152)	(0.147)	(0.138)	(0.147)	(0.126)	(0.120)	(0.152)
Mean Dep. Var.	2.29	171	3.73	3.99	2.26	4.18	-2.90
Observations	13718	15213	12037	12654	11170	13615	13708
NAICS 6-digit FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Decade-level estimates and pre-trends



(a) PRE in Contemporaneous Decade



(b) PRE in Future Decade (pre-trend)

Mechanisms and Additional Results

- Driven by mid- and (to a lesser extent) high-innovation firms, as in the theory Link
- Largely driven by private-sector innovators Link
- Larger effects for heavy manufacturing and mining sectors, similar effects for "critical" vs. "non-critical" sectors, indicative of limited explicit govt. role Link
- Some evidence of spillover effects across the innovation network Link
- Driven by risk in technology area *not* product market Link

Global Estimates and the Role of Geopolitical Alliances

Global estimates

- We extend the US-only analysis to a global sample, constructing an analogous measure of political risk for each country-sector-year:

$$\text{PRE}_{itc} = \sum_{c' \neq c} \text{PoliticalRisk}_{c't} \cdot (\text{ImportShare}_{i,c' \to c,t_0})^2$$

and using the estimating equation:

$$y_{itc} = \beta \cdot \log \text{PRE}_{itc} + \alpha_{ic} + \delta_{tc} + \gamma_{ti} + X'\Gamma + \epsilon_{itc}$$

- Advantages to this approach:
  1. Inclusion of two-way fixed effects addresses some concerns from sector-year analysis
  2. Ability to investigate differences across countries / trade relationships

Global estimates: baseline results

Dependent Variable:	(1) log Patents	(2) Patents	(3) log Fwd Citations	(4) log Patent Importance	(5) log New Firms	(6) log Patents per Firm
log PRE, First Lag	0.084	0.069	0.133	0.132	0.036	0.067
	(0.034)	(0.039)	(0.048)	(0.032)	(0.019)	(0.028)
Mean Dep. Var.	-0.93	1.88	-0.043	-0.90	1.73	-3.15
Observations	243549	2499030	185958	173810	207171	240949
NAICS 6-digit × Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Country × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
NAICS 6-digit × Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Pre-Trends Decadal More FEs Controls

Bilateral political risk

- So far, have treated political risk in a country c equally for all other countries
- Expropriation or conflict risk may spur innovation regardless of bilateral ties
- Or—perceived risk of a breakdown could be higher among non-allies
  - Restrictive policies (e.g., sanctions) may be more likely
  - Trade breakdown as geopolitical strategy (e.g., Clayton et al.)
  - Example: Putin's rockets from the Introduction
- Compile data on all formal alliances (CoW, ATOP) and UN voting patterns to characterize bi-lateral relationships
- Measure risk emanating from non-allies (analogously, allies):

$$\text{PRE}_{itc}^{\text{non-allies}} = \sum_{c' \notin allies(c)} \text{PoliticalRisk}_{c't} \cdot (\text{ImportShare}_{i,c' \to c,t_0})^2$$

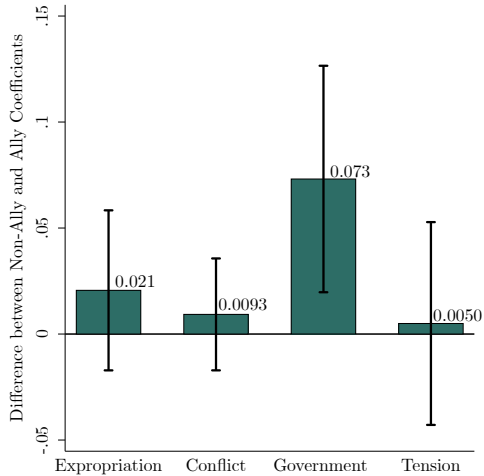
Effects driven by political risk in non-allies

Dependent Variable: log Patents	(1)	(2)	(3)	(4)	(5)	(6)
	Annual Specification			Decadal Specification		
	CoW	UN	ATOP	CoW	UN	ATOP
log $PRE^{non\text{-}allies}$, First Lag	0.033	0.018	0.018	0.035	0.063	0.024
	(0.013)	(0.009)	(0.008)	(0.012)	(0.021)	(0.009)
log PRE^{allies}, First Lag	-0.025	-0.006	-0.011	0.008	-0.001	-0.020
	(0.019)	(0.002)	(0.028)	(0.030)	(0.002)	(0.047)
Mean Dep. Var.	-0.70	-0.86	-0.82	-0.03	0.12	0.12
Observations	112853	161721	201083	19826	37778	37988
NAICS 6-digit × Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Country × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
NAICS 6-digit × Year FE	Yes	Yes	Yes	Yes	Yes	Yes

All outcomes

Sources of political risk shaped by geopolitics

- Which types of risk account for the stronger response to enemy countries?
- Some (e.g., civil war) threaten supply regardless of geopolitical ties
- Others (e.g., democratic accountability) may only threaten enemies of the regime
- FDR: "He may be a ... but he's our ..."



One mechanism: Political risk and trade-restricting policies

- One explanation: firms anticipate greater trade breakdown among non-allies
- Expected changes in policy (e.g., sanctions) would amplify innovation response
- Estimate the following specification:

$$\mathbb{I}(\text{Restrict})_{ckt} = \beta^R \log \text{PR}_{kt} \cdot \text{Enemy}_{ck} + \beta^I \log \text{PR}_{ct} \cdot \text{Enemy}_{ck} + \text{FE} + \epsilon_{ckt}$$

where $\mathbb{I}(\text{Restrict})_{ckt} = 1$ if restriction is imposed in t, by c, affecting trade with k

  - β^R: effect of risk in *receiving* country (e.g., US imposes sanctions on Risky Russia)
  - β^I: effect of risk in *imposing* country (e.g., Risky Russia restricts trade with the US)

- Trade restrictions since 2008 measured using the Global Trade Alert database

One mechanism: Political risk and trade-restricting policies

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
	Restricting Trade Policy that Affects...					
	at least 1 Product			Over 20 Products		
log $PR_{kt} \cdot Enemy_{ck}$	0.058		0.050	0.031		0.027
	(0.012)		(0.016)	(0.008)		(0.010)
log $PR_{ct} \cdot Enemy_{ck}$		0.097	0.076		0.096	0.050
		(0.014)	(0.017)		(0.008)	(0.010)
Mean Dep. Var.	0.163	0.203	0.258	0.037	0.050	0.060
Observations	439545	439545	273002	439545	439545	273002
Imposer × Receiver FE	Yes	Yes	Yes	Yes	Yes	Yes
Imposer × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Receiver × Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Innovation Reshapes the Consequences of Political Risk

Very different elasticities by innovation intensity

	(1)	(2)	(3)	(4)
	log Patents		log Fwd Citations	
Dependent Variable:	Low Innov. Markets	High Innov. Markets	Low Innov. Markets	High Innov. Markets
log PRE, First Lag	0.023	0.085	-0.006	0.107
	(0.038)	(0.035)	(0.067)	(0.049)
Mean Dep. Var.	-2.67	1.23	-2.10	1.80
Observations	134764	108785	98278	98632
NAICS 6-digit × Country FE	Yes	Yes	Yes	Yes
Country × Year FE	Yes	Yes	Yes	Yes
NAICS 6-digit × Year FE	Yes	Yes	Yes	Yes

Does endogenous innovation shape the consequences of political risk?

- So far, evidence of a large increase in innovation—especially in high-innovation markets—when trade partners become more politically risky
- Could $\searrow$ reliance on risky inputs *and* $\nearrow$ the negative effects of political risk on countries that experience it (if they are "innovated out" of the trade network)
- Ideal (impossible) experiment: compare shocks with and w/o innovation response
- Instead, estimate effect of *heterogeneous exposure* to innovative foreign markets
  - High-innovation markets are *more elastic* to foreign political risk
  - Exporters differentially exposed to foreign markets
  - Hypothesis: $\nearrow$ exposure to innovative export markets $\nearrow$ effect of PR on exports

Estimation strategy

- For each sector, measure the foreign innovation exposure (IE) as:

$$\text{IE}_{ic} = \sum_{j \neq c} \text{Exports}_{i,c \to j,t_0} \cdot \text{InnovationStock}_{ij,t_0}$$

  where the innovation stock is calculated as discounted sum of patent applications

- Main estimating equation:

$$\log \text{Exports}_{cit} = \phi(\log \text{PR}_{ct} \cdot \log \text{IE}_{ic}) + \alpha_{ic} + \delta_{tc} + \gamma_{it} + X'\Gamma + \epsilon_{cit}$$

  where i indexes sectors, c countries, and t years

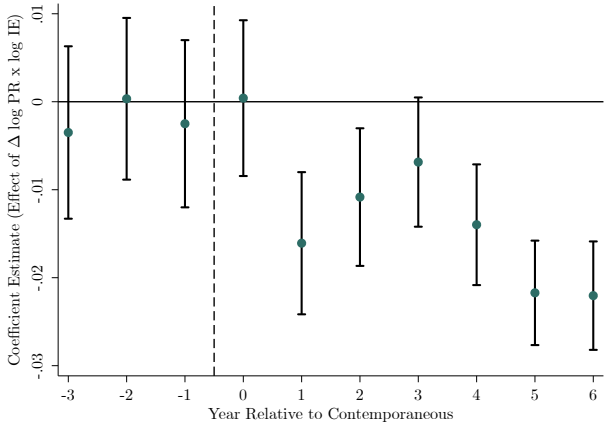
- Hypothesis: $\phi < 0 \implies$ *more negative* effect of political shock on exports when exports concentrated in innovative foreign markets

Effect of political risk on exports mediated by foreign innovation

	(1)	(2)	(3)	(4)
Dependent Variable:		log Exports		
log PR × log IE	-0.048	-0.044		
	(0.003)	(0.003)		
Δ log PR × log IE			-0.017	-0.015
			(0.003)	(0.003)
Mean Dep. Var.	7.72	7.74	7.88	7.90
Observations	1250460	1246192	1178815	1175245
NAICS 6-digit × Exporter FE	Yes	Yes	Yes	Yes
NAICS 6-digit × Year FE	Yes	Yes	Yes	Yes
Exporter × Year FE	Yes	Yes	Yes	Yes

Additional strategies: (i) controlling for destination market characteristics and (ii) exploiting differential exposure across country-sectors *and destination markets* Link

Anticipation or persistence? Effect of leads and lags



Magnitude: 5x marginal effect of political risk on exports in top vs. bottom innovation exposure—a difference larger than the median effect Link

Conclusion

- Global political risks threaten supply chains and production
- Little empirical evidence of how firms, markets, countries react to these threats
- We find technology development responds systematically to foreign political risk:
  - Both zooming in on critical minerals and across all sectors
  - Driven by firms (vs. govt) and manufacturing/energy
  - Strongest responses for political risk in adversary countries
  - Mediates effects of political turmoil on sourcing and exports
- Potential relevance to present policy debate
  - Punishing trade policy could spur foreign innovation and backfire; e.g., DeepSeek?
  - (Temporary) political turmoil can have lasting effects on competitiveness; e.g., US in defense or biotech?

Appendix

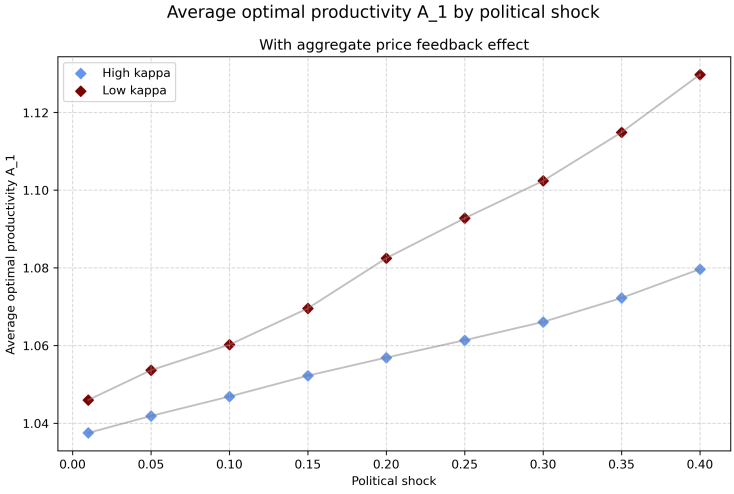
Model calibration Back

Table: Calibration summary (baseline)

Symbol	Parameter	Value
ε	elasticity of substitution between exposed and sheltered goods	2.0
η	elasticity of substitution across firms	3
κ	scale of innovation cost	10^{-4}
δ	shape of innovation cost	14
τ	foreign political shock	0.5
p	probability of foreign political shock	0.5
A_F	foreign productivity	5
w	domestic wage	1
w_F	foreign wage	1

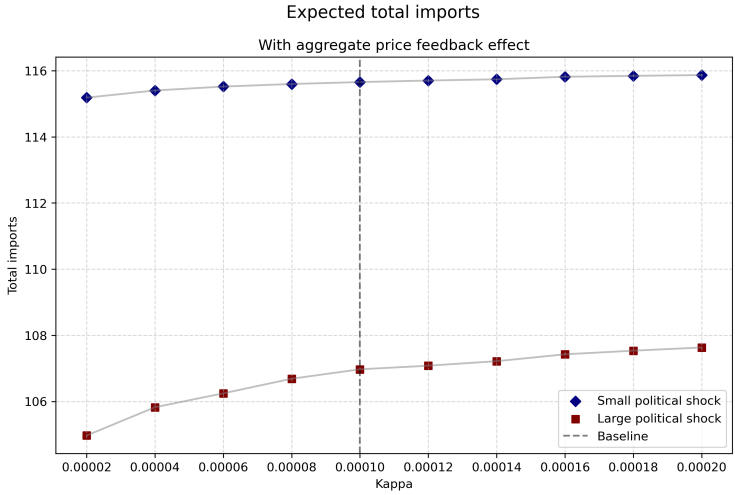
Importer innovativeness and heterogeneous effects

Back

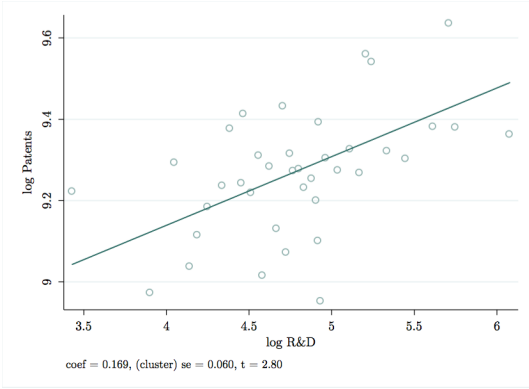


Importer innovativeness and heterogeneous effects

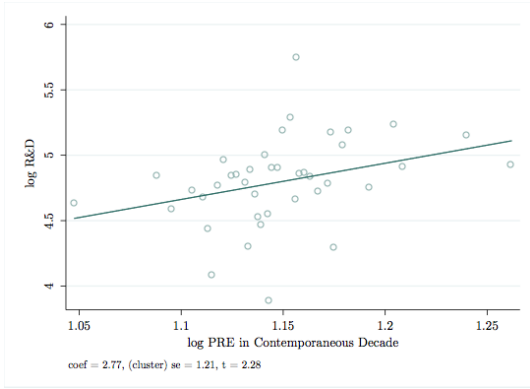
Back



R&D as innovation measure Back1 Back2



(a) Corr b/w Patents and R&D



(b) PRE and R&D

EU Critical Raw Materials policy

Back

The **revised approach** incorporates **novel methodological elements** for trade, import dependency and the actual supply mix to the EU (i.e. the actual sourcing, which is the mix of domestic production plus imports), in parallel to **substantial improvements** for substitution and recycling as risk reducing measures, resulting in the following equation:

$$\boldsymbol{SR = \left[\left(HHI_{WGI,t}\right)_{GS} \cdot \frac{IR}{2} + \left(HHI_{WGI,t}\right)_{EUsourcing}\left(1 - \frac{IR}{2}\right)\right] \cdot (1 - EoL_{RIR}) \cdot SI_{SR}}$$

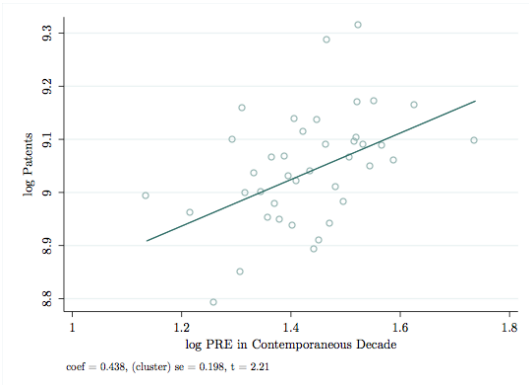
In this formula, SR stands for supply risk; HHI is the Herfindahl Hirschman Index (used as a proxy for country concentration); WGI is the scaled World Governance Index (used as a proxy for country governance); t is the trade adjustment (of WGI); IR stands for Import Reliance; GS is for global supply; $EU_{sourcing}$ is for the actual suppliers; EOL_{RIR} is the End-of-Life Recycling Input Rate; and SI_{SR} = Substitution Index (in supply risk).

In the 2010 criticality report the WGI were used to weight the supply risk (originating from country production concentration).

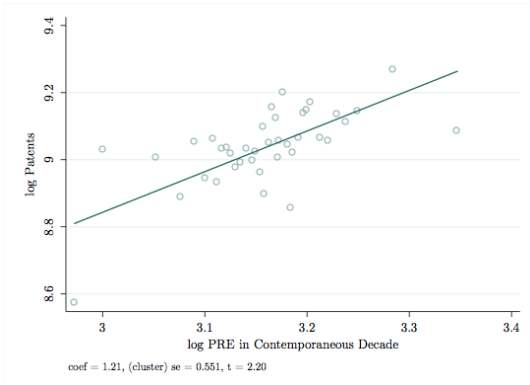
$$HHI_{WGI} = \sum_{c} (S_c)^2 WGI_c$$

where HHI_{WGI} is the Herfindahl–Hirschmann Index, considering the WGI value of the country where each material is produced; and S_c is the share of the country in world production of each material.

US estimates: alternative risk measures Back1 Back2



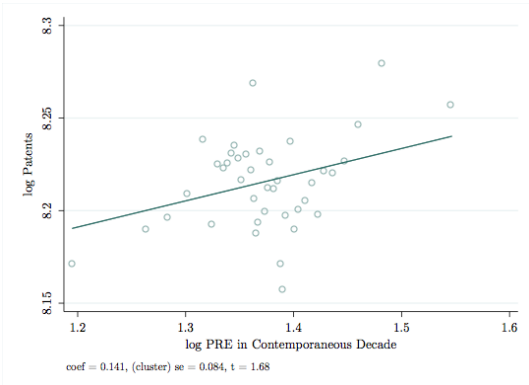
(a) Contemporaneous Import Shares



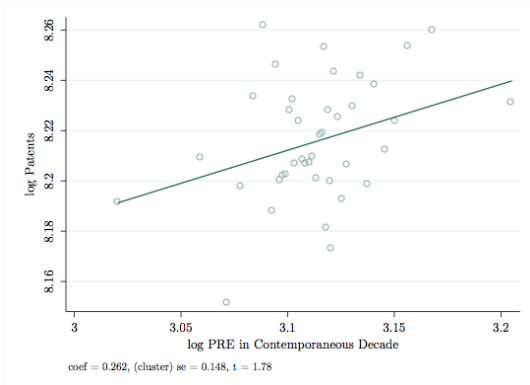
(b) Contemporaneous Import Shares, no Square

Global estimates: alternative risk measures

Back

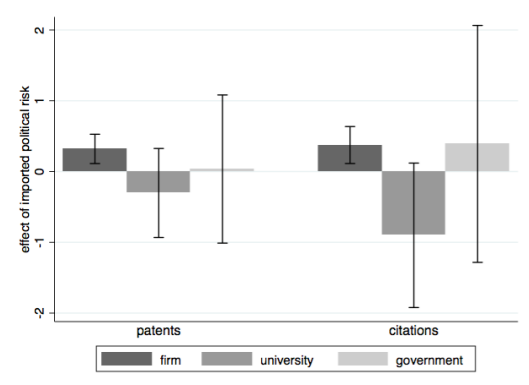


(a) Contemporaneous Import Shares

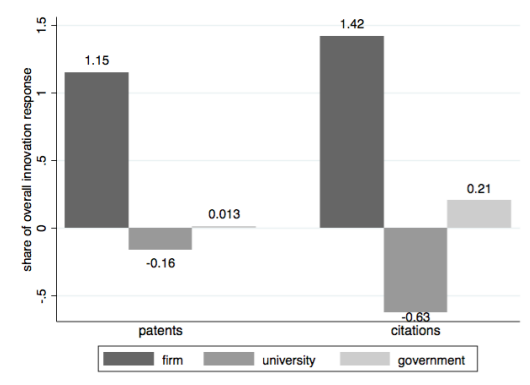


(b) Contemporaneous Import Shares, no Square

Global estimates: which inventors drive the results? Back



(a) Marginal Effects



(b) Share of Innovation Response

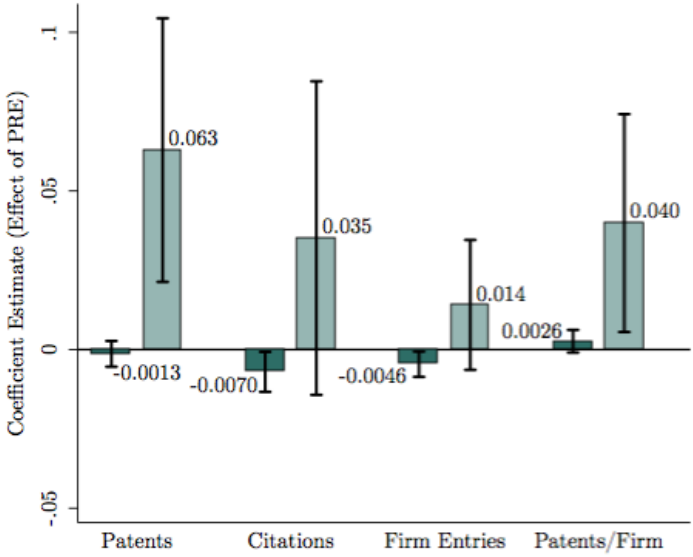
Gloabl estimates: add NAICS 2-digit × Country × Year FE

Back

Dependent Variable:	(1) log Patents	(2) log Fwd Citations	(3) log New Firms	(4) log Patents per Firm
log PRE, First Lag	0.114	0.131	0.057	0.072
	(0.032)	(0.048)	(0.019)	(0.028)
Mean Dep. Var.	-0.93	-0.043	1.73	-3.15
Observations	243549	185958	207171	240949
NAICS 2-digit × Country × Year FE	Yes	Yes	Yes	Yes
NAICS 6-digit × Country FE	Yes	Yes	Yes	Yes
Country × Year FE	Yes	Yes	Yes	Yes
NAICS 6-digit × Year FE	Yes	Yes	Yes	Yes

Use ideal point dataset to categorize friends

Back



Incentives in technology market vs. competition in goods market

- Are the findings driven by risk in the area in which firms *innovate* or *sell*?
- Both possible in the model, but latter would suggest possibility of other (un-modeled) forces (e.g., changes in foreign competition)
- Use COMPUSTAT firm-level data to test:
  - Identify "goods space" sectors (based on COMPUSTAT Naics code)
  - Identify "tech space" sectors (based on ares in which firms patent)
  - Construct separate measures of "goods space" and "tech space" risk shocks
  - Return to baseline regression specification with both as separate regressors

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Incentives in technology market vs. competition in goods market

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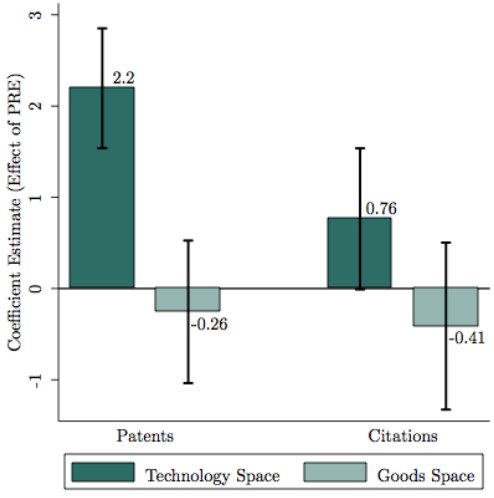

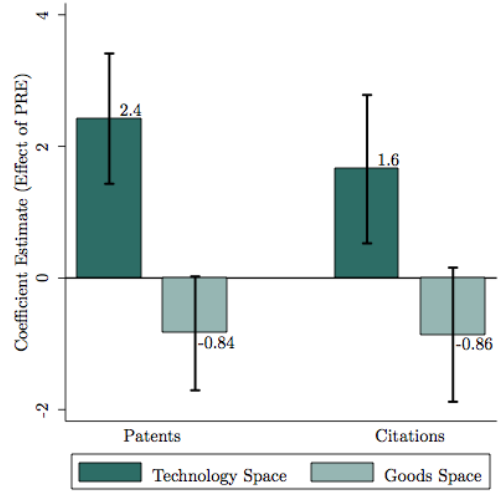

Controlling for lagged imports: global estimates

Back

Dependent Variable:	(1) log Patents	(2) log Fwd Citations	(3) log New Firms	(4) log Patents per Firm
log PRE, First Lag	0.081	0.134	0.033	0.066
	(0.033)	(0.049)	(0.019)	(0.028)
log import, First Lag	0.068	0.076	0.041	0.039
	(0.020)	(0.030)	(0.013)	(0.013)
Mean Dep. Var.	-0.92	-0.034	1.73	-3.15
Observations	242247	184974	206293	239667
NAICS 6-digit × Country FE	Yes	Yes	Yes	Yes
Country × Year FE	Yes	Yes	Yes	Yes
NAICS 6-digit × Year FE	Yes	Yes	Yes	Yes

Controlling for GDP/growth-weighted import exposure: global estimates

Dependent Variable:	(1) log Patents	(2) log Fwd Citations	(3) log New Firms	(4) log Patents per Firm
log PRE, First Lag	0.105	0.153	0.025	0.087
	(0.038)	(0.049)	(0.023)	(0.032)
Mean Dep. Var.	-0.90	-0.030	1.75	-3.14
Observations	210097	163378	179995	207847
NAICS 6-digit × Country FE	Yes	Yes	Yes	Yes
Country × Year FE	Yes	Yes	Yes	Yes
NAICS 6-digit × Year FE	Yes	Yes	Yes	Yes

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Controlling for GDP/growth-weighted import exposure

Back

Dependent Variable:	(1) log Patents	(2) Patents	(3) log Fwd Citations	(4) log Patent Value	(5) log New Firms	(6) log Patents per Firm
log PRE, First Lag	0.344	0.468	0.277	0.247	0.292	0.047
	(0.153)	(0.153)	(0.138)	(0.146)	(0.114)	(0.149)
Mean Dep. Var.	2.29	171	3.73	3.99	4.18	-2.90
Observations	13718	15213	12037	12654	13615	13708
NAICS 6-digit FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Controlling for lagged imports

Back

Dependent Variable:	(1) log Patents	(2) Patents	(3) log Fwd Citations	(4) log Patent Value	(5) log New Firms	(6) log Patents per Firm
	Panel A: Risk Measure Using Contemporaneous Imports					
log PRE, First Lag	0.299	0.275	0.207	0.310	0.044	0.231
	(0.147)	(0.126)	(0.083)	(0.147)	(0.125)	(0.092)
log HHI, First Lag	-0.034	-0.030	-0.076	0.023	0.037	-0.060
	(0.165)	(0.140)	(0.103)	(0.183)	(0.141)	(0.098)
log import, First Lag	0.130	0.135	0.111	0.112	0.016	0.129
	(0.062)	(0.044)	(0.037)	(0.072)	(0.042)	(0.068)
Mean Dep. Var.	2.31	173	3.74	4.02	4.19	-2.89
Observations	13926	15432	12092	12788	13822	13916
	Panel B: Risk Measure Using Pre-Period Imports					
log PRE, First Lag	0.390	0.462	0.312	0.301	0.306	0.082
	(0.154)	(0.152)	(0.141)	(0.150)	(0.122)	(0.156)
log import, First Lag	0.136	0.156	0.121	0.122	0.016	0.134
	(0.094)	(0.073)	(0.044)	(0.111)	(0.044)	(0.087)
Mean Dep. Var.	2.31	174	3.75	4.02	4.19	-2.89
Observations	13571	14942	11902	12518	13471	13561
NAICS 6-digit FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Firm-level heterogeneity

Back

- Theoretical prediction: effects driven by middle innovation-intensity firms (innovating for *insurance*) and potentially also high innovation-intensity firms (if *price effects* are large enough)
- Estimate seprate effects for different groups of firms:

$$y_{jt} = \beta \cdot \text{logPRE}_{i(j),t-1} + \alpha_{i(j)} + \delta_t + X'\Gamma + \epsilon_{jt}, \quad j \in p \tag{1}$$

where j indexes firms, p indexes quantiles of the pre-period patenting distribution, and X includes firm age

- β captures the effect of political risk exposure on innovation for firms in p

Falsification test: *export*-weighted political risk

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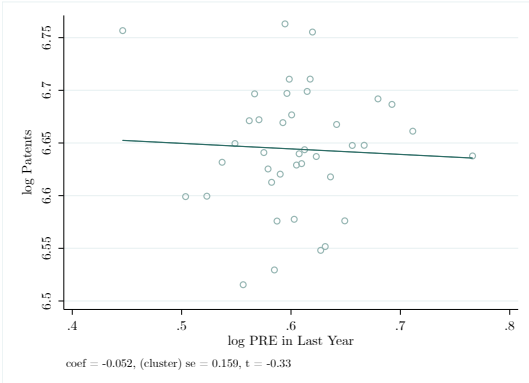
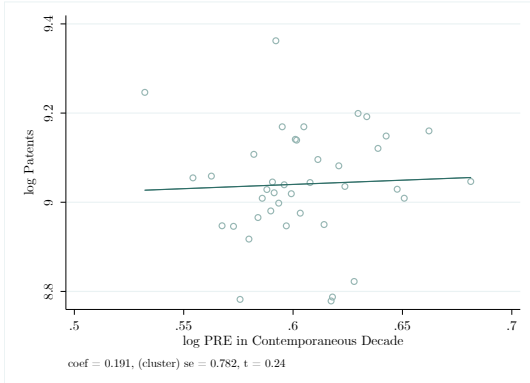


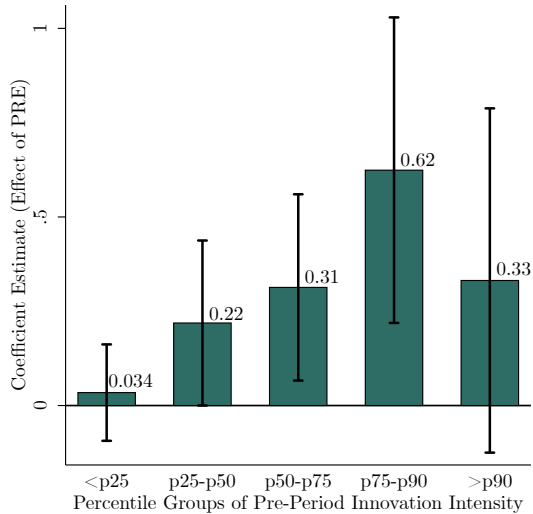
(a) Yearly Estimate



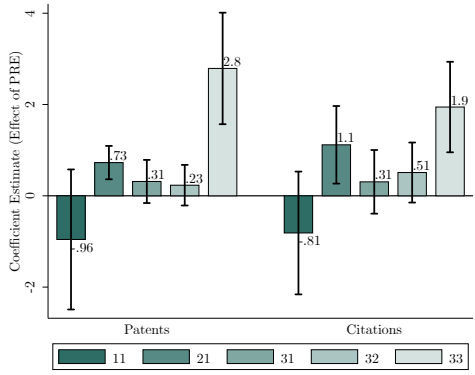
(b) Decadal Estimate

Firm-level heterogeneity

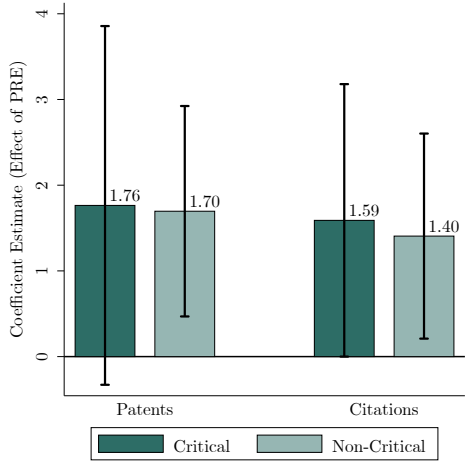
Back



Which sectors drive the results? Back

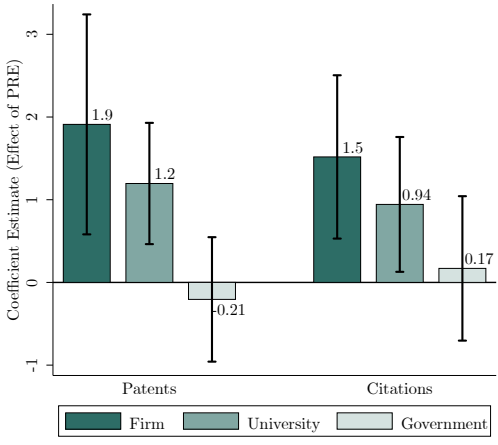


(a) 2-digit NAICS Sector

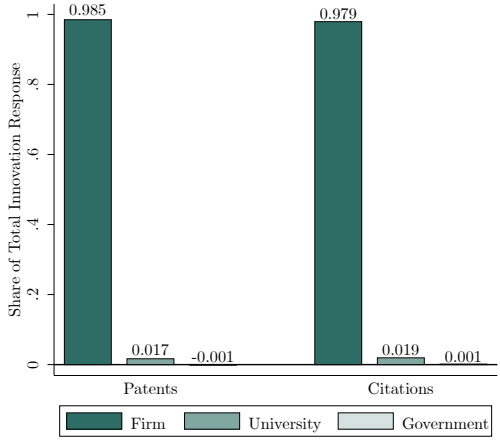


(b) Critical vs Non-Critical Sector (US ITA)

Which inventors drive the results? Back



(a) Marginal Effects



(b) Share of Innovation Response

Spillovers along the supply network

Back

- Using the US input-output tables from the Bureau of Economic Analysis, measure:

$$\begin{aligned} \text{PRE}_{it}^{\text{UP}} &= \sum_k \text{PoliticalRisk}_{kt} \cdot \Big(\sum_{u \neq i} \text{ImportShare}_{k \to c, ut_0} \cdot \frac{\text{Input}_{u \to i}}{\text{Output}_i}\Big)^2 \\ \text{PRE}_{it}^{\text{SUB}} &= \sum_k \text{PoliticalRisk}_{kt} \cdot \Big(\sum_{s \neq i} \text{ImportShare}_{k \to c, st_0} \cdot \text{Similarity}_{si}\Big)^2 \end{aligned} \tag{2}$$

where the import shares are from a fixed pre-period before 2000 and

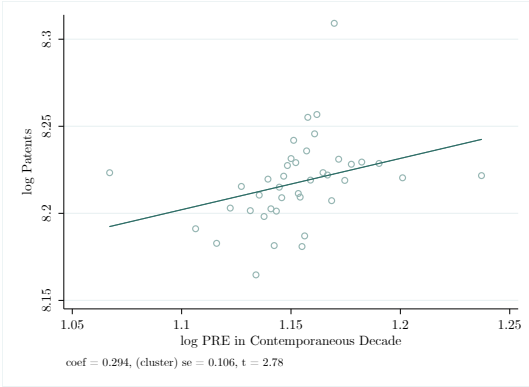
$$\text{Similarity}_{si} = \text{Cos}\big(\{\text{InputShare}_{s \to k}\}_{k \neq s,i}, \{\text{InputShare}_{i \to k}\}_{k \neq s,i}\big)$$

Spillovers along the supply network

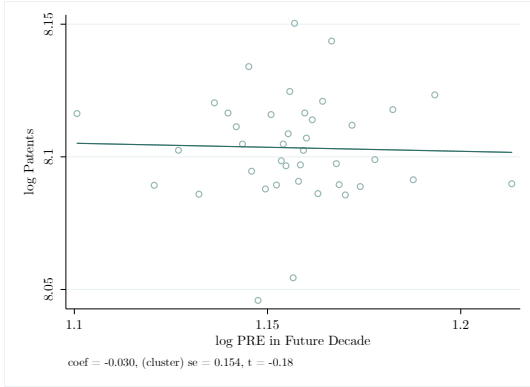
Back

	(1)	(2)	(3)	(4)
Dependent Variable:	log Patents		log Fwd Citations	
log PRE^{UP}, First Lag	0.792		0.422	
	(0.339)		(0.238)	
log PRE^{SUB}, First Lag		1.845		0.909
		(0.757)		(0.488)
Mean Dep. Var.	2.26	2.25	3.33	3.32
Observations	15071	14972	14712	14614
NAICS 6-digit FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Global estimates: decade-level results and pre-trends



(a) PRE in Contemporaneous Decade



(b) PRE in Future Decade (pre-trend)

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Effects driven by political risk in non-allies

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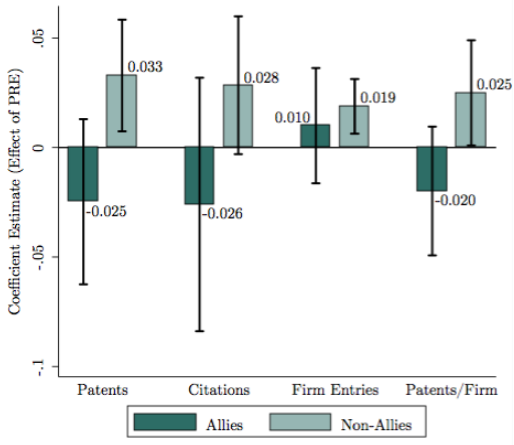
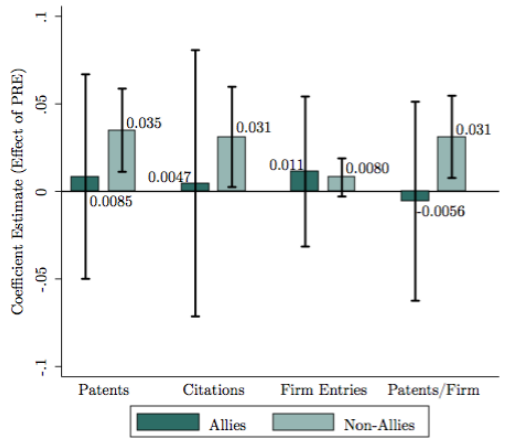


(a) Annual



(b) Decadal

Political risk, innovation, and exports: additional strategies

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- Main concern: decline in exports in sectors with high IE_{ci} driven by something other than the innovative response of foreign countries

- Two strategies to address this:

  1. Control directly for PR_{ct} interacted with *other* features of destination markets

  2. Exploit differential decline in exports not only across sectors *but also across destination markets within sectors*. Revised estimating equation:

$$\log \text{Exports}_{cjit} = \phi(PR_{ct} \cdot IE_{ji}) + \alpha_{icj} + \delta_{ctj} + \gamma_{jit} + \omega_{cit} + \epsilon_{cjit} \tag{3}$$

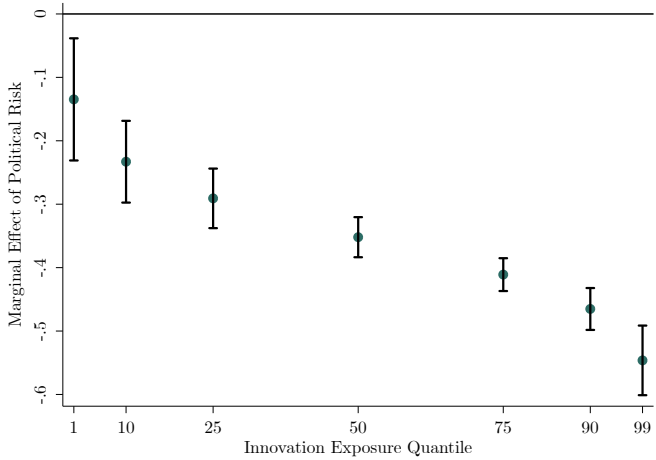
  where now k indexes destination markets and IE_{ki} is simply the pre-period innovation stock in (j, i)

Exploiting variation across destinations, within sector

Back

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	log Exports					
log PR × log IE	-0.034	-0.031	-0.033	-0.053	-0.045	-0.238
	(0.006)	(0.006)	(0.006)	(0.008)	(0.007)	(0.033)
Mean Dep. Var.	5.01	5.01	5.01	5.01	5.01	5.01
Observations	17619120	17619120	17619120	17619120	17619120	17619120
NAICS 6-digit × Exporter FE	Yes	-	Yes	-	Yes	-
NAICS 6-digit × Importer FE	Yes	Yes	-	-	Yes	-
NAICS 6-digit × Year FE	Yes	-	-	Yes	Yes	-
Exporter × Year FE	Yes	-	Yes	Yes	-	-
Importer × Year FE	Yes	Yes	-	Yes	-	-
Exporter × Importer FE	Yes	Yes	Yes	-	-	-
NAICS 6-digit × Exporter × Year FE	No	Yes	No	No	No	Yes
NAICS 6-digit × Importer × Year FE	No	No	Yes	No	No	Yes
NAICS 6-digit × Exporter × Importer FE	No	No	No	Yes	No	Yes
Exporter × Importer × Year FE	No	No	No	No	Yes	Yes

Magnitudes: effects of political shocks by innovation exposure



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