Trade, Productivity and (Mis)allocation

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October 2019

Motivation

- **Rapid expansion in international trade in recent decades has intensified debates about trade policy**
  - **Advanced countries**: competition from low-wage countries, employment and inequality
  - **Developing countries**: mixed gains possibly interacting with structural weaknesses (education, governance, etc.)

- **How does globalization affect aggregate productivity and welfare ?**
  - Transmission channels with firm heterogeneity: selection, reallocation
  - Mode of trade liberalization : bilateral vs. unilateral trade reforms

- **Do market frictions / *misallocation* modify the gains from trade?**
  - Evidence on the role of misallocation (e.g. MFA quotas allocation in China before 2004 ~ Khandelwal, Wei and Schott, AER 2013)
  - Macro evidence that greater misallocation of productive resources across firms reduces aggregate productivity and welfare (Hsieh-Klenow QJE 2009, Bartelsman-Haltiwanger-Scarpetta AER 2013)

Overview: Theory & Methodology

- **Analytically and numerically investigate the impact of international trade on aggregate productivity and welfare**

- Evaluate adjustment mechanisms in **heterogeneous-firm model** with and without resource misallocation
  - **No misallocation**: predicted gains from bilateral and export liberalization, ambiguous effects of import liberalization
  - **Misallocation**: can amplify, dampen or reverse the gains from trade

- **Map theoretical concepts to empirical measures**
  - Aggregate productivity (and welfare) in theory vs. measured aggregate productivity (revenue-based)
  - Olley-Pakes decomposition of aggregate productivity: AggProd = AvgProd + Cov(Prod,Size) → Useful data moments to test for the transmission channels

Overview: Empirics

- Exploit unique cross-country data that captures firm heterogeneity & data on value-added trade by final use (ECB CompNet, WIOD)
  - 14 European countries, 20 manufacturing industries, 1998-2011
  - Establish causality using IV strategy (tariffs, Bartik) and China shock

- International trade significantly increases aggregate productivity
  - **Export demand**: ↑ avg prod (~3/4), ↑ prod-size covariance (~1/4)
  - **Import competition**: ↑ avg prod (≤5/4), ↓ prod-size covariance (≥-1/4)

- Results consistent only with model simulations with misallocation

- Efficient institutions amplify gains from import competition, but dampen gains from export expansion

Outline

1. Theory
    a. Set up
    b. Theory → empirics
    c. Predictions
    d. Counterfactuals
2. Data
3. Empirics
4. Conclusions

Theoretical Set-Up

- **2-country GE model** with CES demand and monopolistic competition in differentiated sector: $U_i = H_i^{1-\beta} Q_i^{\beta}$, $Q_i^{\beta} = \left[\int_z q_i(z)^{\alpha} dz\right]^{1/\alpha}$
  - Free entry of heterogeneous firms
  - Exogenous w_i=1 if CRS outside good ($\beta < 1$), endogenous otherwise ($\beta = 1$)
- Production and trade technology
  - Sunk entry cost $w_i f_i^E$, fixed production cost $w_i f_i$, constant marginal cost
  - Fixed export cost $w_i f_{ij}$, asymmetric iceberg trade costs τ_{ij}
- No misallocation: firms draw productivity φ from $G_i(\varphi)$
  - Marginal cost w_i/φ (Melitz 2003)
- Misallocation: firms draw productivity φ & distortion η from $H_i(\varphi, \eta)$
  - Marginal cost $w_i/\varphi\eta$ (Hsieh-Klenow 2009, Bartelsman et al 2013)

Resource Misallocation

- We interpret η as any distortion which modifies the marginal cost of the firm
  - Ex: labor market frictions (exogenous)
  - A firm can access "too much" labor, this would be equivalent to a subsidy of η>1. Conversely, a tax would correspond to η<1
- Two parameters govern the degree of misallocation :
  - the dispersion of the distortion draw (σ_η)
  - the correlation between the distortion and productivity $\rho(\varphi, \eta)$
- **Firm selection, production and export activity depend on $\varphi\eta$, but optimal resource allocation (and agg productivity + welfare) depend on φ alone**
  - Implicit subsidy to surviving producers financed with lump-sum tax on consumers (reduces disposable income and welfare)
- **Aggregate productivity and welfare negatively impacted by σ_η**

Equilibrium conditions Misallocation and welfare

Main predictions

Proposition 1 With **flexible** wages and no misallocation,

$\downarrow(\tau_{ij},\tau_{ji})$, $\downarrow\tau_{ij}$, $\downarrow\tau_{ji}$ → $\uparrow W_i$, $\uparrow AggProd_i$

Proposition 2 With **fixed** wages and no misallocation,

$\downarrow(\tau_{ij},\tau_{ji})$, $\downarrow\tau_{ij}$ → $\uparrow W_i$, $\uparrow AggProd_i$

$\downarrow\tau_{ji}$ → $\downarrow W_i$, $\downarrow AggProd_i$ **(Metzler Paradox)**

Proposition 3 With **misallocation**,

$\downarrow(\tau_{ij},\tau_{ji})$, $\downarrow\tau_{ij}$, $\downarrow\tau_{ji}$ → $\uparrow\downarrow W_i$, $\uparrow\downarrow AggProd_i$

- Trade gains/losses are not monotonic in initial misallocation or in misallocation parameters σ_η and $\rho(\varphi,\eta)$
- Misallocation can foster / dampen the productivity or welfare gains from trade → Need numerical simulations

Numerical Simulation: Fixed Wages

Counterfactual effects of 20% fall in variable trade costs

	Bilateral Liberalization				Export Liberalization				Import Liberalization			
	Welfare	Agg Prod	Avg Prod	Cov Term	Welfare	Agg Prod	Avg Prod	Cov Term	Welfare	Agg Prod	Avg Prod	Cov Term
No Misallocation: $\sigma_\eta=0$												
	2.73%	3.50%	2.75%	0.75%	3.77%	4.89%	3.84%	1.05%	-0.49%	-0.60%	-0.48%	-0.12%
Misallocation: $\sigma_\eta=0.15$												
$\rho=-0.4$	-1.68%	-0.05%	-0.16%	0.11%	2.32%	2.26%	1.77%	0.49%	-3.27%	-1.55%	-1.37%	-0.18%
$\rho=0$	2.70%	3.48%	2.81%	0.67%	2.62%	4.46%	3.54%	0.91%	0.58%	-0.21%	-0.13%	-0.08%
$\rho=0.4$	0.92%	7.71%	6.42%	1.29%	0.15%	8.47%	7.11%	1.36%	1.38%	0.03%	0.11%	-0.09%

Calibration of parameters

Outline

1. Theory
2. Data
3. Empirics
4. Conclusions

CompNet Productivity Data

- Unique cross-country, cross-sector panel data on macro aggregates and micro heterogeneity (Lopez-Garcia et al 2015)
  - Standardized aggregation of firm-level data country by country, coordinated by ECB and European System of Central Banks
  - 14 countries: Austria, Belgium, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Poland, Portugal, Slovakia, Slovenia, Spain
  - 20 NACE-2 manufacturing sectors
  - 1998-2011 unbalanced panel

- Indicators for firm labor productivity, capital productivity, TFP, size
  - Multiple moments of each distribution and joint distributions
  - Olley-Pakes (1996) decomposition of aggregate productivity

WIOD Trade Data

- Annual bilateral trade data in value added by sector of final use
  - 14 countries, 20 NACE-2 sectors, 1998-2011
  - X_{ijkst}: gross sales from input sector k in origin i to sector s in destination j in year t
- Trade exposure in country i, sector k, year t
  - Export demand: mean 7.65, st dev 1.74

$$ExpDemand_{ikt} = \ln\left[\sum_{j\neq i,s} X_{ijkst}\right]$$

  - Import competition: mean 6.41, st dev 1.97

$$ImpComp_{ikt} = \ln\left[\sum_{j\neq i,s\neq k} X_{jikst}\right]$$

Outline

1. Theory
2. Data
3. Empirics
    a. OLS correlation
    b. IV causality
    c. Robustness
    d. Mechanisms
4. Conclusions

IV Causality

- Use IV 2SLS to identify causal effect of trade exposure on productivity moments

$$Y_{ikt} = \alpha + \beta_1 \cdot \widehat{ExpDemand}_{ikt} + \beta_2 \cdot \widehat{ImpComp}_{ikt} + \Gamma \cdot Z_{ikt} + \psi_{it} + \varepsilon_{ikt}$$

$$\{ExpDemand_{ikt}, ImpComp_{ikt}\} = \alpha_{IV} + \Gamma_{IV} \cdot Z_{ikt} + \Theta \cdot IV_{ikt} + \phi_{it} + \epsilon_{ikt}$$

- Ideal instruments for trade exposure
  - $ExpDemand_{ikt}$: separate exogenous foreign demand for ik goods from i's endogenous export supply of k goods
  - $ImpComp_{ikt}$: separate exogenous foreign supply of k goods to i from i's endogenous import demand for k goods

Bartik Instruments

Initial trade structure of each country-sector + contemporaneous trade flows of each trade partner (Hummels et al AER 2014, Berman et al JIE 2015)

- IV for $ExpDemand_{ikt}$
  - **Foreign demand**: weighted average absorption by i's export destinations, using i's initial export shares as weights (WIOD)

$$FDemand_{ikt} = \ln\left[\sum_{j\neq i} \frac{X_{ijk,t=0}}{X_{ik,t=0}}\left(Y_{jkt} + M_{-i,jkt} - X_{-i,jkt}\right)\right]$$

- IV for $ImpComp_{ikt}$
  - **Foreign supply**: weighted average export value added for final consumption by i's import origins, using i's initial import shares as weights (WIOD)

$$FSupply_{ikt} = \ln\left[\sum_{j\neq i} \frac{M_{ijk,t=0}}{M_{ik,t=0}} XVA^{final}_{-i,jkt}\right]$$

  - **Import tariffs** $MTariff_{ikt}$: average applied tariff (WITS)

Causal Effects of Trade (Second Stage)

20% ↑ exp demand (imp compet) → ≈ 8% (1.4%) ↑ agg prod

- 7.3% (10%) ↑ agg prod with sector-year FE
- Exp demand: ↑ avg prod (~ 3/4), ↑ prod-size covariance (~ 1/4)
- Imp compet: ↑ avg prod (~ 5/4), ↓ prod-size covariance (~ -1/4)

	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt)	**0.398*** **	**0.295*** **	**0.103*** **	**0.367*** **	**0.226** **	**0.141*** **
	(0.039)	**(0.039)**	**(0.014)**	**(0.109)**	**(0.098)**	**(0.050)**
^Imp Comp (ikt)	**0.068*** **	**0.090*** **	**-0.021*** **	**0.502*** **	**0.585*** **	**-0.083**
	(0.014)	**(0.014)**	**(0.005)**	**(0.185)**	**(0.166)**	**(0.059)**
N	2,777	2,777	2,777	2,777	2,777	2,777
R2	0.820	0.852	0.485	0.856	0.887	0.649
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y
Sector*Year FE	N	N	N	Y	Y	Y

Sensitivity & Extensions

Robustness analysis

- Single trade dimension
- 1-year lagged trade effects
- Winsorize at 1st and 99th perc
- Drop individual countries or sectors

Additional results

- Weight sectors by employment share $L_{ik,t=0} / L_{i,t=0}$
- Chinese import competition
- Import penetration ratio

Institutional and Market Frictions

- Rule of Law : index of overall institutional capacity
  - Mean 1.11, st dev 0.49 ***World Bank Governance Indicators***
- (Inverse) Corruption: perceived use of public power for private gain
  - Mean 1.07, st dev 0.69 ***World Bank Governance Indicators***
- Labor Market Flexibility : avg of 21 indicators for firing & hiring costs
  - Mean 3.28, st dev 0.37 ***OECD Employment Database***
- Creditor Rights' Protection : index of financial contractibility
  - Mean 5.86, st dev 1.79 ***World Bank Doing Business***
- (Inverse) Product Market Regulation : avg of 18 indicators for state control, barriers to entrepreneurship, barriers to trade and investment
  - Mean 1.17, st dev 0.25 ***OECD Market Regulation***

Institutional and Market Frictions

Efficient institutions, factor and product markets amplify gains from import competition, but dampen gains from export expansion

	ln Agg Prod (ikt)				
Institution Measure:	Rule of Law	(Inverse) Corruption	Labor Market Flexibility	Creditor Rights Protection	(Inverse) Product Market Regulation
	(1)	(2)	(3)	(4)	(5)
^Exp Dem (ikt)	1.066***	0.850***	1.121***	0.718***	1.314***
	(0.126)	(0.096)	(0.261)	(0.158)	(0.172)
^Imp Comp (ikt)	-0.113**	-0.063*	-0.202**	-0.108*	-0.045
	(0.050)	(0.038)	(0.096)	(0.061)	(0.061)
^Exp Dem (ikt) x Institution (it)	**-0.476*** (0.067)**	**-0.302*** (0.042)**	**-0.218*** (0.069)**	**-0.048** (0.019)**	**-0.769*** (0.130)**
^Imp Comp (ikt) x Institution (it)	**0.136*** (0.031)**	**0.095*** (0.020)**	**0.083*** (0.027)**	**0.028*** (0.009)**	**0.085* (0.046)**
N	2,777	2,777	2,777	2,777	2,777
R2	0.792	0.797	0.747	0.811	0.825
Ctry*Year FE, Controls	Y	Y	Y	Y	Y

Conclusions

- Theoretically, trade liberalization can have ambiguous welfare and productivity effects

- Empirically, export demand and import competition both increase aggregate productivity:
  - No productivity-enhancing reallocation with import competition, plausibly due to misallocation across firms
  - Institutional frictions can grip the reallocation process

- Policy implications
  - Interaction btw trade policy and structural reforms matter;
  - Efficient product & labor markets can help to amplify the welfare gains from trade;

Appendix

Literature

- **Macro**: resource misallocation across firms within countries contribute to productivity differences across countries
  - Restuccia-Rogerson 2008, Hsieh-Klenow 2009, Foster-Haltiwanger-Syverson 2008, Bartelsman-Haltiwanger-Scarpetta 2013, Gopinath et al 2015, Hopenhayn 2014 …
- **Trade**: role of firm heterogeneity & reallocation across firms for trade gains
  - Arkolakis-Costinot-RodriguezClare 2012, Melitz-Redding 2014 …
  - Pavcnik 2002, Bustos 2011, Amiti-Khandelwal 2013, Bernard et al 2011, Goldberg et al 2010, Khandelwal-Topalova 2013, Alfaro-Chen 2017 …

Literature

- **Financial** and **labor market frictions** distort firm-level trade activity
  - Manova 2013, Chor-Manova 2012, Foley-Manova 2015 …
  - Helpman-Itskhoki-Redding 2010, Cuñat-Melitz 2012, Tombe 2015 …
- **Variable mark-ups** result in market share misallocation across firms and moderate pro-competitive gains from trade
  - Epifani-Gancia 2011, Edmond-Midrigan-Xu 2015, Dhingra-Morrow 2016, Feenstra-Weinstein 2017, ACDR 2018 …
- **Market frictions creating resource misallocation** appears to modify gains from trade
  - Khandelwal-Schott-Wei 2013, Chung 2018, Bai-Jin-Lu 2018, Ruggieri 2018

Firm Problem: First Best

$$\max \pi_{ij}(\varphi) = p_{ij}(\varphi)q_{ij}(\varphi) - \frac{w_i \tau_{ij} q_{ij}(\varphi)}{\varphi} - w_i f_{ij}$$

$$\text{s.t. } q_{ij}(\varphi) = \beta E_j P_{jQ}^{\sigma-1} p_{ij}(\varphi)^{-\sigma}$$

➔

$$p_{ij}(\varphi) = \frac{w_i \tau_{ij}}{\alpha\varphi} \qquad q_{ij}(\varphi) = \beta E_j P_{jQ}^{\sigma-1} \left(\frac{\alpha\varphi}{w_i \tau_{ij}}\right)^{\sigma}$$

$$l_{ij}(\varphi) = f_{ij} + \frac{\tau_{ij} q_{ij}(\varphi)}{\varphi} \qquad c_{ij}(\varphi) = \left(f_{ij} + \frac{\tau_{ij} q_{ij}(\varphi)}{\varphi}\right) w_i$$

$$r_{ij}(\varphi) = \beta E_j \left(\frac{\alpha P_{jQ}\varphi}{w_i \tau_{ij}}\right)^{\sigma-1} \qquad \pi_{ij}(\varphi) = \frac{r_{ij}(\varphi)}{\sigma} - w_i f_{ij}$$

Firm Problem: Constrained Optimum

$$\max \pi_{ij}(\varphi,\eta) = p_{ij}(\varphi,\eta)q_{ij}(\varphi,\eta) - \frac{w_i\tau_{ij}q_{ij}(\varphi,\eta)}{\varphi\eta} - w_i f_{ij}$$

$$\text{s.t. } q_{ij}(\varphi,\eta) = \beta E_j P_{jQ}^{\sigma-1} p_{ij}(\varphi,\eta)^{-\sigma}$$

➔

$$p_{ij}(\varphi,\eta) = \frac{w_i\tau_{ij}}{\alpha\varphi\eta} \qquad q_{ij}(\varphi,\eta) = \beta E_j P_{jQ}^{\sigma-1}\left(\frac{\alpha\varphi\eta}{w_i\tau_{ij}}\right)^{\sigma}$$

$$l_{ij}(\varphi,\eta) = f_{ij} + \frac{\tau_{ij}q_{ij}(\varphi,\eta)}{\varphi} \qquad c_{ij}(\varphi,\eta) = \left(f_{ij} + \frac{\tau_{ij}q_{ij}(\varphi,\eta)}{\varphi\eta}\right)w_i$$

$$r_{ij}(\varphi,\eta) = \beta E_j\left(\frac{\alpha P_{jQ}\varphi\eta}{w_i\tau_{ij}}\right)^{\sigma-1} \qquad \pi_{ij}(\varphi,\eta) = \frac{r_{ij}(\varphi,\eta)}{\sigma} - w_i f_{ij}$$

Equilibrium with No Misallocation

- **Zero-profit productivity cut-offs** $\pi_{ij}\left(\varphi_{ij}^{*}\right) = 0$

- **Free entry** $w_i f_i^E = \sum_j E\left[\pi_{ij}(\varphi)\mathbb{I}(\varphi \geq \varphi_{ij}^{*})\right]$

- **Labor market clearing** (if no outside sector)

$$L_i = \sum_j M_i E[l_{ij}(\varphi)\mathbb{I}\left(\varphi \geq \varphi_{ij}^{*}\right)] + M_i f_i^E$$

- **Income-expenditure balance**

$$\beta Y_j = \beta w_j L_j = \sum_i R_{ij} = \sum_i M_i E[r_{ij}(\varphi)\mathbb{I}\left(\varphi \geq \varphi_{ij}^{*}\right)]$$

Equilibrium with Misallocation

- **Zero-profit profitability** $\underline{\varphi} = \varphi\eta$ cut-offs $\quad \pi_{ij}\left(\underline{\varphi}_{ij}^{*}\right) = 0$

  → **Free entry** and **labor market clearing** conditions adjusted accordingly

- Misallocation implies **distortionary taxes and subsidies**, covered through lump-sum taxation
  - Firm incurs cost $c_{ij} = \left(f_{ij} + \frac{\tau_{ij} q_{ij}(\varphi,\eta)}{\varphi\eta}\right) w_i$
  - But workers receive $c'_{ij} = \left(f_{ij} + \frac{\tau_{ij} q_{ij}(\varphi,\eta)}{\varphi}\right) w_i$
  - Lump-sum tax $T_i = \sum_j M_i E\left\{\left[c'_{ij}(\varphi,\eta) - c_{ij}(\varphi,\eta)\right] \mathbb{I}\left(\varphi\eta \geq \underline{\varphi}_{ij}^{*}\right)\right\}$

- **Income-expenditure balance**

$$\beta Y_j = \beta\left(w_j L_j - T_j\right) = \sum_i R_{ij} = \sum_i M_i E\left[r_{ij}(\varphi,\eta)\mathbb{I}\left(\varphi\eta \geq \underline{\varphi}_{ij}^{*}\right)\right]$$

Back

Welfare

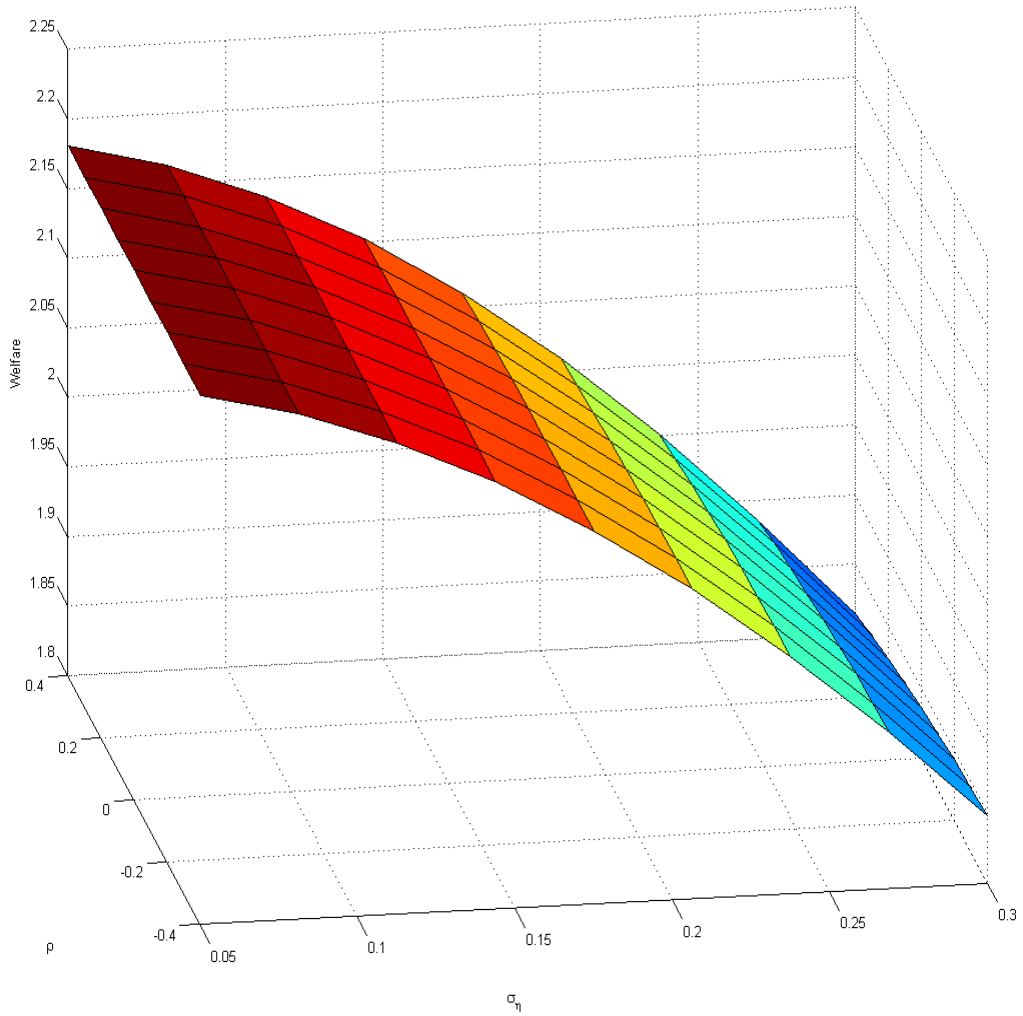
- **Welfare is proportional to the real wage and the ratio of disposable income to gross income**

$$W_i \propto \frac{w_i}{P_i}\chi_i, \quad P_i = P_{iQ}^{\beta}, \quad \chi_i = \frac{w_i L_i - T_i}{w_i L_i}$$

- **Welfare increases with productivity cut-off φ_{ii}^* without misallocation, and with profitability cut-off $\underline{\varphi}_{ii}^*$ and disposable income share χ_i with misallocation**

$$W_i \propto \begin{cases} \left(\varphi_{ii}^*\right)^{\beta} & without\ misallocation \\ (\chi_i)^{\frac{\beta+\sigma-1}{\sigma-1}} \left(\underline{\varphi}_{ii}^*\right)^{\beta} & with\ misallocation \end{cases}$$

Welfare & Misallocation



Back

Challenge: From Theory to Empirics

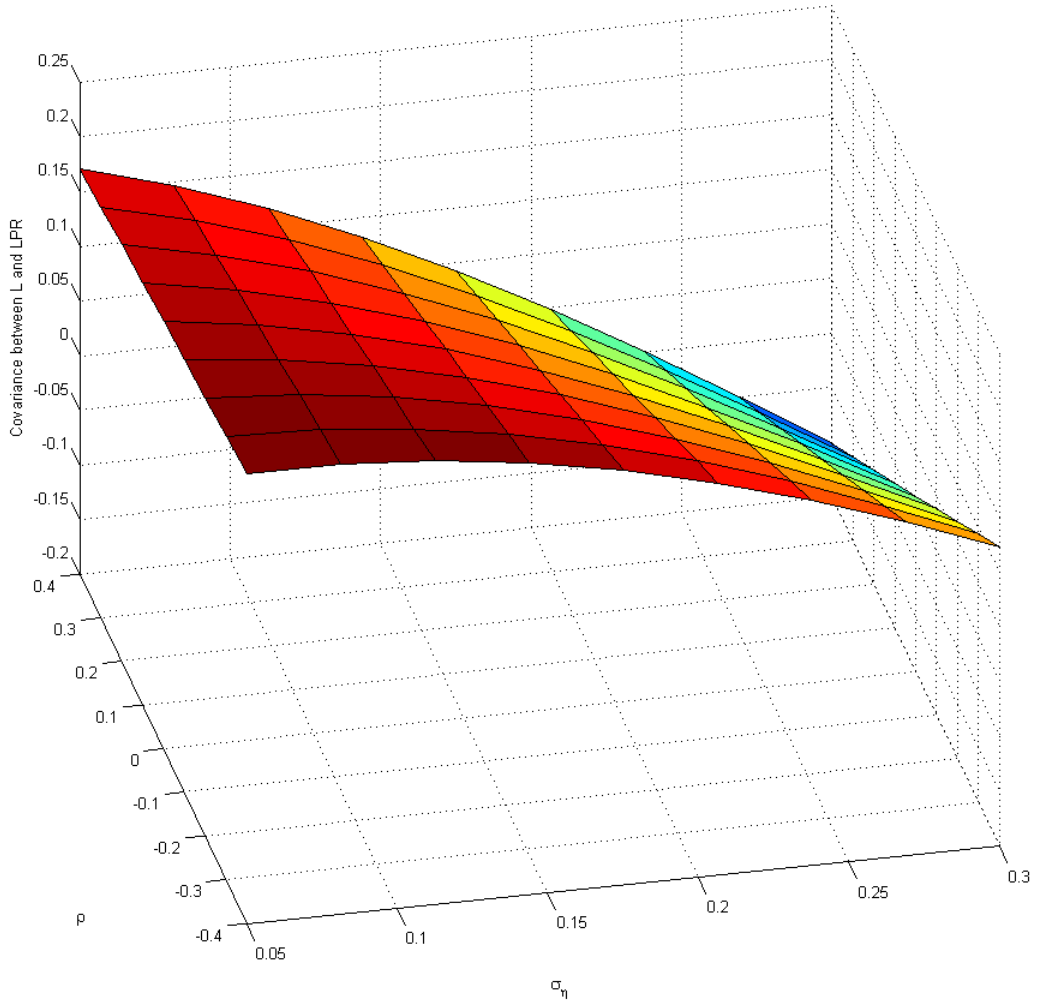
4. Welfare vs. measured aggregate productivity

- Welfare $W_i \propto$ agg prod across firms selling in *i* ≠ agg prod across *i* firms

$$AggProd_i = \begin{cases} \dfrac{\sigma\theta}{\sigma\theta - (\sigma-1)} \dfrac{w_i}{P_i^{1/\beta}} & without\ misallocation \\ \dfrac{\sigma\theta}{(\sigma-1)\theta K_i + \theta - (\sigma-1)} \dfrac{w_i}{P_i^{1/\beta}} & with\ misallocation \end{cases}$$

- Size-weighted avg distortion across firms $K_i = \dfrac{\sum_j \int \int_{\varphi\eta \geq \underline{\varphi}_{ij}^*}^{\infty} \eta(\varphi\eta)^{\sigma-1} dH_i(\varphi,\eta)}{\sum_j \int \int_{\varphi\eta \geq \underline{\varphi}_{ij}^*}^{\infty} (\varphi\eta)^{\sigma-1} dH_i(\varphi,\eta)}$
- $W_i \propto AggProd_i$ only with Pareto and no misallocation
- W_i and $AggProd_i$ tend to comove in simulations with efficient allocation

OP Covariance & Misallocation



Back

Trade Liberalization with Flexible Wages and No Misallocation

Proposition 1 With **flexible** wages and no misallocation,

$\downarrow(\tau_{ij},\tau_{ji})$, $\downarrow\tau_{ij}$, $\downarrow\tau_{ji}$ → $\uparrow W_i$, $\uparrow AggProd_i$

- Lower export cost τ_{ij} increases export demand
  - Lower export cut-off φ_{ij}^* → higher production cut-off $\boldsymbol{\varphi_{ii}^*}$
  - Reallocation of activity towards more productive firms
- Lower import cost τ_{ji} increases import competition
  - Lower domestic demand → higher production cut-off $\boldsymbol{\varphi_{ii}^*}$
  - Reallocation of activity towards more productive firms

Trade Liberalization with Fixed Wages and No Misallocation

Proposition 2 With **fixed** wages and no misallocation,

$$\downarrow(\tau_{ij},\tau_{ji}),\ \downarrow\tau_{ij} \rightarrow \uparrow W_i,\ \uparrow AggProd_i$$

$$\downarrow\tau_{ji} \rightarrow \downarrow W_i,\ \downarrow AggProd_i$$

- Lower import cost τ_{ji} → lower foreign export cut-off φ^*_{ji} → higher foreign production cut-off φ^*_{jj}
  - Direct effect: tougher home market → higher home production cut-off $\boldsymbol{\varphi^*_{ii}}$
  - Indirect effect: tougher foreign market → higher home export cut-off φ^*_{ij} → lower home production cut-off $\boldsymbol{\varphi^*_{ii}}$
  - When w_i cannot fall, indirect effect dominates in "Metzler paradox" (Demidova-RodriguezClare 2013, Bagwell-Lee 2016)

Trade Liberalization with Misallocation

Proposition 3 With misallocation,

$$\downarrow(\tau_{ij},\tau_{ji}),\ \downarrow\tau_{ij},\ \downarrow\tau_{ji} \rightarrow \uparrow\downarrow W_i,\ \uparrow\downarrow AggProd_i$$

- Trade gains/losses are not monotonic in initial misallocation or in misallocation parameters σ_η and $\rho(\varphi,\eta)$
- Misallocation can foster / dampen the selection + reallocation process
- No analytical solution → Need simulations

Challenge: From Theory to Empirics

1. **Theoretical vs. measured firm productivity**
   - Theoretical φ is **quantity-based (TFPQ)**, empirical measures Φ are **revenue-based (TFPR, LPR)**

$$\Phi_i(\varphi) = \frac{r_i(\varphi)}{P_i l_i(\varphi)} = \frac{w_i}{\alpha P_i}\left[1 - \frac{f_i}{l_i(\varphi)}\right]$$

   - With misallocation, we have a similar expression but now the measured productivity depends on the distortion η

2. **Measured aggregate productivity decomposition**
   - Agg productivity = avg firm productivity + covariance of firm productivity and employment share (Olley-Pakes 1996, Melitz-Polanec 2015)

$$AggProd_{ikt} = \underbrace{\frac{1}{N_{ikt}}\sum_f Prod_{fikt}}_{AvgProd_{ikt}} + \underbrace{\sum_f \left(\theta_{fikt} - \overline{\theta_{ikt}}\right)\left(Prod_{fikt} - \overline{Prod_{ikt}}\right)}_{CovProd_{ikt}}$$

Challenge: From Theory to Empirics

1. **Theoretical vs. measured firm productivity**
   - Theoretical φ is **quantity-based (TFPQ)**, empirical measures Φ are **revenue-based (TFPR, LPR)**

$$\Phi_i(\varphi) = \frac{r_i(\varphi)}{P_i l_i(\varphi)} = \frac{w_i}{\alpha P_i}\left[1 - \frac{f_i}{l_i(\varphi)}\right]$$

   - Both productivity measures are equivalent conditional on export status ;
   - With misallocation, we have a similar expression but now the measured productivity depends on the distortion η

Challenge: From Theory to Empirics

2. Measured aggregate productivity decomposition

- Agg productivity = avg firm productivity + covariance of firm productivity and employment share (Olley-Pakes 1996, Melitz-Polanec 2015)

$$\widetilde{\Phi}_i = \overline{\Phi}_i + \ddot{\Phi}_i = \int_{\varphi_{ii}^*}^{\infty} \Phi_i(\varphi) \frac{dG_i(\varphi)}{1 - G_i(\varphi_{ii}^*)} + \int_{\varphi_{ii}^*}^{\infty} \left[\Phi_i(\varphi) - \overline{\Phi}_i\right]\left[\theta_i(\varphi) - \overline{\theta}_i\right] \frac{dG_i(\varphi)}{1 - G_i(\varphi_{ii}^*)}$$

$$\Leftrightarrow AggProd_{ikt} = \underbrace{\frac{1}{N_{ikt}} \sum_f Prod_{fikt}}_{AvgProd_{ikt}} + \underbrace{\sum_f \left(\theta_{fikt} - \overline{\theta_{ikt}}\right)\left(Prod_{fikt} - \overline{Prod_{ikt}}\right)}_{CovProd_{ikt}}$$

- $\ddot{\Phi}_i > 0$ without misallocation, $\ddot{\Phi}_i \gtrless 0$ with misallocation
- f, i, k, t : firm, country, sector, year

OP covariance & misallocation

Numerical Simulation

- **No misallocation**: log-normal productivity with $\mu_\phi = 0$, $\sigma_\phi = 1$
- **Misallocation**: joint log-normal productivity and distortion with
  $\mu_\phi = 0$, $\sigma_\phi = 1$, $\mu_\eta = 0$, $\sigma_\eta = 0.15$, $\rho(\phi, \eta) \in \{-0.4, 0, 0.4\}$
- Other model parameters (Burstein-Cravino 2015)
  - Elasticity of substitution $\sigma = 3$
  - Initial trade costs $\tau = \tau_i = \tau_e = 1.81$
  - Fixed cost of production 1.2
  - Fixed cost of exports 1.75
  - Sunk cost of entry 0.1

Back

Numerical Simulation: Flexible Wages

Counterfactual effects of 20% fall in variable trade costs

	Bilateral Liberalization				Export Liberalization				Import Liberalization			
	Welfare	Agg Prod	Avg Prod	Cov Term	Welfare	Agg Prod	Avg Prod	Cov Term	Welfare	Agg Prod	Avg Prod	Cov Term
No Misallocation: $\sigma_\eta=0$												
	3.92%	3.50%	2.75%	0.75%	1.39%	1.22%	0.96%	0.26%	1.95%	1.72%	1.35%	0.37%
Misallocation: $\sigma_\eta=0.15$												
$\rho-0.4$	3.92%	3.49%	2.65%	0.84%	1.40%	1.22%	0.92%	0.30%	1.96%	1.72%	1.30%	0.42%
$\rho=0$	3.87%	3.47%	2.80%	0.67%	1.37%	1.21%	0.98%	0.22%	1.93%	1.70%	1.38%	0.32%
$\rho=0.4$	3.85%	3.47%	2.94%	0.53%	1.35%	1.20%	1.04%	0.16%	1.91%	1.70%	1.46%	0.24%

CompNet Data Coverage

	Years	# Sector-Years	Avg # Firms per Sector-Year
AUSTRIA	2000-2011	178	68
BELGIUM	1998-2010	254	709
ESTONIA	1998-2011	157	218
FINLAND	1999-2011	233	573
FRANCE	1998-2009	231	3,559
GERMANY	1998-2011	274	721
HUNGARY	2003-2011	164	1,484
ITALY	2001-2011	218	4,356
LITHUANIA	2000-2011	179	263
POLAND	2005-2011	128	709
PORTUGAL	2006-2011	110	1,637
SLOVAKIA	2001-2011	182	109
SLOVENIA	1998-2011	232	216
SPAIN	1998-2011	271	3,192

OLS Correlation

- OLS estimate of the long-run relationship between aggregate productivity and trade exposure

$$Y_{ikt} = \alpha + \beta_1 \cdot ExpDemand_{ikt} + \beta_2 \cdot ImpComp_{ikt} + \Gamma \cdot Z_{ikt} + \psi_{it} + \varepsilon_{ikt}$$

  - Y_{ikt} : productivity measure in country i, sector k, year t
  - Z_{ikt} : # firms ($\ln N_{ikt}$), sector trends ($\ln N_{kt}$, $\ln L_{kt}$)
  - φ_{it} : 14 country * 14 year FE
    (subsume GDP per capita, GDP, institutions, macro shocks)
  - ε_{ikt} : clustered by sector-year

Aggregate outcomes: output, VA and Employment

↑ exports ↔ ↑ output, value added, employment
↑ imports ↔ ↓ output & employment, ↑ value added

	ln Output (ikt)	ln Value Added (ikt)	ln Employ-ment (ikt)
Exp Dem (ikt)	**0.403*** **	**0.380*** **	**0.243*** **
	(0.029)	**(0.022)**	**(0.014)**
Imp Comp (ikt)	**-0.139*** **	**0.041*** **	**-0.066*** **
	(0.015)	**(0.015)**	**(0.006)**
ln N Firms (ikt)	0.552***	0.573***	0.736***
	(0.023)	(0.023)	(0.019)
Avg ln N Firms (kt)	-0.969***	-0.710***	-0.727***
	(0.032)	(0.033)	(0.023)
Avg ln Employment (kt)	1.285***	0.653***	0.858***
	(0.065)	(0.045)	(0.028)
N	2,811	2,811	2,811
R2	0.927	0.928	0.949
Country*Year FE	Y	Y	Y

Aggregate Productivity

↑ exports, ↑ imports ↔ ↑ aggregate productivity

- 20% ↑ trade ↔ 2.1%-2.5% ↑ productivity
- ↑ exports ↔ ↑ avg firm productivity, ↑ allocative efficiency
- ↑ imports ↔ ↑ avg firm productivity, ↓ allocative efficiency

	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
Exp Dem (ikt)	**0.125*** **	**0.080*** **	**0.045*** **
	(0.016)	**(0.016)**	**(0.007)**
Imp Comp (ikt)	**0.106*** **	**0.124*** **	**-0.019*** **
	(0.013)	**(0.013)**	**(0.005)**
N	2,811	2,811	2,811
R2	0.849	0.868	0.519
Country*Year FE	Y	Y	Y

Endogeneity

Two potential sources of endogeneity:

- **Reverse causality**
  - More productive countries may export more because they are more competitive on world markets → β_1 biased +
  - Lower local productivity may induce more entry by foreign exporters → β_2 biased –

- **Omitted variable bias**
  - Country-year FE control for aggregate supply and demand shocks
  - OVB must vary systematically across sectors within country-years -> use sector-year FE in robustness

Measurement Error & Sample Selection

- Size threshold varies across countries
  - Include country-year fixed effects
  - Control for $\ln N_{ikt}$
- Outliers
  - Drop observations with $N_{ikt} < 20$
  - Drop observations in top and bottom percentile by annual change in Y_{ikt}, $ExpDemand_{ikt}$ and $ImpComp_{ikt}$

IV Relevance (First Stage)

	Exp Dem (ikt)		Imp Comp (ikt)	
Foreign Demand (ikt)	**0.638*** **	**0.443*** **	**-0.002**	**-0.036**
	(0.034)	**(0.062)**	**(0.022)**	**(0.030)**
Foreign Supply (ikt)	**0.087*** **	**0.140***	**0.868*** **	**0.345*** **
	(0.015)	**(0.081)**	**(0.007)**	**(0.031)**
Import Tariff (ikt)	**-4.693*** **	**0.662**	**-2.802*** **	**-1.332*** **
	(0.847)	**(0.816)**	**(0.507)**	**(0.437)**
ln N Firms (ikt)	0.555***	0.569***	0.036**	0.007
	(0.034)	(0.032)	(0.018)	(0.016)
Avg ln N Firms (kt)	-0.741***		-0.112***	
	(0.033)		(0.025)	
Avg ln Employment (kt)	0.344***		0.113***	
	(0.065)		(0.042)	
N	2,777	2,777	2,777	2,777
R2	0.889	0.924	0.974	0.986
Country*Year FE	Y	Y	Y	Y
Sector*Year FE	N	Y	N	Y

Winsorizing & Weighting

	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
Panel C. Winsorizing Outliers						
^Exp Dem (ikt)	0.393***	0.301***	0.092***	0.206*	0.078	0.127*
	(0.039)	(0.039)	(0.014)	(0.120)	(0.122)	(0.067)
^Imp Comp (ikt)	0.073***	0.094***	-0.021***	0.637***	0.792***	-0.154*
	(0.014)	(0.014)	(0.006)	(0.245)	(0.236)	(0.087)
Panel D. Weighting by Sectors' Initial Employment Share by Country, L (ikt=0) / L (it=0)						
^Exp Dem (ikt)	0.405***	0.352***	0.053***	0.967***	0.743***	0.225***
	(0.037)	(0.035)	(0.009)	(0.202)	(0.177)	(0.057)
^Imp Comp (ikt)	0.082***	0.097***	-0.015***	0.435**	0.579***	-0.144**
	(0.015)	(0.014)	(0.004)	(0.212)	(0.196)	(0.060)
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y
Sector*Year FE	N	N	N	Y	Y	Y

China vs. ROW Import Competition

- How do firms respond to competition from foreign firms with relatively low vs. high levels of productivity, factor costs, and quality?

- Dramatic rise in Chinese exports since WTO accession in 2001 and removal of MFA quotas in 2005
  - Large shock ~ quasi-natural experiment (Autor et al 2015, Bloom et al 2015)

$$ChinaImpComp_{ikt} = \ln\left[\sum_{s \neq k} X_{China \to i,kst}\right]$$

- IV for $ChinaImpComp_{ikt}$
  - Import tariffs $Tariff_{ikt}$
  - Chinese export supply: Chinese export value added for final consumption, weighted by China's share in i's initial imports

$$ChinaSupply_{ikt} = \ln\left[\frac{M_{China \to i,k,t=0}}{M_{ik,t=0}} XVA^{final}_{-i,China,kt}\right]$$

China vs. ROW Import Competition

Dep Variable:	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
Panel C. Import Competition from China vs. ROW						
^Exp Dem (ikt)	0.371***	0.290***	0.082***	0.337***	0.200**	0.137***
	(0.038)	(0.038)	(0.013)	(0.104)	(0.093)	(0.047)
^Imp Comp ROW (ikt)	0.082***	0.086***	-0.004	0.398**	0.484***	-0.086
	(0.015)	(0.015)	(0.006)	(0.182)	(0.163)	(0.067)
^Imp Comp China (ikt)	-0.015	0.005	-0.019***	0.136**	0.141***	-0.005
	(0.014)	(0.014)	(0.004)	(0.058)	(0.051)	(0.023)

Mechanisms

Misallocation, indirect evidence #1 : Empirical results for {AggProd, AvgProd, CovProd} are *consistent* only with **numerical simulations of the model** with misallocation

→ Free entry, fixed wages & misallocation, $\sigma_\eta > 0$ **and** $\rho(\varphi,\eta) > 0$.

→ **Robust to controls for other mechanisms?**

- Firm-selection (in model) : control for **min firm productivity;**
- Innovation (out model) :with mixed empirical evidence so far, controls with **country-sector R&D**

Misallocation Indirect evidence #2 : Institutional strength modifies the impact of trade iff misallocation

Firm Selection

Trade increases min firm productivity :

- Firm selection = 1/3 of the effect of ExpDem on AggProd (2/3 of ImpComp -> AggProd)
- Firm selection = 1/2 effect of both on AvgProd

	ln min Prod (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt)	**0.198*** **	**0.275*** **	**0.152*** **	**0.124*** **
	(0.040)	**(0.027)**	**(0.020)**	**(0.013)**
^Imp Comp (ikt)	**0.073*** **	**0.026*** **	**0.039*** **	**-0.013** **
	(0.015)	**(0.010)**	**(0.007)**	**(0.005)**
ln min Prod (ikt)		0.642***	0.733***	-0.091***
		(0.025)	(0.018)	(0.011)
N	2,750	2,750	2,750	2,750
R2	0.911	0.913	0.948	0.473
Ctry*Year FE, Controls	Y	Y	Y	Y

Selection + Innovation

Firm selection and productivity upgrading are not the whole story

	ln R&D (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt)	**0.103**	**0.282*** **	**0.154*** **	**0.129*** **
	(0.115)	**(0.027)**	**(0.019)**	**(0.012)**
^Imp Comp (ikt)	**0.164*** **	**0.016***	**0.038*** **	**-0.022*** **
	(0.046)	**(0.009)**	**(0.007)**	**(0.004)**
ln min Prod (ikt)		0.657***	0.736***	-0.079***
		(0.022)	(0.016)	(0.009)
ln R&D (ikt)		-0.000	-0.018***	0.017***
		(0.008)	(0.006)	(0.003)
N	2,777	2,750	2,750	2,750
R2	0.999	0.915	0.949	0.501
Ctry*Year FE, Controls	Y	Y	Y	Y

Robustness & Extensions

Key results survive various sensitivity checks

- Fixed mass of firms (but no Metzler without misallocation)
- No misallocation or asymmetric misallocation in foreign

Model extensions motivate identification strategy

- Multiple differentiated sectors
- Export cost shocks ~ foreign demand shocks,
  import cost shocks ~ foreign supply shocks

Endogenous Productivity Upgrading

- Innovation: falling trade costs may incentivize or discourage firms to upgrade their technology with economies of scale in R&D
  - Shocks change absolute & relative profits with & without innovation
  - Export expansion increases potential revenues for some, but reduces sales for others (Bustos 2011)
  - Import competition hurts domestic sales (Steinwender 2015)
- X-inefficiency: falling trade costs may induce firms to trim their fat
- Multi-product firms: falling trade costs can raise firm productivity via reallocations across products (Mayer, Melitz, Ottaviano 2016)

OLS First Differences

- OLS estimate of the short- to medium-run relationship between aggregate productivity and trade exposure

$$\Delta Y_{ikt} = \alpha + \beta_1 \cdot \Delta ExpDemand_{ikt} + \beta_2 \cdot \Delta ImpComp_{ikt} + \Gamma \cdot \Delta Z_{ikt} + \varphi_t + \varepsilon_{ikt}$$

  - ΔY_{ikt} : 1-, 3- or 5-year change in productivity, overlapping periods
  - $\Delta ExpDemand_{ikt}$, $\Delta ImpComp_{ikt}$, ΔZ_{ikt} : concurrent or lagged change
  - country x sector FE differenced out
  - φ_t : trends in productivity growth
  - ε_{ikt} : robust standard errors

Trade-Productivity Nexus in the Short to Medium Term

	Δ = 1 year			Δ = 3 years			Δ = 5 years		
	Δ ln Agg Prod (ikt)	Δ ln Avg Prod (ikt)	Δ Cov Term (ikt)	Δ ln Agg Prod (ikt)	Δ ln Avg Prod (ikt)	Δ Cov Term (ikt)	Δ ln Agg Prod (ikt)	Δ ln Avg Prod (ikt)	Δ Cov Term (ikt)
Δ Exp Dem (ikt)	**0.116*** **	**0.034**	**0.082*** **	**0.142*** **	**0.053***	**0.089*** **	**0.162*** **	**0.088*** **	**0.074*** **
	(0.028)	**(0.025)**	**(0.027)**	**(0.027)**	**(0.027)**	**(0.018)**	**(0.032)**	**(0.031)**	**(0.019)**
Δ Imp Comp (ikt)	**0.083*** **	**0.102*** **	**-0.019**	**0.062** **	**0.102*** **	**-0.040** **	**0.078*** **	**0.108*** **	**-0.030***
	(0.021)	**(0.022)**	**(0.019)**	**(0.025)**	**(0.024)**	**(0.017)**	**(0.030)**	**(0.027)**	**(0.016)**
N	2,546	2,546	2,546	2,073	2,073	2,073	1,587	1,587	1,587
R2	0.114	0.115	0.022	0.101	0.117	0.044	0.096	0.094	0.035
Year FE, Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y

Robustness: Single Trade Dimension

	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
Panel A. Only Export Demand						
^Exp Dem (ikt)	0.461***	0.350***	0.111***	0.417***	0.304***	0.114**
	(0.039)	(0.041)	(0.018)	(0.112)	(0.097)	(0.047)
Panel B. Only Import Competition						
^Imp Comp (ikt)	0.148***	0.149***	-0.001	0.730***	0.728***	0.001
	(0.013)	(0.015)	(0.005)	(0.150)	(0.142)	(0.050)
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y
Sector*Year FE	N	N	N	Y	Y	Y

Robustness: Lagged Trade Effects

	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt-1)	**0.395*** **	**0.292*** **	**0.103*** **	**0.297*** **	**0.179***	**0.118** **
	(0.041)	**(0.041)**	**(0.014)**	**(0.102)**	**(0.092)**	**(0.049)**
^Imp Comp (ikt-1)	**0.069*** **	**0.091*** **	**-0.022*** **	**0.500*** **	**0.569*** **	**-0.069**
	(0.015)	**(0.014)**	**(0.006)**	**(0.180)**	**(0.163)**	**(0.062)**
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y
Sector*Year FE	N	N	N	Y	Y	Y

Robustness: Sector FE

	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt)	**0.300*** **	**0.197** **	**0.103** **
	(0.097)	**(0.085)**	**(0.045)**
^Imp Comp (ikt)	**0.294** **	**0.296** **	**-0.002**
	(0.131)	**(0.118)**	**(0.042)**
N	2,777	2,777	2,777
R2	0.869	0.897	0.635
Ctry*Year FE, Controls	Y	Y	Y
Sector FE	Y	Y	Y

Chinese Import Competition

- Dramatic rise in Chinese exports since WTO accession in 2001 and removal of MFA quotas in 2005
  - Large, exogenous trade shock serves as quasi-natural experiment for identification (Autor et al 2015, Bloom et al 2015)

$$ChinaImpComp_{ikt} = \ln\left[\sum_{s\neq k} X_{China\rightarrow i,kst}\right]$$

- IV for $ChinaImpComp_{ikt}$
  - Import tariffs $Tariff_{ikt}$: average applied tariff
  - China's global export supply: Chinese export value added for final consumption, weighted by China's share in i's initial imports
  - China's export supply to the US: weighted average Chinese exports to the US by NACE-4 product, using i's initial product import shares as weights

$$ChinaSupply_{ikt} = \left\{\ln\left[\frac{M_{China\rightarrow i,k,t=0}}{M_{ik,t=0}}\, XVA^{final}_{-i,China,kt}\right], \ln\left[\sum_{p\in\Omega_k}\frac{M_{ip,t=0}}{M_{ik,t=0}} X_{China\rightarrow US,pt}\right]\right\}$$

Chinese Import Competition

	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt)	**0.438*** **	**0.388*** **	**0.051*** **	**0.263*** **	**0.171** **	**0.092** **
	(0.035)	**(0.036)**	**(0.009)**	**(0.089)**	**(0.077)**	**(0.040)**
^China Imp Comp (ikt)	**0.011**	**0.034*** **	**-0.023*** **	**0.090**	**0.105***	**-0.015**
	(0.012)	**(0.012)**	**(0.003)**	**(0.057)**	**(0.053)**	**(0.024)**
N	2,777	2,777	2,777	2,777	2,777	2,777
R2	0.811	0.835	0.545	0.888	0.911	0.670
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y
Sector*Year FE	N	N	N	Y	Y	Y

Import Penetration Ratio

$$ImpCompRatio_{ikt} = \ln \frac{\sum_{j,s \neq k} X_{jikst}}{Turnover_{ik}}$$

	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt)	**0.433*** **	**0.329*** **	**0.104*** **	**0.465*** **	**0.345*** **	**0.121** **
	(0.038)	**(0.038)**	**(0.013)**	**(0.140)**	**(0.124)**	**(0.058)**
^Imp Comp Ratio (ikt)	**0.101*** **	**0.144*** **	**-0.043*** **	**0.153*** **	**0.181*** **	**-0.028**
	(0.020)	**(0.020)**	**(0.010)**	**(0.053)**	**(0.047)**	**(0.024)**
N	2,777	2,777	2,777	2,777	2,777	2,777
R2	0.811	0.845	0.495	0.860	0.891	0.652
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y
Sector*Year FE	N	N	N	Y	Y	Y

Institutional and Market Frictions

Efficient institutions, factor and product markets amplify gains from import competition, but dampen gains from export expansion

	Rule of Law			(Inverse) Corruption		
	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt)	1.066***	0.862***	0.204***	0.850***	0.670***	0.180***
	(0.126)	(0.111)	(0.037)	(0.096)	(0.085)	(0.031)
^Imp Comp (ikt)	-0.113**	-0.053	-0.060***	-0.063*	-0.013	-0.050***
	(0.050)	(0.044)	(0.012)	(0.038)	(0.034)	(0.010)
^Exp Dem (ikt) x Institution (it)	**-0.476*** (0.067)**	**-0.405*** (0.059)**	**-0.070*** (0.017)**	**-0.302*** (0.042)**	**-0.252*** (0.036)**	**-0.050*** (0.012)**
^Imp Comp (ikt) x Institution (it)	**0.136*** (0.031)**	**0.106*** (0.028)**	**0.030*** (0.006)**	**0.095*** (0.020)**	**0.074*** (0.018)**	**0.021*** (0.004)**
N	2,777	2,777	2,777	2,777	2,777	2,777
R2	0.792	0.835	0.459	0.797	0.839	0.460
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y

Institutional and Market Frictions

Efficient institutions, factor and product markets amplify gains from import competition, but dampen gains from export expansion

	Labor Market Flexibility			Creditor Rights Protection			(Inverse) Product Market Regulation		
	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)	ln Agg Prod (ikt)	ln Avg Prod (ikt)	Cov Term (ikt)
^Exp Dem (ikt)	1.121***	0.763***	0.358***	0.718***	0.511***	0.207***	1.314***	1.047***	0.267***
	(0.261)	(0.238)	(0.063)	(0.158)	(0.147)	(0.040)	(0.172)	(0.155)	(0.045)
^Imp Comp (ikt)	-0.202**	-0.102	-0.100***	-0.108*	-0.063	-0.045***	-0.045	0.033	-0.078***
	(0.096)	(0.089)	(0.027)	(0.061)	(0.055)	(0.015)	(0.061)	(0.055)	(0.016)
^Exp Dem (ikt) x Institution (it)	**-0.218*** (0.069)**	**-0.143** (0.063)**	**-0.075*** (0.016)**	**-0.048** (0.019)**	**-0.033* (0.017)**	**-0.015*** (0.005)**	**-0.769*** (0.130)**	**-0.636*** (0.118)**	**-0.133*** (0.032)**
^Imp Comp (ikt) x Institution (it)	**0.083*** (0.027)**	**0.060** (0.026)**	**0.024*** (0.008)**	**0.028*** (0.009)**	**0.025*** (0.008)**	**0.003 (0.002)**	**0.085* (0.046)**	**0.039 (0.043)**	**0.046*** (0.013)**
N	2,777	2,777	2,777	2,777	2,777	2,777	2,777	2,777	2,777
R2	0.747	0.802	0.447	0.811	0.848	0.463	0.825	0.858	0.398
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y

Alternative Misallocation Measures

- Indicators of resource (mis)allocation across firms in the literature
  - MRPK and MRPL dispersion (Hsieh-Klenow 2009, Gopinath et al 2015)
  - TFPR dispersion (Hsieh-Klenow 2009, Bartelsman et al 2013)
  - PCM dispersion (Edmond et al 2015)

- These indicators face conceptual challenges in distinguishing between efficient allocation and misallocation
  - Measurement error can inflate dispersion
  - Dispersion = misallocation only with constant mark-ups, CRS, no shocks or adjustment costs (Dhingra-Morrow 2014, Bartelsman et al 2013, Foster et al 2015, 2016)

Alternative Misallocation Measures

	MRPK St Dev	MRPL St Dev	TFPR St Dev	PCM p80 / p20	MRPK St Dev	MRPL St Dev	TFPR St Dev	PCM p80 / p20
^Exp Dem (ikt)	**-0.203*** **	**0.272*** **	**0.297*** **	**0.039*** **	**0.425*** **	**0.059**	**0.125**	**-0.156*** **
	(0.069)	**(0.038)**	**(0.035)**	**(0.015)**	**(0.145)**	**(0.082)**	**(0.155)**	**(0.045)**
^Imp Comp (ikt)	**0.193*** **	**0.095*** **	**0.059*** **	**-0.008**	**0.408***	**0.483*** **	**0.981*** **	**0.189** **
	(0.026)	**(0.012)**	**(0.013)**	**(0.005)**	**(0.229)**	**(0.131)**	**(0.248)**	**(0.078)**
N	2,777	2,777	2,382	2,775	2,777	2,777	2,382	2,775
R2	0.552	0.810	0.784	0.693	0.703	0.872	0.792	0.733
Ctry*Year FE, Controls	Y	Y	Y	Y	Y	Y	Y	Y
Sector*Year FE	N	N	N	N	Y	Y	Y	Y