Trade policy on a buyer-seller network

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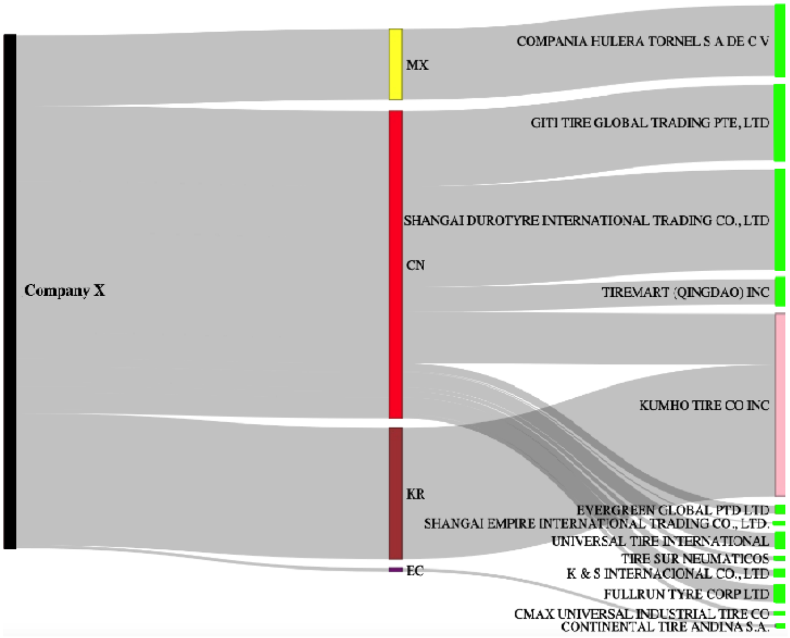
June 15, 2023

- What are the allocation and price effects of trade policy?
  - ▷ Renewed interest due to the US-China trade war
  - ▷ Tariffs imposed to China $\longrightarrow$ Change source country to avoid tariffs
    - "There is no reason for the U.S. Consumer to pay the Tariffs, [...] if you by buy from a non-Tariffed Country [...]" tweeted by @realDonaldTrump, May 13th 2019
    - Early 2018: Tariffs on US$ 50 billion. Trade diversion of US$ 21 billion (Nicita 2019, Beckers and Schroeter 2020)

- This paper studies the importance of the matching structure of importers with suppliers for the magnitude of the reallocation
  - ▷ How?: Colombia's floor price restrictions on Chinese truck tires imports
    - Importers procure either only from china or simultaneously from many origins
    - Suppliers either multinational or single-country
  - ▷ Findings: Matches with multinational suppliers significantly boost reallocation


Company X
MX
CN
KR
EC
COMPANIA HULERA TORNEL S A DE C V
GITI TIRE GLOBAL TRADING PTE, LTD
SHANGAI DUROTYRE INTERNATIONAL TRADING CO., LTD
TIREMART (QINGDAO) INC
KUMHO TIRE CO INC
EVERGREEN GLOBAL PTD LTD
SHANGAI EMPIRE INTERNATIONAL TRADING CO., LTD.
UNIVERSAL TIRE INTERNATIONAL
TIRE SUR NEUMATICOS
K & S INTERNACIONAL CO., LTD
FULLRUN TYRE CORP LTD
CMAX UNIVERSAL INDUSTRIAL TIRE CO
CONTINENTAL TIRE ANDINA S.A.

Related Literature

- **Tariff pass-through**: Amiti et al 2019, Fajgelbaum et al 2020, Cavallo et al 2021
- **Trade reallocation/Tariff-jumping**: Blonigen 2002, Flaaen et al 2019, Blanchard et al 2021, Benguria and Saffie 2023, Fajgelbaum et al 2023

Contributions

1. Add variation in multinational production activity
2. Shed light on heterogeneity underlying conventional reallocation patterns
    - Stylized facts
    - Model: Reallocation channels' decomposition, counterfactual networks

I use two data sources to conduct my analysis :

- Colombian Customs data which identifies
  - Importing firm
  - Foreign supplier
  - Country of manufacture
  - Quantity
  - Value (inclusive of duty)
- Global tire reports from TIREBUSINESS.COM which contain
  - Worldwide production facilities
  - Ownership

▷ Combining these datasets I can identify Colombian importers that source from single-country producers, as well as from multinational producers with plants in different countries.

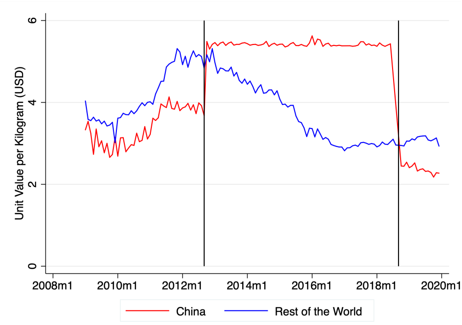
- Case Study: Enactment and ending of Colombia's **antidumping** policy against China for **truck tires**

Fact 1: The policy materializes as a binding price floor

Fact 2: This generates reallocation away from china, towards competing countries

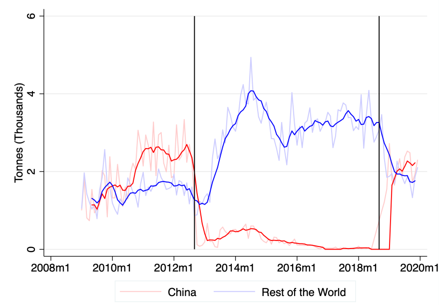
Colombian Imports of Truck Tires, by Origin

Average **Price**



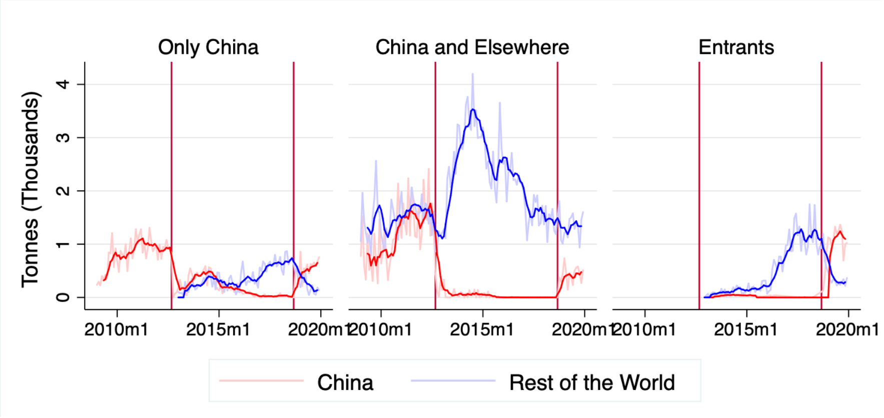
Car Tire Prices

Total **Volume**



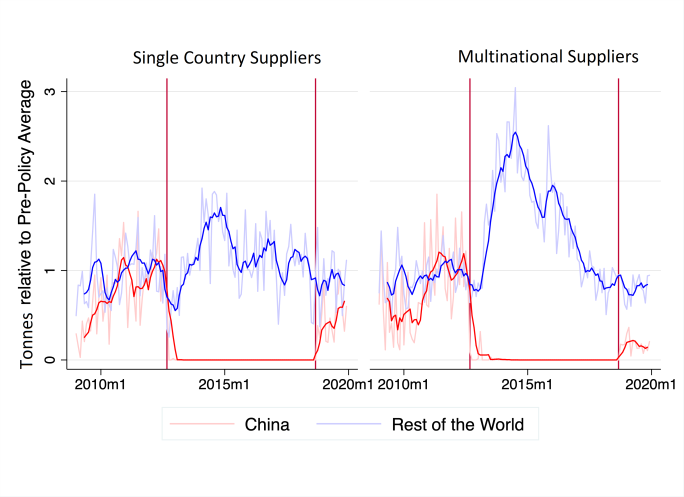
Totals

Fact 3: Importers that prior to the policy procured from multiple origins (China and Elsewhere) exhibit more reallocation



Totals Large & Small

Fact 4: Imports procured from rest of the world exhibit a larger increase for matches with multinational suppliers



Totals Large & Small

- Nested structure of product differentiation
  - ▷ Varieties are defined by the tuple *importer* × *supplier* × *origin* (indexed *ijo*). Assumptions
  - ▷ Three CES layers with elasticity parameters σ, ρ, κ Structure

$$y_{ijo} = a_{ijo}\ p_{ijo}^{-\kappa}\ p_{ij}^{\kappa-\rho}\ P_i^{\rho-\sigma}\ P^{\sigma-1}\ YP$$

where

- y_{ijo} and p_{ijo} are import quantity and price of variety *ijo*
- p_{ij}, P_i, P are price indexes, YP is aggregate expenditure

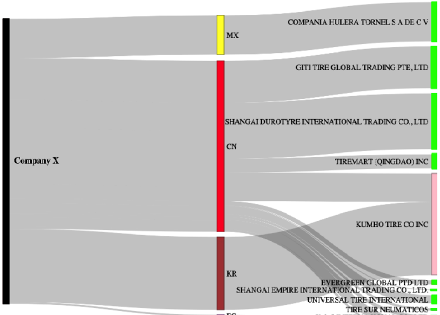
Model implications for international reallocation elasticities

$$y_{ijo} = a_{ijo}\ p_{ijo}^{-\kappa}\ p_{ij}^{\kappa-\rho}\ P_i^{\rho-\sigma}\ P^{\sigma-1}\ YP$$

- the elasticity of variety ω from korea w.r.t a price change by ω' from china is:

$$\begin{aligned} \mathcal{N}_{\omega\omega'} = &\ (\sigma-1)\ \mathbb{S}_{\omega'} S_{\omega'} s_{\omega'} && \text{Substitution from standard trade models} \\ &+ (\rho-\sigma)\ S_{\omega'} s_{\omega'}\ \mathbb{I}(i=i') && \text{importer initially in korea and china} \\ &+ (\kappa-\rho)\ s_{\omega'}\ \mathbb{I}(i=i', j=j') && \text{supplier initially in korea and china} \end{aligned}$$

where $\mathbb{S}$, S and s are shares within each nest and $\mathbb{I}(\cdot)$ is an indicator



Model implications for international reallocation elasticities

$$y_{ijo} = a_{ijo} \; p_{ijo}^{-\kappa} \; p_{ij}^{\kappa-\rho} \; P_i^{\rho-\sigma} \; P^{\sigma-1} \; UP$$

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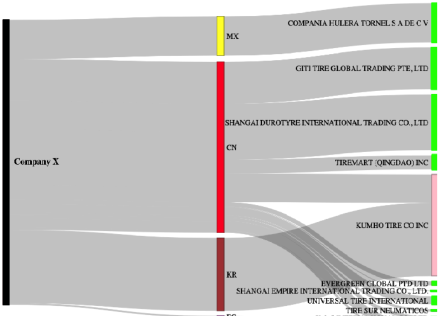

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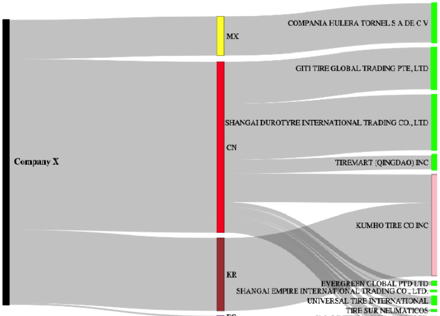

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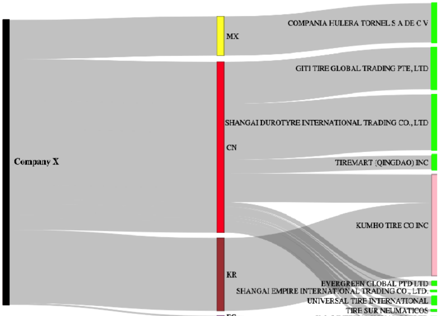


Following the model we can write

$$\Delta \ln y_{ijo} = (\sigma - 1)\Delta \ln P + (\rho - \sigma)\Delta \ln P_i + (\kappa - \rho)\Delta \ln p_{ij} - \kappa\, \Delta \ln p_{ijo} + \Delta \ln PY + \Delta \ln a_{ijo}$$

- The policy induces a minimum price jump that every Chinese variety must abide
- I use the GAP between pre-policy prices and price floor as instrument for price changes:

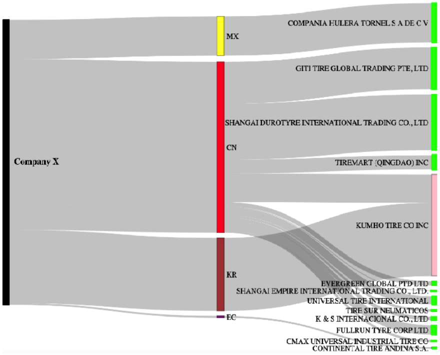
$$GAP = \begin{cases} ln(5.37) - ln(p_{ijo}^{pre}) & \text{for Chinese varieties with } p_{ijo}^{pre} < 5.37. \\ 0 & \text{for other Chinese varieties} \\ 0 & \text{for non-Chinese varieties} \end{cases}$$

- Same instrument as Card and Krueger (1994) for minimum wage in fast food industry in New Jersey vs Pennsyvania

Estimation Details

Channels for volume increase in rest of the world

	Standard substitution	Importer procures from many origins	Supplier is multinational	Frequency
Multinational	23%	28%	49%	16
Single-Country	59%	41%	-	40
Aggregate	35%	32.5%	32.5%	56



- The baseline results show the reallocation through the observed network.
- Counterfactual 1: Split multinational suppliers into additional single-country suppliers
- Counterfactual 2: CTF 1 + Split importers that procure from many origins

	Relocation Percentage	Change in Average Price
Baseline	75%	9%
Network without Multinational Suppliers (MS)	58.7%	17%
Network w/neither MS nor simultaneous sourcing	47.4%	21%

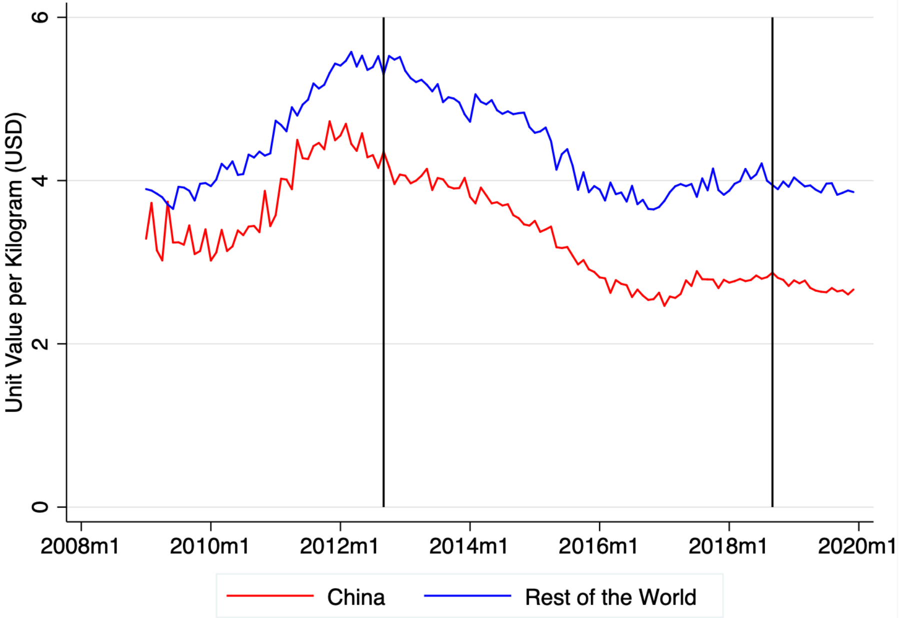
Conclusion

- Policy induces reallocation of imports away from China
- This paper studied the importance of the matching structure of importers with suppliers for the magnitude of the reallocation
- This matching generates heterogeneous degrees of international participation, which are modeled in a quantitative trade model
  - Estimating equation for the international reallocation elasticities
  - Obtain elasticities in a case study with a price floor policy
- Contributions:
  - Shed light on heterogeneous response to policy
  - Quantify the additional elasticity of reallocation for multinationals
  - Assess policy effects with alternative networks

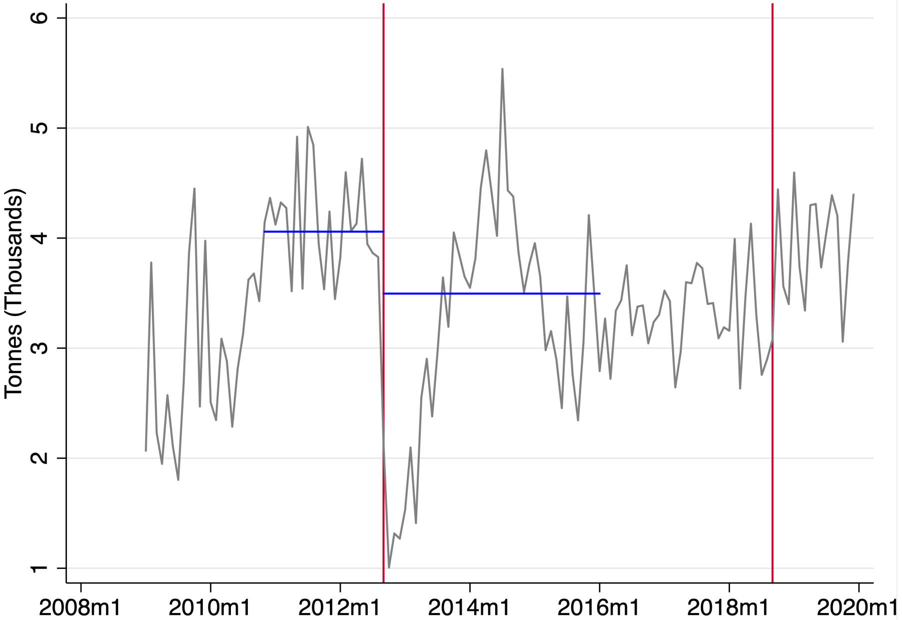
Data: Summary Statistics

Type of match	China			Rest of the World		
	Freq.	Price	Quantity (MM)	Freq.	Price	Quantity (MM)
Multinational	16	4.12	0.395	16	4.81	0.994
		(0.54)	(0.419)		(0.37)	(1.013)
Single-Country	79	3.76	0.211	40	4.53	0.602
		(0.36)	(0.297)		(0.77)	(1.171)
Importer procures single origin	42	3.75	0.108	-	-	-
		(0.53)	(0.174)			

Passenger car tires prices



FACT 2: TOTALS



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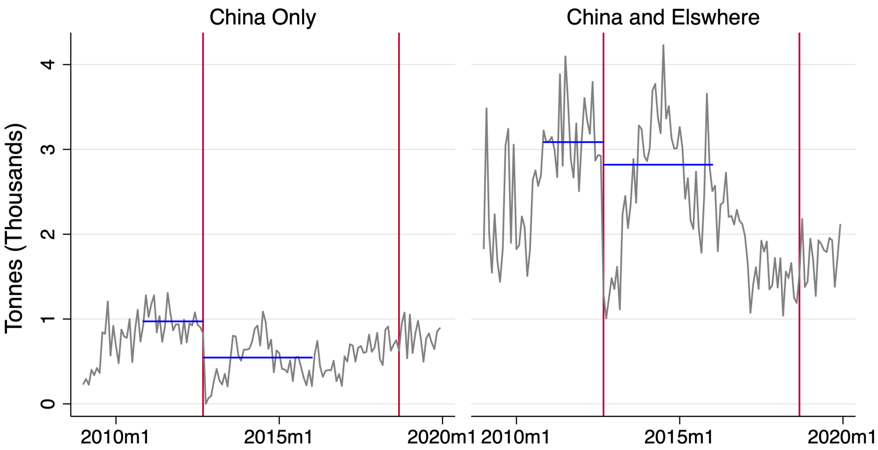
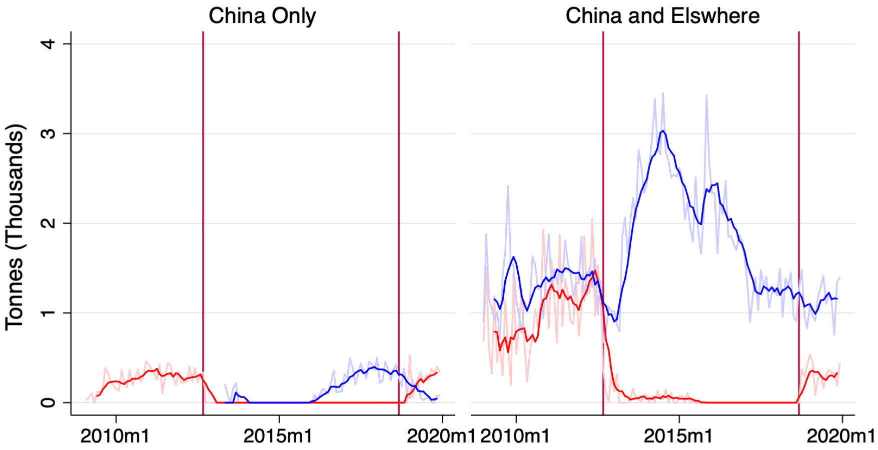


FACT 3: Large importers



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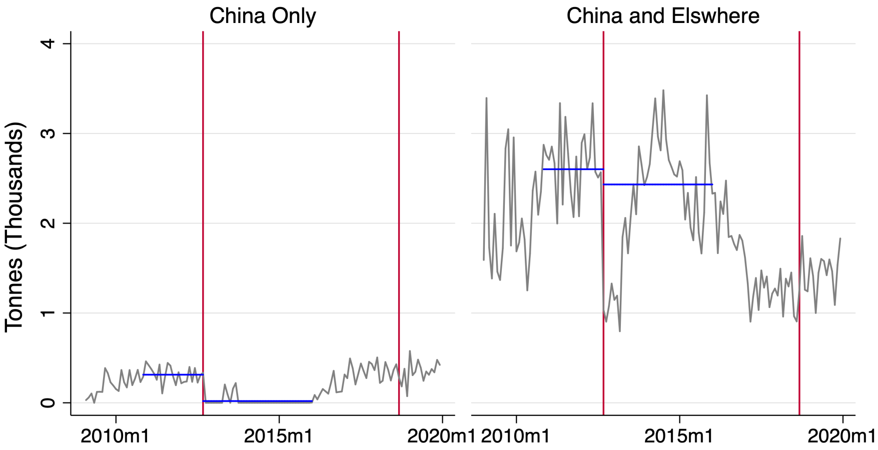

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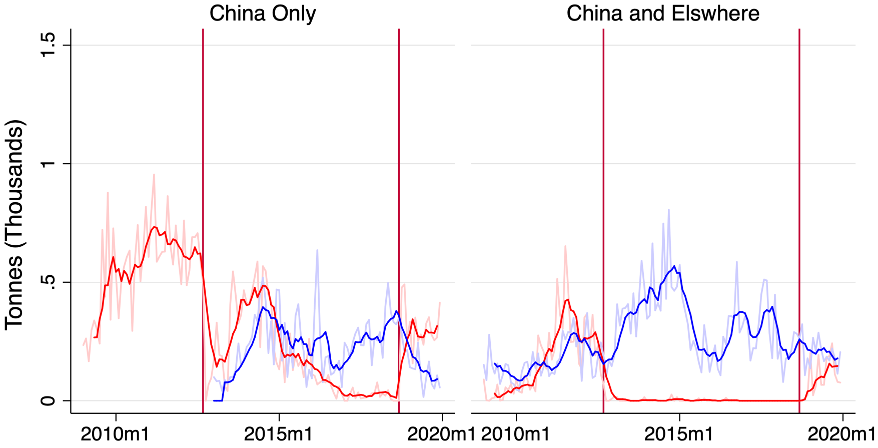

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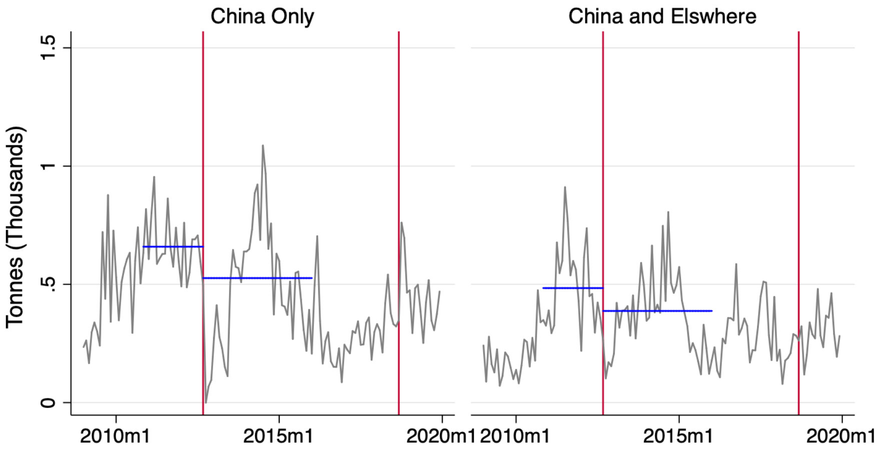
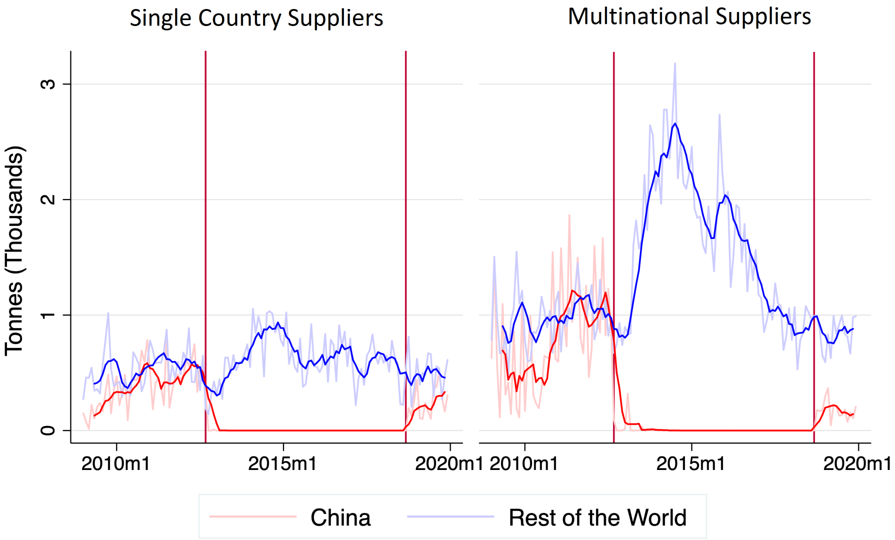


FACT 4: Levels



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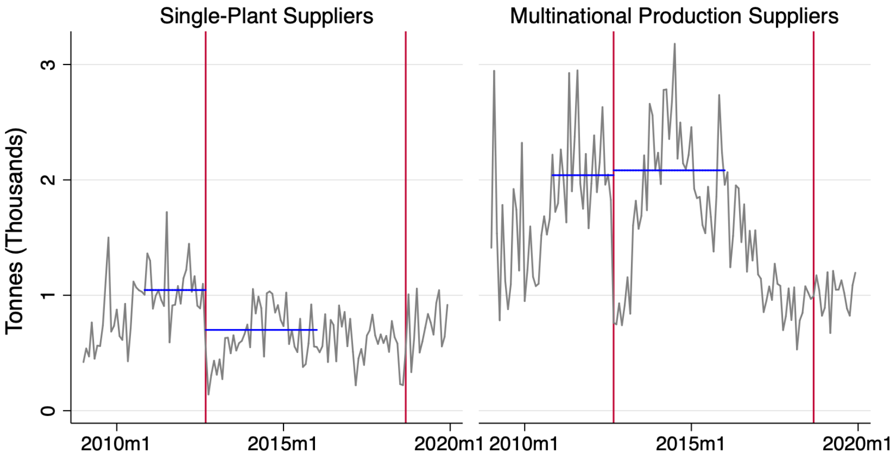

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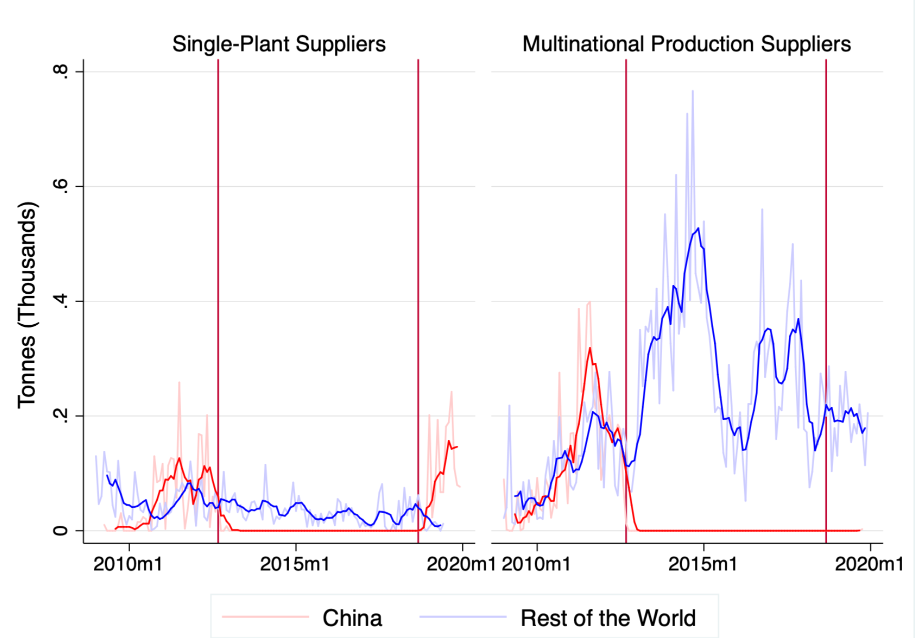

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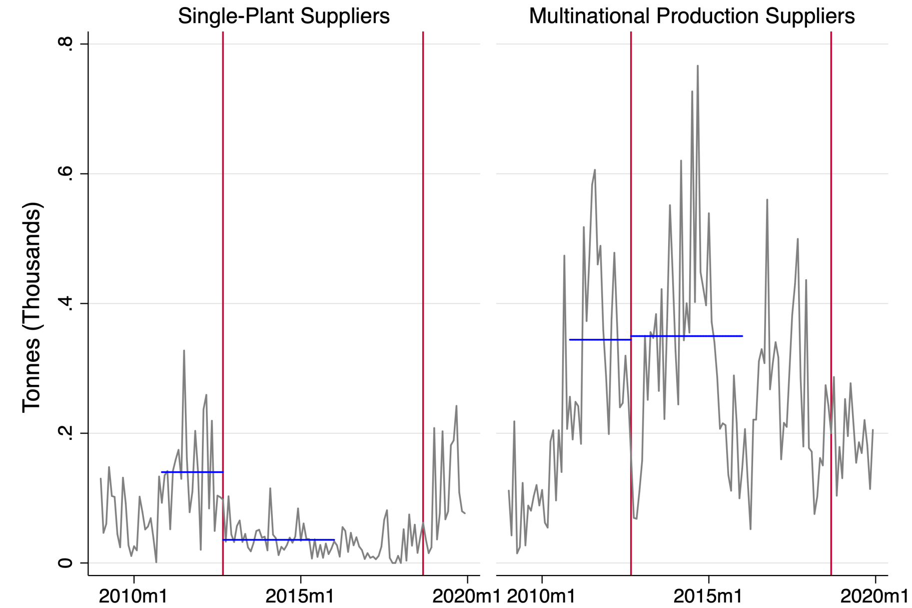

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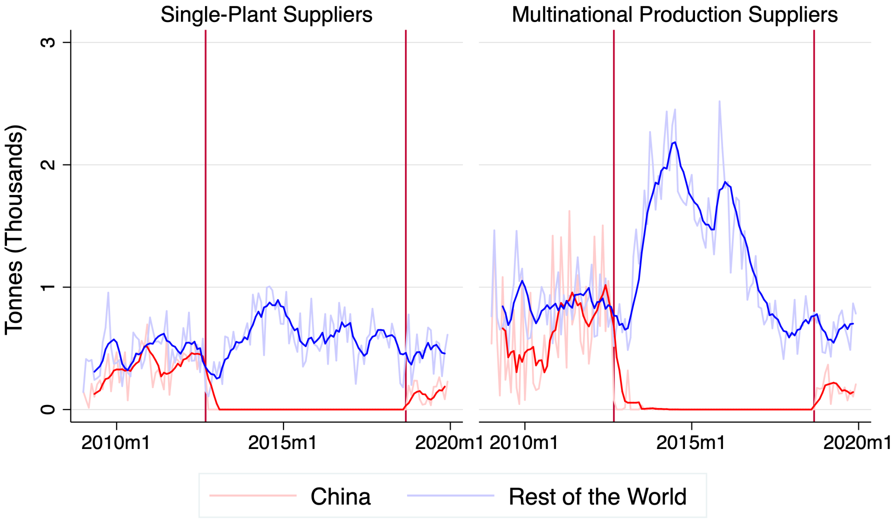
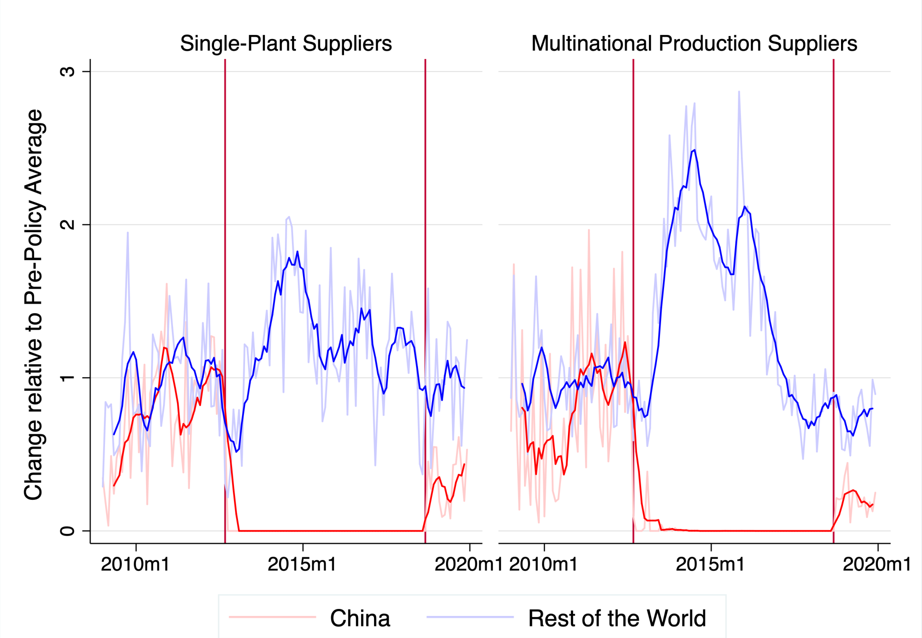


FACT 4: Large importers relative



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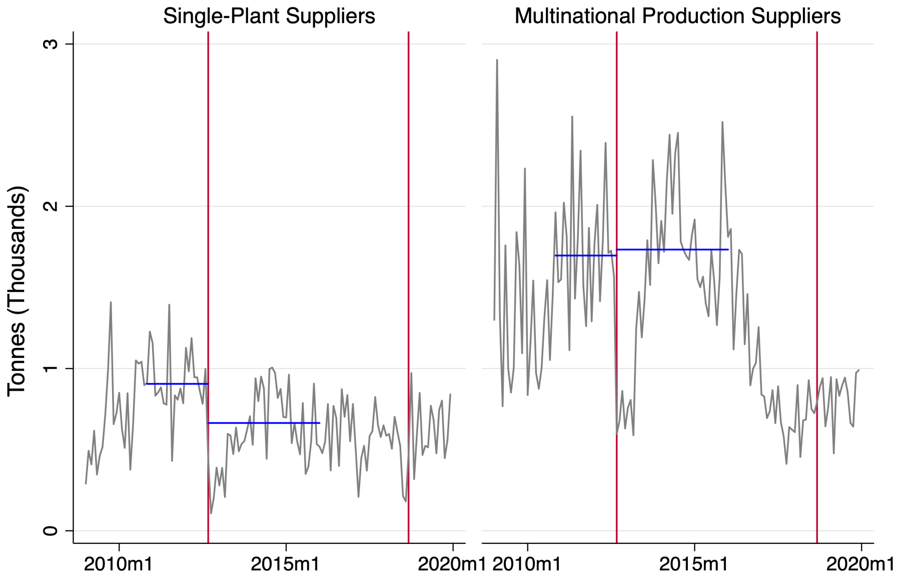


Model: Firms

$$\max_{\{y_{ijo}\}} \sum_{j \in J_i} \sum_{o \in O_{ij}} (p_{ijo} - z_{ijo})\, y_{ijo}$$

subject to

$$p_{ijo} = PY^{\frac{1}{\sigma}} y_i^{\left(1-\frac{1}{\sigma}\right)} y_{ij}^{\left(\frac{1}{\kappa}-\frac{1}{\rho}\right)} y_{ijo}^{-\frac{1}{\kappa}} a_{ijo}^{\frac{1}{\kappa}}$$

- Within an importer's product mix, the marginal quantities affect profit through its effect on each product:

FOC:

$$z_{ijo} = \underbrace{p_{ijo}\left[\left(1-\frac{1}{k}\right)+\left(\frac{1}{\kappa}-\frac{1}{\rho}\right)s_{ijo}+\left(\frac{1}{\rho}-\frac{1}{\sigma}\right)s_{ijo}S_{ij}\right]}_{\text{Through own product}}$$

$$+\sum\nolimits_{o'\neq o}\underbrace{p_{ijo}\left[\left(\frac{1}{\kappa}-\frac{1}{\rho}\right)s_{ijo'}+\left(\frac{1}{\rho}-\frac{1}{\sigma}\right)s_{ijo'}S_{ij}\right]}_{\text{Through products from same supplier}}$$

$$+\sum\nolimits_{j'\neq j}\sum\nolimits_{l\in O_{ij}}\quad\underbrace{p_{ijo}\left[\left(\frac{1}{\rho}-\frac{1}{\sigma}\right)s_{ij'l}S_{ij'}\right]}_{\text{Through products from different supplier}}$$

$$\iff p_{ijo} = \tfrac{\sigma}{\sigma-1}z_{ijo}$$

back

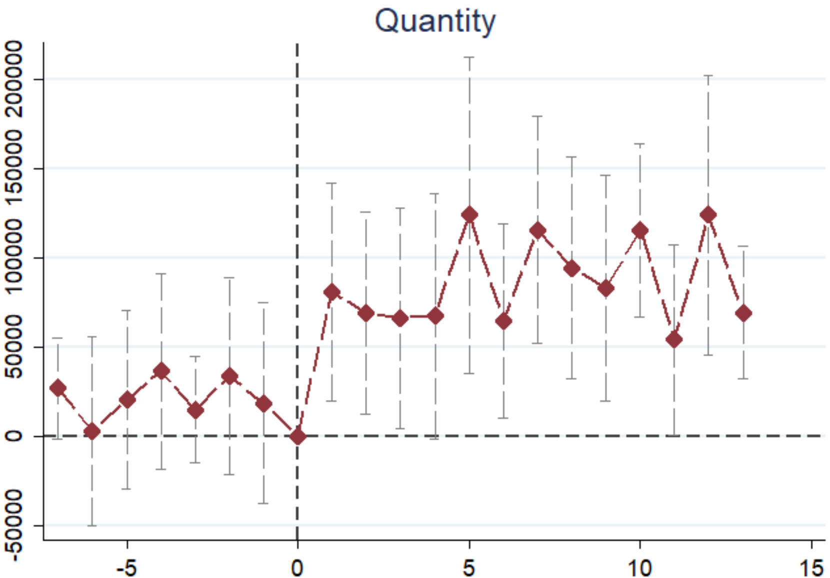
Differences in differences

$$\ln y_{g,ijo,t} = \delta_{g,ijo} + \gamma_{ijo,t} + \beta_1 Policy_{g,t} + \beta_2 Policy_{g,t} \times VarType_{ijo} + \varepsilon_{g,ijo,t}$$

$$\ln y_{g,ijo,t} = \delta_{g,ijo} + \gamma_{ijo,t} + \beta_1 D_{g,t} + \beta_2 D_{g,t} \times VarType_{ijo} + \varepsilon_{g,ijo,t}$$

	(1)	(2)
Policy	0.411***	
	(0.117)	
Policy*Type	0.345**	
	(0.139)	
D		1.632***
		(0.464)
D*Type		1.415**
		(0.548)
N	3210	3210
r2	0.8607	0.8612

Event study graph



Model's Assumptions

- Importing firms are matched with foreign suppliers and retail a final good in the domestic market
  - ▷ Matches are given. Matching process not modeled.
  - ▷ Consumers do not import. They purchase the imported final good from importers.
  - ▷ Competition in the domestic market yield a constant-markup pricing behvior by importers.

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  - ▷ Competition in the domestic market yield a constant-markup pricing behvior by importers.
- Varieties are differentiated by *importer* × *supplier* × *origin*.
  - ▷ Consumer is aware of all three margins ⟶ Autoparts with safety standards
  - ▷ First importers, then suppliers ⟶ importer retails, but also provides a service

Tiers of nesting :

- Bottom: $y_{ij} = \left(\sum_{o \in O_{ij}} a_{ijo}^{\frac{1}{\kappa}} y_{ijo}^{\frac{\kappa - 1}{\kappa}} \right)^{\frac{\kappa}{\kappa - 1}}$
  - y_{ij} nests all varieties with same importer and supplier
  - y_{ijo} = Quantity consumed of variety indexed by importer i, supplier j and origin o
  - a_{ijo} = Taste shock for variety ijo
  - O_{ij} = Set of origins within the match of importer i and supplier j

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- Middle: $y_i = \left(\sum_{j \in J_i} y_{ij}^{\frac{\rho-1}{\rho}} \right)^{\frac{\rho}{\rho-1}}$
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With the corresponding price indexes and prices, P, P_i, p_{ij}, p_{ijo}, the demand for variety ijo is

$$y_{ijo} = a_{ijo}\ p_{ijo}^{-\kappa}\ p_{ij}^{\kappa-\rho}\ P_i^{\rho-\sigma}\ P^{\sigma-1}\ YP$$

The main estimating equation derived from the model:

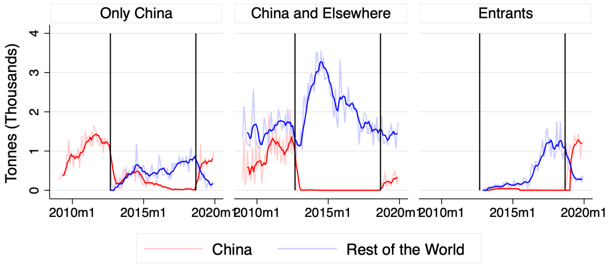
$$\Delta \ln y_{ijo} = (\sigma - 1)\Delta \ln P + (\rho - \sigma)\Delta \ln P_i + (\kappa - \rho)\Delta \ln p_{ij} - \kappa \ \Delta \ln p_{ijo} + \Delta \ln PY + \Delta \ln a_{ijo}$$

Least squares estimating equation:

$$\Delta \ln y_{ijo} = \alpha + \beta_1 \Delta \ln P_i + \beta_2 \Delta \ln p_{ij} + \beta_3 \ \Delta \ln p_{ijo} + \varepsilon_{ijo}$$

- ▷ Ideally one would use fixed effects and the instrument to estimate β_3
- ▷ Then recover κ and build $\Delta \ln p_{ij}$ to estimate β_2 and so on

$$\Delta \ln y_{ijo} = \alpha + \beta_1 \Delta \ln P_i + \beta_2 \Delta \ln p_{ij} + \beta_3 \Delta \ln p_{ijo} + \varepsilon_{ijo}$$



- Missing values for changes in Chinese varieties
- I want to use the changes in RoW quantities AND leverage the shock to Chinese tires
- GMM estimation for continuing varieties and constructing $\Delta \ln p_{ij}$ using Feenstra's correction

Ad-Hoc Least Squares

- Entry and exit of varieties accounted for using the variety correction from Feenstra (1994)

$$p_{ij} = \left[\sum_{o \in O_{ij}} a_{ijo} p_{ijo}^{1-\kappa} \right]^{\frac{1}{1-\kappa}}$$

$$= \left[\sum_{o \in C(O_{ij})} a_{ijo} p_{ijo}^{1-\kappa} \frac{1}{S(C(O_{ij}))} \right]^{\frac{1}{1-\kappa}}$$

where

- $C(O_{ij})$ is the set of continuing varieties within the match of importer i and supplier j
- $S(C(O_{ij}))$ is the share that continuing varieties represent in total imports from the match

I write the demand in changes using hat-algebra (i.e. $\hat{x} = dx/x$):

$$\hat{y}_{ijo} = (\sigma - 1)\hat{P} + (\rho - \sigma)\hat{P}_i + (\kappa - \rho)\hat{p}_{ij} - \kappa\hat{p}_{ijo} + \hat{PU} + \hat{a}_{ijo}$$

$$\hat{p}_{ijo} = \hat{z}_{ijo}$$

$$\hat{p}_{ij} = \sum_{o \in C(O_{ij})} s^*_{ijo}\hat{p}_{ijo} - \frac{1}{1-\kappa}\hat{S}(C(O_{ij})) + \frac{1}{1-\kappa}\sum_{o \in C(O_{ij})} s^*_{ijo}\hat{a}_{ijo}$$

$$\hat{P}_i = \sum_{j \in C(J_i)} S^*_{ij}\hat{p}_{ij} - \frac{1}{1-\rho}\hat{S}(C(J_i))$$

$$\hat{P} = \sum_{i \in C(I)} \mathbb{S}^*_i \hat{P}_i - \frac{1}{1-\sigma}\hat{S}(C(I))$$

- $\hat{z}_{ijo}$ is the import price
- $\mathbb{S}^*$, S^* and s^* are shares within each nest

I write the demand in changes using hat-algebra (i.e. $\hat{x} = dx/x$):

$$\hat{y}_{ijo} = (\sigma - 1)\hat{P} + (\rho - \sigma)\hat{P}_i + (\kappa - \rho)\hat{p}_{ij} - \kappa\hat{p}_{ijo} + \hat{PU} + \hat{a}_{ijo}$$

$$\hat{p}_{ijo} = \hat{z}_{ijo}$$

$$\hat{p}_{ij} = \sum_{o \in C(O_{ij})} s^*_{ijo}\hat{p}_{ijo} - \frac{1}{1-\kappa}\hat{S}(C(O_{ij})) + \frac{1}{1-\kappa}\sum_{o \in C(O_{ij})} s^*_{ijo}\hat{a}_{ijo}$$

$$\hat{P}_i = \sum_{j \in C(J_i)} S^*_{ij}\hat{p}_{ij} - \frac{1}{1-\rho}\hat{S}(C(J_i))$$

$$\hat{P} = \sum_{i \in C(I)} \mathbb{S}^*_i \hat{P}_i - \frac{1}{1-\sigma}\hat{S}(C(I))$$

- $\hat{z}_{ijo}$ is the import price
- $\mathbb{S}^*$, S^* and s^* are shares within each nest

- price change by continuing varieties in the nest
- change in market share of the continuing varieties in the nest
- turned into units that account for "price change of non-continuing"

Instruments

$$\Delta \ln y_{ijo} = \alpha + \beta_1 \Delta \ln P_i + \beta_2 \Delta \ln p_{ij} + \beta_3 \ \Delta \ln p_{ijo} + \varepsilon_{ijo}$$

- Consider the following example:

Variety	origin	importer	supplier	Status	Pre Price	Post Price	price floor
1	Korea	Serv. Leon	Michelin	Continuing	4.7	4.7	-
2	China	Serv. Leon	Michelin	Dropped	4.1	MISSING	5.3

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- The missing price precludes the computation of the regressors for the estimation

Variety	Δln y	Δln pijo	Δln pij	ln Pi
1	0.7	0	MISSING	MISSING
2	MISSING	MISSING	MISSING	MISSING

- However, I can use the distance to the price floor instead of the missing price change

back

Instruments for prices and price indexes:

- Policy induces a price jump that at least reaches the price floor for chinese varieties.
- The gap between pre-policy prices and the floor introduces exogenous variation.

$$\hat{p}_{ijo}^{IV} = \begin{cases} ln(floor) - ln(price_{pre}) & \text{if origin is China.} \\ 0 & \text{otherwise.} \end{cases}$$

$$\hat{p}_{ij}^{IV} = \sum_{o \in C(O_{ij})} s_{ijo}^{*} \hat{p}_{ijo}^{IV}$$

$$\hat{P}_{i}^{IV} = \sum_{j \in C(J_i)} S_{ij}^{*} \hat{p}_{ij}^{IV}$$

where

- $C(O_{ij})$ is the set of continuing origins within the GVC of importer i and supplier j
- s_{ijo}^{*} is the share of continuing origin o in the set $C(O_{ij})$
- $C(J_i)$ is the set of continuing suppliers that trade with importer i
- S_{ij}^{*} is the share of continuing supplier o in the set $C(J_i)$

Instruments for Entry/Exit corrections:

- Use distance to the price floor of chinese varieties in the same nest:
  - Strong within-nest substitution
  - Cheaper varieties take larger market share
  - Correction is larger when they exit

$$\hat{S}(C(O_{ij}))^{IV} = \sum_{o=china} s_{ijo}(ln(floor) - ln(price^{pre}_{ijo}))$$

$$\hat{S}(C(J_i))^{IV} = \sum_{j \in J_i} \sum_{o=china} s_{ij} s_{ijo}(ln(floor) - ln(price^{pre}_{ijo}))$$

where

- $C(O_{ij})$ is the set of continuing origins within the GVC of importer i and supplier j
- s_{ijo} is the share of chinese variety o in the set O_{ij}
- $C(J_i)$ is the set of continuing suppliers that trade with importer i
- s_{ij} is the share of chinese supplier o in the set J_i

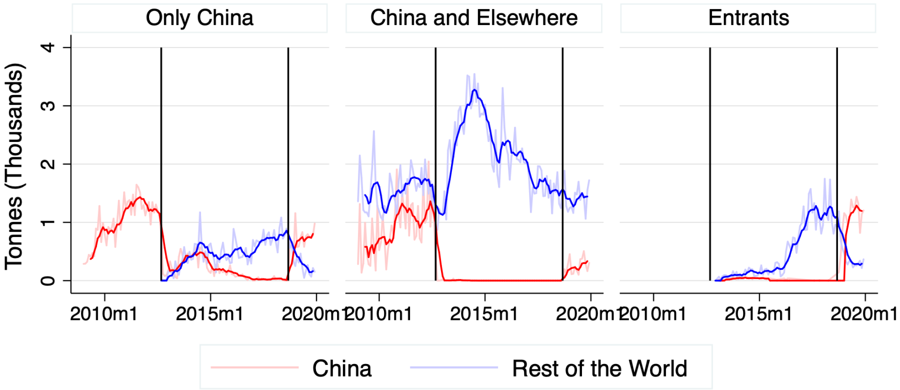
back

Results

$$\Delta \ln y_{ijo} = (\sigma - 1)\Delta \ln P + (\rho - \sigma)\Delta \ln P_i + (\kappa - \rho)\Delta \ln p_{ij} - \kappa \, \Delta \ln p_{ijo} + \Delta \ln PU + \Delta \ln a_{ijo}$$

	OLS	IV		IV	GMM	Elasticity governs substitution
$-\kappa$	-6.139***	-6.799***	κ	6.7	8	Varieties with same importer and supplier
	(1.534)	(1.139)				
$\kappa - \rho$	3.513***	4.521***	ρ	2.2	3.3	Varieties with the same importer
	(1.48)	(1.51)				
$\rho - \sigma$	1.587***	1.392	σ	0.88	1.9	All varieties
	(0.743)	(0.773)				

Transition


Only China
China and Elsewhere
Entrants
Tonnes (Thousands)
0
1
2
3
4
2010m1
2015m1
2020m1
China
Rest of the World

Transition

AUTOS MARCH 23, 2015 / 1:36 AM / UPDATED 6 YEARS AGO

ChemChina to buy into Italian tire maker Pirelli in $7.7 billion deal

June 29, 2015 02:00 AM

ZC Rubber opens Thailand manufacturing plant

TIRE BUSINESS REPORT

TIRE BUSINESS

NEWS SHOP FLOOR MULTIMEDIA EVENTS DATA RESOURCES ADVERTISE

Among Chinese tire companies with off-shore production are:

- Double Coin Holdings Ltd. — truck and OTR tires in Thailand since 2017;
- Guizhou Tyre — building a truck/bus tire plant in Vietnam;

Automotive News China

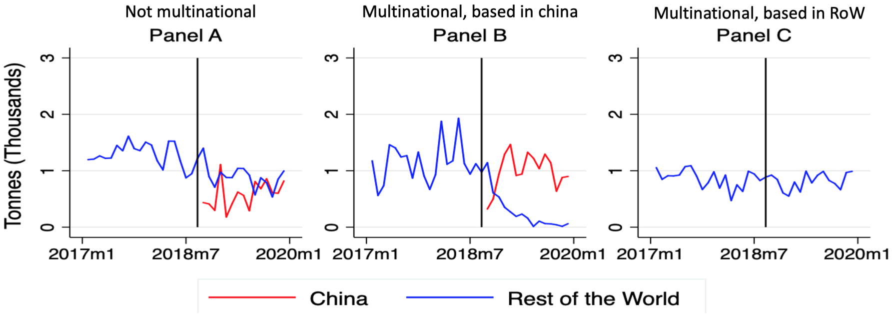
June 12, 2015 12:00 AM

Linglong begins making truck and bus tires in Thailand

Rubber & Plastics News

Transition

- For group A there is some substitution, but not complete
- For group B there is a transition that ends up in a complete substitution
- Group C does not return to China



Transition

Analyzing the policy ending suggests:

- Trading with multinational suppliers is still a driver of rapid switching across origins
- After five years of price control, the organizational structure of the industry changed considerably, including:
  - Internationalization of Chinese suppliers
  - Importers engage in less multi-origin sourcing

Next step: Model that endogenizes such extensive margin.