

Royal Economic Society Easter School 2024
Trade and International Economics
Trade dynamics in frictional markets

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Part I

Introduction

Motivation

- ▶ International markets are plagued with (search, information, contractual) frictions
- ▶ These frictions give rise to long-lasting relationships
- ▶ In contrast, most of the trade literature uses static models in which
 - ▶ Trade adjustments occur instantaneously
 - ▶ A large share of the adjustment involves the extensive margin
- ▶ This lecture: Trade adjustments in frictional markets

Motivation

- ▶ Shocks to global value chains have become a major policy concern during the pandemic (see WSJ and others)
 - ▶ Surge of supply disruptions / input shortages
 - ▶ Logistics issues
- ▶ Focus has then shifted to other types of risks
 - ▶ Geopolitical risks
- ▶ Major concern for policy makers (in the EU and the US)
 - ▶ 50% of aggregate trade is embodied in GVCs
 - ▶ Key channel for the international transmission of shocks
 - ▶ How to design resilient and secure GVCs?

Roadmap

- ▶ Uncertainty in frictional product markets (Martin et al, 2023)
 - ▶ Uncertainty affects investment decisions
 - ▶ Thus trade at the extensive margin
 - ▶ Especially in more frictional markets
- ▶ Shocks in rigid value chains (Lafrogne-Joussier et al, 2022)
 - ▶ Evidence from natural experiments
 - ▶ Determinants of supply chain resilience
- ▶ Normative insights

Part II

Uncertainty in frictional good markets

Theoretical framework

- ▶ Consider a seller-buyer relationship characterized by a quality-adjusted price p
- ▶ Buyer maximizes the net present value of the stream of future profits

$$V(p, I) \quad (V'_p < 0, \quad V'_I > 0)$$

- ▶ Aggregate demand I is distributed according to the conditional pdf $g(I_{t+1}|I_t)$
- ▶ Buyer receives outside offers drawn in a cdf $H_P(p')$ with probability λ
- ▶ Buyer decides to switch iif:

$$V(p', I_t) - V(p, I_t) > C(\gamma; p)$$

$C(\gamma; p)$ a sunk switching cost ($C'_\gamma > 0$, $C(1; p) = 0$)

Theoretical predictions

1. Expected duration of a buyer-seller relationship:

$$\mathbb{E}[\mathcal{D}|p] = \frac{1}{\lambda H_P(p^*(\gamma, g; p, l))}$$

with $p^*(\gamma, g; p, l)$ the reservation price ($\frac{\partial p^*(\gamma, p)}{\partial \gamma} < 0$)

- ⇒ Conditional on the quality of the match, more frictions (a lower λ) and a larger switching cost (a high $C(\gamma; p)$) shift the distribution of durations towards “stickier” relationships

Theoretical predictions

2. More uncertainty in l shifts the distribution of durations up, along the distribution of stickiness
3. A positive uncertainty shock pushes $p^*(\gamma, g; p, l)$ down, thus reducing the switching probability on impact, more so in stickier product markets

⇒ **More uncertainty mutes trade adjustments**

	Stickiness		
	None	Medium	High
Switching probability			
Before	.060	.029	.017
After	.060	.025	.008
Change (%)	-0	-14	-53

Sources: Martin et al (2023). The table shows the probability of a switch in a simulated population of firms, before and after a positive uncertainty shock

Data & Empirical Strategy

Data:

- ▶ Firm-to-firm export data over 1996-2010, EU12
- ▶ “World Uncertainty Index” from Ahir et al. (2019) at the country and quarterly levels

Empirical Strategy:

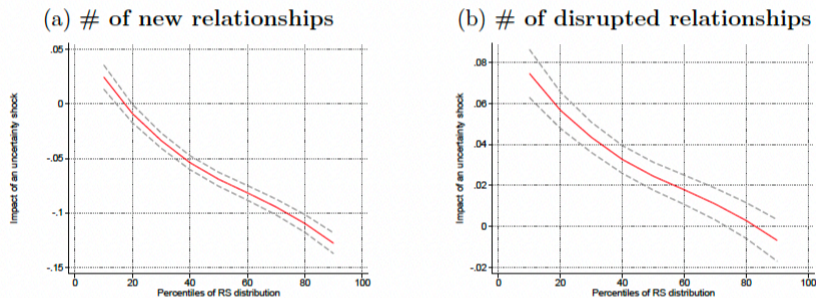
1. Estimate the degree of stickiness from the distribution of durations, at the (hs6) product level (RS_p)
2. Reduced-form estimate:

$$E(X_{pct} | Uncert_{ct}, RS_p, FE) = \exp(\alpha Uncert_{ct} + \beta RS_p + \gamma RS_p \times Uncert_{ct} + FE),$$

X_{pct} is either the count of new seller-buyer relationships or the count of terminated relationships in a specific market (product \times destination) at a given point in time.

Extensive margin impact of uncertainty shocks

Figure 2: *Impact of an uncertainty shock along the distribution of RS*



Notes: This figure illustrates the percentage-point impact of an uncertainty shock on the number of new firm-to-firm relationships (panel a) and the number of disrupted firm-to-firm relationships (panel b). The results are obtained from the estimations in Table 5, specifically column (1) for panel (a) and column (5) for panel (b).

Sources: Martin et al (2023).

Trade adjustments to uncertainty shocks

- ▶ A one sd uncertainty shock leads to a .11 pp reduction in trade growth (to be compared with -.15 pp for a shock to GDP growth)
 - ▶ Impact of uncertainty shocks mostly driven by the extensive margin (\neq growth shock)
 - ▶ Extensive margin adjustments vary depending on the degree of stickiness
- ⇒ Rigid structure of frictional product markets

Part III

Building resilient GVCs?
Evidence from natural experiments

Insights from the theoretical literature

- ▶ See, among others, Acemoglu et al (2015), Baqaee & Farhi (2019), Elliott et al (2022)
- ▶ In production networks, localized shocks propagate
 - ▶ Downstream, through input prices
 - ▶ Upstream, through input demands
 - ▶ Horizontally, through complementarities
- ▶ Size of the propagation depends on
 - ▶ Centrality of the treated firm (Domar weight)
 - ▶ Elasticity of substitution between inputs (**Stickiness**)

Empirical Literature

- ▶ Empirical literature has mostly exploited natural experiments
- ▶ Tohoku Earthquake:
 - ▶ Carvalho et al (2021): Transmission across Japanese regions, along production networks
 - ▶ Boehm et al (2019): Evidence of an international transmission within multinational companies
- ▶ Covid-related supply chain disruptions
 - ▶ **Lafrogne-Joussier et al (2022)**: Impact of the early lockdown in China through GVCs
 - ▶ Khanna et al (2023): Transmission of strict lockdown policies across Indian states, along the value chain
- ▶ Extreme weather events
 - ▶ Barrot & Sauvagnat (2016): Extreme weather events in the US
 - ▶ Balboni et al (2023): Floods in Pakistan

Data & Empirical Strategy

Data:

- ▶ French customs + VAT statements, 2019-2020, Monthly, Firm
(×Product×Country)

Sample:

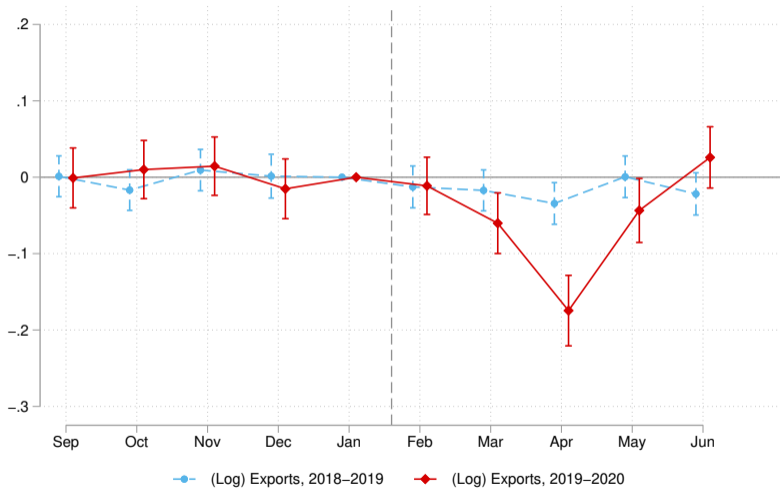
- ▶ “Firms in GVCs” before the shock, meaning:
 - ▶ Import intermediates *and* export
 - ▶ Between Sep. 2019 and Jan. 2020
- ▶ Treatment and Control groups:
 - ▶ **importing from China** before the shock (N=14,880)
 - ▶ **importing from elsewhere** before the shock (N=18,603)

Summary Stat

Empirical specification:

$$Y_{ft} = \sum_{\substack{l=-4 \\ l \neq 0}}^5 \beta^l \mathbb{1}_{\{Treated_f=1\}} \times \mathbb{1}_{\{t=l\}} + \theta_f + \delta_t + \varepsilon_{ft}$$

Impact on firm-level exports



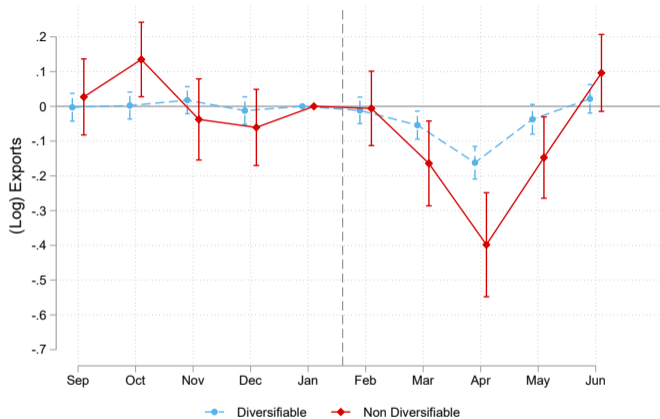
Notes: Standard errors are clustered at the firm-level. Confidence intervals at 5%.

Differences-in-difference results

	Dep. Var: log of					
	Imports		Exports		Dom sales	Export price
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment × Post	-0.074 ^a	-0.074 ^a	-0.050 ^a	-0.035 ^a	-0.055 ^a	-0.007 ^a
	(0.010)	(0.006)	(0.011)	(0.005)	(0.007)	(0.002)
Firm FE	Yes	× Product	Yes	× Product	Yes	× Product
Time FE	Yes	× Product	Yes	No	Yes	No
Product×Destination×Period				Yes		Yes
# Treated	12,086	10,852	12,086	11,542	12,086	11,542
# Control	13,563	24,174	13,563	13,566	13,563	13,566
R ²	0.857	0.869	0.856	0.735	0.901	0.864
# Obs.	211,818	2,196,743	202,622	6,712,916	236,121	6,344,742

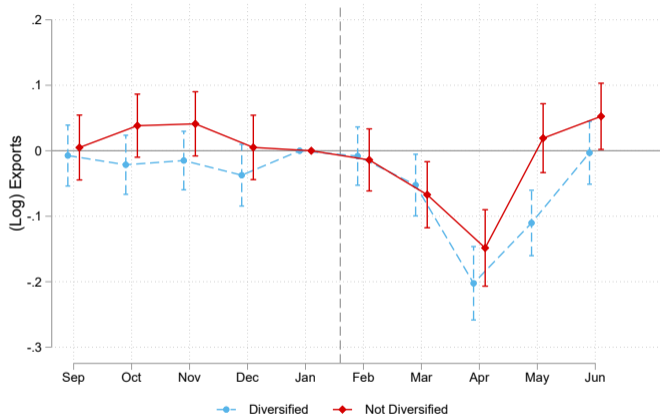
Notes: Note: DiD on data from September 2019 to June 2020. Standard errors clustered at the firm-level

Role of the concentration on the supply-side



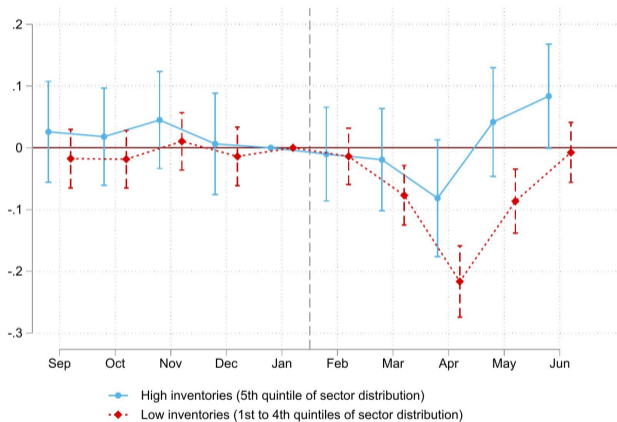
Notes: The “Non Diversifiable” group is composed of firms which imports from China include at least 10% on products for which China represents more than 60% of world exports. Standard errors are clustered at the firm-level. Confidence intervals are defined at 5%.

Diversification of value chains?



Notes: “Diversified” firms have their main inputs imported from China also sourced from at least one origin in the pre-period. Standard errors clustered at the firm-level. Confidence intervals are defined at 5%. Ex-ante vs ex-post diversification

Inventories as a buffer



Notes: High inventory firms have a ratio of inventories over sales falling in the fifth quintile of the firm's sector-specific distribution. Standard errors are clustered at the firm-level. Confidence intervals are defined at 5%.

Part IV

Building resilient GVCs?
Normative insights

Taking stock

- ▶ Shocks to sticky firm-to-firm relationships can have sizeable economic (and geopolitical) consequences
- ▶ “Resilience” of GVCs has become a policy objective
- ▶ “New” policy objective calls for new instruments
- ▶ Efficiency-resilience trade-off

Market failures

- ▶ Design of resilience policies requires to identify the relevant market failures
- ▶ Non-exhaustive list of candidates (Mejean & Rousseaux, 2023)
 - ▶ Concentration gives rise to non-diversified risks (Acemoglu et al, 2012, di Giovanni et al, 2023)
 - ▶ Suboptimal investment in resilience under network externalities (Grossman et al, 2023)
 - ▶ Information frictions limit firms' capacity to comprehend their risk exposure, beyond their immediate suppliers (Bui et al, 2022)
 - ▶ Potential divergence between the private and social assessments of the risk-efficiency trade-off (Baldwin & Freeman, 2021)
 - ▶ Potential divergence between economic and geopolitical interests (Thoenig, 2023)

Network Externality: Grossman, Helpman & Sabal (2023)

- ▶ Resilience of supply chains is the result of forward-looking investments by firms
- ▶ These investments confer externalities on other firms in the production network
- ▶ These investments may also affect the firm's bargaining power
- ▶ Decentralized equilibrium may thus feature inefficiently low / high investments at various points of the value chain
- ▶ Can implement the first-best allocation using a combination of subsidies to input purchases, network formation and investment in resilience
- ▶ First-best is implementable: Policies only depend on local production function parameters

Questions? Comments?
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Shortages in the news



TECH

The global chip shortage is starting to have major real-world consequences

PUBLISHED FRI, MAY 7 2021-3:40 AM EDT | UPDATED MON, MAY 17 2021-8:52 PM EDT

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BUSINESS

Everywhere You Look, the Global Supply Chain Is a Mess

Winter storms and crammed ports in the U.S. add to disruptions of production and supplies during the pandemic

Back

Resilience in the political agenda

- ▶ Executive Order on America's Supply Chains, 02/24/2021: *"The United States needs resilient, diverse, and secure supply chains to ensure our economic prosperity and national security. Pandemics and other biological threats, cyber-attacks, climate shocks and extreme weather events, terrorist attacks, geopolitical and economic competition, and other conditions can reduce critical manufacturing capacity and the availability and integrity of critical goods, products, and services. Resilient American supply chains will revitalize and rebuild domestic manufacturing capacity, maintain America's competitive edge in research and development, and create well-paying jobs."*
- ▶ France Relance: *"The France of 2030 will have to be more independent, more competitive, more attractive. It is about no longer depending on others for essential goods, no longer risking critical supply disruptions."* (600 million euros for "securing critical supplies")

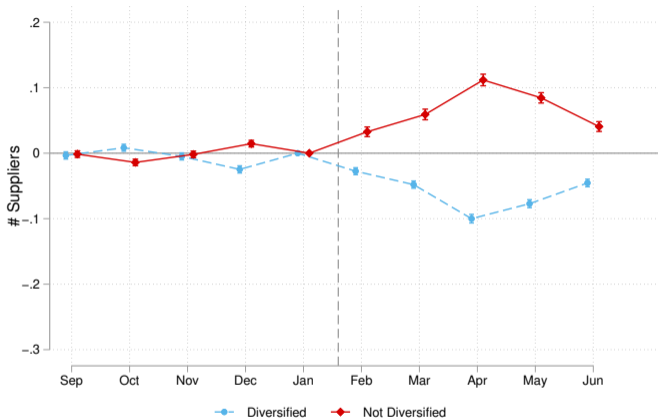
Summary Statistics on the Estimation Sample

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	Nb. of firms	Avg. Imports Exports (M euro)		% of aggregate Imports Exports	
All firms	33,483	6.87	13.3	89.5	91.6
Importers from					
China	14,880	10.4	21.7	61.0	66.1
Elsewhere	18,603	3.9	6.7	28.6	25.4
Monthly importers from					
China	4,495	20.3	41.8	36.0	38.6
Elsewhere	10,387	6.7	9.8	27.3	20.9

Source: French customs, import and export files. The summary statistics are computed on firms both importing and exporting between September 2019 and January 2020. Statistics on imports are about intermediate goods.

Ex-ante versus ex-post diversification



Notes: Diversified firms have their main inputs imported from China also sourced from at least one origin. The outcome is the (log-) number of countries the firm sources the product from. Standard errors clustered at the firm \times product-level. Confidence intervals are defined at 5%. [Back](#)

Network Externality: Theoretical framework

- ▶ Vertical supply chain with multiple tiers S
- ▶ At each tier (but tier 0), production involves labor and inputs sourced from tier $s - 1$
- ▶ Each firm has a non-zero probability of disruption (zero production for one period)
- ▶ Each firm can invest into
 - ▶ its “resilience” (\downarrow disruption probability) and
 - ▶ its “redundancy” / “diversification” (\uparrow thickness of their network)
- ▶ At each seller-buyer pair, there is cooperative bargaining (Nash-in-Nash)
- ▶ Bargaining equilibrium imposes a sequence of bargainings, from the most downstream to the most upstream firms

Network Externality: Private and social incentives

- ▶ Equilibrium price is a markup over the marginal cost of inputs (= production costs of upstream firms), with the markup reflecting the relative bargaining weights of the firms and the substitutability between inputs
- ▶ Investment in resilience / in diversification confers a positive externality on downstream suppliers → Underinvestment
- ▶ These externalities then spillover to upstream and downstream firms along the supply chain while having a negative impact (through competition) on firms in other networks

Network Externality: Implementing the planner's problem

- ▶ Implementing the first-best allocation requires three instruments
 1. Subsidies / taxes on F2F transactions
 - ▶ Counteract the effect of the markup on marginal cost
 2. Subsidies / taxes on resilience investment
 - ▶ Reflect two offsetting considerations
 - ▶ Positive externality on downstream suppliers
 - ▶ Impact of the transaction subsidies on the profitability of resilience investments
 3. Subsidies / taxes on investment in supplier relationships
 - ▶ Same as those for resilience
 - ▶ Despite the impact on bargaining
- ▶ When subsidies optimally tackle distortive markups, all positive and negative spillovers of resilience investment to firms that are not direct suppliers concal in the GE
- ▶ Also solve for the second-best in the absence of transaction subsidies