## Trade Wars and the Reallocation of Market Power in Global Export Markets

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### Motivation

Tariff shocks cause large firms to enter/exit markets  $\Rightarrow$  changes in prices and markups

This paper:

- Empirically, we document a small number of firms in origin-destination-product markets
  - $\Rightarrow$  These markets are concentrated and firms may price strategically
- Theoretically, we reassess price and welfare impacts of a bilateral trade war ⇒ Entry/exit reallocates market power of large firms, amplifying impacts
- Monopolistic competition trade models: entrants and exitors are marginal firms
   ⇒ limited welfare impact

## Firms' product-level exports from 11 origin countries

#### 13.3 million firm-product-origin-destination-year observations



Combined with HS06 product-level tariff data for 165 destinations from WTO 
Details

## Concentrated origin-destination-product markets

	25th Percentile	Median	75th Percentile		
(a) Number of firms	7.00	3.00	1.00		
(b) Herfindahl-Hirschman Index	0.34	0.64	1.00		
(c) Cumulative market share cond. on $\geq 1$ incumbent and $\geq 1$ entrant					
– Incumbents – Entrants	30.3% 69.7%	61.9% 38.1%	85.7% 14.3%		

Note: 1.3M product-origin-destination-year granular markets based on 3600 products, 11 origins, 165 destinations, and 12 years. Product is defined as a 6-digit HS product.

- $\Rightarrow$  Small number of firms at origin-destination-product level
  - Firms likely compete oligopolistically within an origin
  - Firms' entry and exit can have big impact on market structure



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## Exporters' responses to tariff changes

	Quantity <sub>fiodt</sub>	
Destination-average tariff <sub>idt</sub>	-0.78***	
	(0.06)	
Bilateral tariff <sub>iodt</sub>	-2.40***	
	(0.13)	
Observations	13.3M	
$R^2$	0.715	

Note: Firm-product-origin-year and product-destination fixed effects added to all regressions

- Decompose tariff into common (eg MFN) and origin-specific components
- $\Rightarrow$  Monopolistic competition  $\Rightarrow$  same quantity responses
- $\Rightarrow$  Oligopolistic competition  $\Rightarrow$  diff. responses due to changes in rel. competitiveness

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### Exporters' responses to tariff changes

	Quantity fiodt	Markup <sub>fiodt</sub>	
Destination-average tariff <sub>idt</sub>	-0.78***	0.05**	
Bilateral tariff <sub>iodt</sub>	(0.06) -2.40*** (0.13)	(0.02) 0.23*** (0.03)	
Observations $R^2$	13.3M 0.715	13.3M 0.888	

Note: Firm-product-origin-year and product-destination fixed effects added to all regressions

• Markup increase slightly as tariff rises

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## Exporters' responses to tariff changes

	Quantity <sub>fiodt</sub>	Markup <sub>fiodt</sub>	Within-origin market share <sub>fiodt</sub>	Origin's market share in dest <sub>iodt</sub>
Destination-average tariff <sub>idt</sub>	-0.78***	0.05**	1.18***	-1.19**
	(0.06)	(0.02)	(0.09)	(0.11)
Bilateral tariff <sub>iodt</sub>	-2.40***	0.23***	3.54***	-3.89***
	(0.13)	(0.03)	(0.16)	(0.22)
Observations	13.3M	13.3M	13.3M	13.3M
$R^2$	0.715	0.888	0.776	0.887

Note: Firm-product-origin-year and product-destination fixed effects added to all regressions

- Two reallocation effects (Crowley, Han, Prayer; JIE 2024)
- $\Rightarrow$  Within-origin market share increases (due to exits of small firms from same origin)
- $\Rightarrow$  Origin's market share decrease (as firms from the origin become less competitive)

## Model outline

Objectives:

- 1. Capture micro market structure and match exporters' responses to tariff changes
- 2. Evaluate price and welfare effects of bilateral trade war
- 3. Decompose welfare changes by extending Baqaee and Farhi (24)
  - $\Rightarrow$  Price effect is larger with oligoplistic competition and endogenous entry
  - $\Rightarrow$  Welfare losses amplified by endogenous entry

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Key elements:

- Multi-country oligopolistic competition GE model with heterogeneous products and firms
- Limited number of firms at product-origin-destination level
- Firms re-optimize exporting decisions after a trade policy shock

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#### Market structure

#### Oligoplistic competition at three nested levels

A triple nested CES demand structure with limited number of firms within each origin to incorporate imperfect competition

Across products

Within product, across origins

Across firms within an origin

$$Y_{dt} = \left(\int_{i} y_{idt}^{\frac{\eta-1}{\eta}} di\right)^{\frac{\eta}{\eta-1}},$$
$$y_{idt} = \left(\sum_{o} y_{iodt}^{\frac{\rho-1}{\rho}}\right)^{\frac{\rho}{\rho-1}},$$
$$y_{iodt} = \left(\sum_{f \in \mathcal{F}_{iodt}} y_{fiodt}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}},$$

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allowing for  $\sigma \neq \rho$ .

Notation: f (firm), i (product), o (origin), d (destination), t (time)

Details

## Quantitative model

Simulate a model of 4 countries with 1000 products; SMM to match empirical estimates

Estimated parameters	Value
Within-origin elasticity of substitution $\sigma$	6.05
Cross-origin elasticity of substitution $ ho$	3.49
Productivity dispersion (inverse)	9.95
Heterogeneous demand preference	0.39

	Data		Model	
Targeted tariff elasticity estimates	Common	Bilateral	Common	Bilateral
Quantity	-0.78	-2.40	-1.58	-2.39
Firm's within-origin market share	1.18	0.23 3.54	1.16	2.70
Origin's market share in dest.	-1.19	-3.89	-1.41	-3.93

## Investigate price and welfare impacts of trade war

Trade war between 2 (out of 4) countries: bilateral tariff increase from  $10\% \Rightarrow 20\%$ 

We consider four scenarios:

- 1. Fixed No. of firms + constant markup  $(\sigma = \rho = \eta)$
- 2. Fixed No. of firms + variable markups
- 3. Endogenous entry + constant markup ( $\sigma = \rho = \eta$ )
- 4. Endogenous entry + variable markup

To make fair comparison, we calibrate constant markup model to match trade elasticity of variable markup model

## Price and welfare impact on trade war economies



• Oligopolistic competition leads to higher price increase as domestic firms raise their markup

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## Price and welfare impact on trade war economies



• With limited number of firms, exits lead to large variety loss and push up aggregate price

#### Price and welfare impact on trade war economies



- Entry amplifies welfare losses
- Ambiguous welfare impact from oligopolistic competition without extensive margin adjustment

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### Welfare decomposition

• Extend Baqaee and Farhi (24) to allow for extensive margin adjustment:

$$\mathrm{d}\log W_{d} \approx -\underbrace{\sum_{a} \tilde{\lambda}_{ad} \,\mathrm{d}\log \tau_{ad}}_{\Delta \mathrm{Tariff \ wedge}} -\underbrace{\sum_{a} \tilde{\lambda}_{ad} \,\mathrm{d}\log \mu_{ad}}_{\Delta \mathrm{Markup \ wedge}} +\underbrace{\sum_{b} \left(\Lambda_{bd} - \tilde{\lambda}_{bd}\right) \mathrm{d}\log \Lambda_{b}}_{\Delta \mathrm{Factor \ income \ wedge}} +\underbrace{E_{d}}_{\mathrm{Variety \ effect}}$$

- first three terms capture welfare changes brought by continuing firms
- a is firm-product-origin triplet; b captures labor, tariff revenue, and profit 'factor'
- $\tilde{\lambda}_{ad}$  : d's expenditure exposure to a;  $\Lambda_{bd}$  : share of factor b in d's income;
- $\Lambda_b$ : share of factor *b* in world income
- Approximation of variety effect:

$$\begin{split} \textbf{\textit{E}}_{d} \approx \underbrace{-\frac{1}{\varepsilon} \left[ \sum_{a \in \mathcal{A}_{dt} \cap a \notin \mathcal{A}_{dt-1}} \tilde{\lambda}_{ad} - \sum_{a' \notin \mathcal{A}_{dt} \cap a' \in \mathcal{A}_{dt-1}} \tilde{\lambda}_{a'd} \right]}_{\text{Effect on aggregate price (a la Feenstra 94)}} + \underbrace{\sum_{b \in \mathcal{B}_{dt} \cap b \notin \mathcal{B}_{dt-1}} \Lambda_{bd} - \sum_{b' \notin \mathcal{B}_{dt} \cap b' \in \mathcal{B}_{dt-1}} \Lambda_{b'd}}_{\text{Effect on factor income}} \\ \text{where } \varepsilon \text{ is trade elasticity} \end{split}$$

## Decomposing entry effect on welfare



• Welfare effect of trade war is amplified by endogenous entry

## Decomposing entry effect on welfare



• Endogenous entry has two effects:

(a) direct variety effect + (b) indirect effect on continuing firms: mitigate direct effect





## Conclusion

Entry/exit of large firms and strategic pricing are key elements in the analyses of trade policy changes:

- Empirically, relying on firm-product data from 11 countries, we document
  - Highly concentrated origin-destination-product markets
  - Differential exporters' responses to common vs bilateral tariff changes
- Theoretically, we decompose price and welfare impact of bilateral trade war
  - Extend Baqaee and Farhi (24) to allow for extensive margin adjustments
  - Entry and exit of large firms  $\Rightarrow$  2-3 times larger price and welfare impact

# Appendix

## Data Sources

#### **Firm-Product-Level Exports**

- World Bank Exporter Dynamics Database
- Chinese and Egyptian Customs Authorities

#### **Industry-Level Imports**

UN Comtrade

Appendix

## Trade Agreements

• World Bank Deep Trade Agreements Database

#### Tariffs

- WTO
- Feenstra & Romalis 2014

Variation to identify trade policy impacts:

Country	Observations (firm-product-origin-destination-year)	with PTA
China	20,043,162	1,168,391
Mexico	3,608,510	2,353,379



## Statistics for US market

#### Concentrated granular origin-destination-product markets

	25th Percentile	Median	75th Percentile		
(a) Number of firms	24.00	7.00	2.00		
(b) Herfindahl index	0.25	0.50	0.92		
(c) Cumulative market share cond. on $\geq 1$ incumbent and $\geq 1$ entrant					
– Incumbents – Entrants	49.4% 51.6%	81.9% 18.1%	95.2% 4.8%		

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## Markups and demand elasticities

The triple nested market structure implies two distinct market shares that matter for demand elasticity  $\varepsilon_{fiodt}$  and markup  $\mu_{fiodt}$ :

$$\begin{split} \varepsilon_{\textit{fiodt}} &= \sigma - \textit{ms}_{\textit{fiodt}} [\sigma - \rho + (\rho - \eta) \textit{ms}_{\textit{iodt}}] \\ \mu_{\textit{fiodt}} &= \frac{\varepsilon_{\textit{fiodt}}}{\varepsilon_{\textit{fiodt}} - 1} \end{split}$$

where

• ms<sub>fiodt</sub>: firm f's market share among all firms from origin o selling product i in d at t

• *ms<sub>iodt</sub>*: origin *o*'s market share of product *i* in destination *d* at time *t* 

Implication: A bilateral tariff reduction leads to  $\uparrow ms_{iodt}$  and  $\Downarrow ms_{fiodt}$ 

- $\Rightarrow\,$  Demand facing a firm could become more or less elastic, depending on which force dominates
- $\Rightarrow$  Markups may rise or fall (Crowley, Han, Prayer; JIE 2024)

## Market structure and demand elasticities

General case: oligopolistic competition within origin and industry

$$\varepsilon_{\textit{fiodt}} = \sigma - \textit{ms}_{\textit{fiodt}}[\sigma - \rho + (\rho - \eta)\textit{ms}_{\textit{iodt}}]$$

Special cases:

1. Monopolistic competition (e.g. Melitz 2003) when  $N_{iodt}$  is large and/or  $\sigma = \rho = \eta$ :

Constant markup: 
$$rac{arepsilon_{ ext{fiodt}}}{arepsilon_{ ext{fiodt}}-1} = rac{\sigma}{\sigma-1}$$

2. Oligopolistic competition within industry (e.g. Atkeson and Burstein 2008) when  $\sum_{o} N_{iodt}$  is finite and  $\sigma = \rho > \eta$ :

$$\varepsilon_{\text{fiodt}} = \rho - (\rho - \eta) \text{ms}_{\text{fiodt}} \text{ms}_{\text{iodt}}$$

3. Oligopolistic competition within origin when  $N_{iodt}$  is finite but  $\sum_{o} N_{iodt}$  is large:

$$\varepsilon_{fiodt} \rightarrow \sigma - ms_{fiodt}(\sigma - \rho)$$

Note: Elasticity of substitution within origin ( $\sigma$ ), across origins ( $\rho$ ), across products ( $\eta$ )

## Melitz (2003) case and fixed cost



Melitz, fixed cost denominated in consumption

• If fixed cost is denominated in consumption, model's prediction of welfare change coincide's with ACR formula

## Melitz (2003) case and fixed cost



Melitz, fixed cost denominated in consumption

- If fixed cost is denominated in consumption, model's prediction of welfare change coincide's with ACR formula
- If fixed cost is denominated in labor, resource is loss in entry and model's prediction of welfare change is smaller than ACR formula

Atkeson & Burstein, N = 4

## Atkeson & Burstein (2008) case and number of firms



Atkeson & Burstein, N = 20

- With variable markup, ACR formula no longer a sufficient statistics of welfare change
- The model converges to monopolistic competition as number of firms increases, and ACR formula
  performs better

## Aggregate markup and factor income contribution to welfare change



 The negative welfare impact of markup increases (by domestic firms) is offset by positive impact of rising factor income (i.e. higher profit of domestic firms)

## Contribution of domestic firms' markup and factor wedges

Domestic firms' profit rises as markup increases

Domestic firms' markup

Domestic firms' profit



Two offsetting welfare effects:

(a) markup increase  $\Rightarrow$  welfare  $\downarrow$  + (b) profit increase  $\Rightarrow$  higher purchasing power  $\Rightarrow$  welfare  $\uparrow$ 

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## Decomposing entry effect on welfare



- Endogenous entry has two effects:
  - (a) direct variety effect + (b) indirect effect on continuing firms: reduce welfare loss