Trade, Productivity and (Mis)allocation

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CompNet-EBRD-IWH FINPRO Conference
December 2019
Motivation

- Rapid expansion in international trade in recent decades has intensified debates about trade policy and structural reforms
  - Advanced countries: competition from low-wage countries, inequality
  - Developing countries: mixed gains, weak macro fundamentals
- How does globalization affect aggregate productivity and welfare?
  - Firm heterogeneity: selection, reallocation
  - Efficient allocation: institutional, factor, product market frictions
  - Bilateral vs. unilateral trade reforms
- This paper: theoretically and empirically examine the impact of international trade on aggregate productivity and welfare
Overview: Theory & Methodology

- Study trade impact and adjustment mechanisms in heterogeneous-firm model with and without resource misallocation
  - No misallocation: definite gains from bilateral and export liberalization, ambiguous effects of import liberalization
  - Misallocation can amplify, dampen or reverse the gains from trade: all trade reforms have ambiguous effects

- Map theoretical concepts to empirical measures
  - Firm productivity vs. measured firm productivity
  - Welfare vs. aggregate productivity vs. measured aggregate productivity
  - OP decomposition: \( \text{AggProd} = \text{AvgProd} + \text{Cov}(\text{Prod}, \text{Size}) \)
Overview: Empirics

- Exploit unique macro data that captures micro firm heterogeneity & value-added trade flows by export & import sector (ECB, WIOD)
  - 14 European countries, 20 manufacturing industries, 1998-2011
  - Establish causality using tariffs and Bartik shocks as IVs

- 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)

- Mechanism: reallocation across firms under resource misallocation
  1. Results consistent only with model simulations with misallocation
  2. Trade improves firm selection, but minProd not a sufficient statistic
  3. Efficient institutions, factor and product markets amplify gains from import competition, but dampen gains from export expansion

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Literature

Macro: productivity dispersion and resource misallocation across firms contribute to productivity differences across countries

Trade: firm heterogeneity & reallocation across firms shape trade gains

Contribution: embed trade and macro insights on firm heterogeneity and misallocation into integrated model of trade, welfare and productivity
Contribution: provide causal evidence for the gains from trade in a cross-section of countries yet still incorporate firm dimension
Literature

- Financial and labor market frictions distort firm-level trade activity
  - Manova 2013, Chor & Manova 2012, Foley & Manova 2015 …
  - Helpman et al 2010, Tombe 2015, Ruggieri 2018 …

- Frictions in input and output markets affect resource allocation and gains from trade
  - Khandelwal et al 2013, Chung 2018, Bai et al 2018

- Variable mark-ups result in market share misallocation and moderate pro-competitive gains from trade

**Contribution:** quantify the productivity gains from trade under misallocation
**Contribution:** distinguish between export access and import competition
Outline

1. Theory
   a. Set up
   b. Theory $\rightarrow$ 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

- Production and trade technology
  - Sunk entry cost $w_if_i^E$, fixed production cost $w_if_i$, constant marginal cost
  - Fixed export cost $w_if_ij$, asymmetric iceberg trade costs $\tau_{ij}$

- No misallocation: firms draw productivity $\varphi$ from $G_i(\varphi)$
  - Marginal cost $w_i/\varphi$ (Melitz 2003)

- Misallocation: firms draw productivity $\varphi$ & distortion $\eta$ from $H_i(\varphi, \eta)$
  - Marginal cost $w_i/\varphi\eta$ (Hsieh-Klenow 2009, Bartelsman et al 2013)
Resource Misallocation

- We interpret $\eta$ as any distortion that creates a wedge b/w social marginal cost of input bundle and private marginal cost to the firm
  - Ex: imperfect institutions, capital or labor market frictions
  - Qualitatively similar to revenue distortion in product market

- Misallocation governed by $\sigma_\eta$ and $\rho(\phi, \eta)$
  - Trade can change misallocation outcome, but not primitives

- Firm selection, production and export activity depend on $\phi \eta$, while optimal resource allocation would depend on $\phi$ alone
  - Distortionary taxes and subsidies covered via lump-sum taxation
  - No additional misallocation due to variable mark-ups
Firm Problem: First Best

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

s.t. \(q_{ij}(\varphi) = \beta E_j P_j^\sigma p_{ij}(\varphi)^{-\sigma}\)

\[
p_{ij}(\varphi) = \frac{w_i \tau_{ij}}{\alpha \varphi}
\]

\[
q_{ij}(\varphi) = \beta E_j P_j^\sigma \left(\frac{\alpha \varphi}{w_i \tau_{ij}}\right)^\sigma
\]

\[
l_{ij}(\varphi) = f_{ij} + \frac{\tau_{ij} q_{ij}(\varphi)}{\varphi}
\]

\[
c_{ij}(\varphi) = \left(f_{ij} + \frac{\tau_{ij} q_{ij}(\varphi)}{\varphi}\right) w_i
\]

\[
l_{ij}(\varphi) = \beta E_j \left(\frac{\alpha P_j \varphi}{w_i \tau_{ij}}\right)^{\sigma-1}
\]

\[
c_{ij}(\varphi) = \frac{r_{ij}(\varphi)}{\sigma} - w_i f_{ij}
\]

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Firm Problem: Constrained Optimum

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

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

\[
p_{ij}(\varphi, \eta) = \frac{w_i \tau_{ij}}{\alpha \varphi \eta}
\]

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

\[
l_{ij}(\varphi, \eta) = f_{ij} + \frac{\tau_{ij} q_{ij}(\varphi, \eta)}{\varphi}
\]

\[
c_{ij}(\varphi, \eta) = \left( f_{ij} + \frac{\tau_{ij} q_{ij}(\varphi, \eta)}{\varphi \eta} \right) w_i
\]

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

\[
\pi_{ij}(\varphi, \eta) = \frac{r_{ij}(\varphi, \eta)}{\sigma} - w_i f_{ij}
\]
Equilibrium

- Zero-profit productivity or profitability $\varphi = \varphi \eta$ cut-offs
  \[ \pi_{ij}(\varphi^*_ij) = 0 \quad \pi_{ij}(\varphi^*_ij) = 0 \]

- Free entry
  \[ w_i f_i^E = \sum_j E[\pi_{ij}(\varphi)I(\varphi \geq \varphi^*_ij)] \]

- Distortionary taxes and subsidies covered via lump-sum taxation
  - Firm cost $c_{ij} = \left(f_{ij} + \frac{\tau_{ij}q_{ij}(\varphi,\eta)}{\varphi \eta}\right)w_i$, workers get $c'_{ij} = \left(f_{ij} + \frac{\tau_{ij}q_{ij}(\varphi,\eta)}{\varphi}\right)w_i$
  - Lump-sum tax $T_i = \sum_j M_i E \left\{ [c'_{ij}(\varphi,\eta) - c_{ij}(\varphi,\eta)]I(\varphi \eta \geq \varphi^*_ij) \right\}$

- Income-expenditure balance
  \[ \beta Y_j = \beta (w_j L_j - T_j) = \sum_i R_{ij} = \sum_i M_i E[r_{ij}(\varphi,\eta)I(\varphi \eta \geq \varphi^*_ij)] \]
Welfare & Aggregate Productivity

- Welfare depends on real wage and disposable income share

\[ W_i \propto \frac{w_i}{P_i} \chi_i, \quad P_i = P_i^\beta, \quad \chi_i = \frac{w_iL_i - T_i}{w_iL_i} \]

- Agg Prod depends on real wage & weighted avg distortion

\[ \text{AggProd}_i = \begin{cases} 
\frac{\sigma \theta}{\sigma \theta - (\sigma - 1)} \frac{w_i}{P_i^{1/\beta}} & \text{without misallocation} \\
\frac{\sigma \theta}{(\sigma - 1) \theta \tilde{\eta}_i + \theta - (\sigma - 1)} \frac{w_i}{P_i^{1/\beta}} & \text{with misallocation}
\end{cases} \]

- Misallocation affects \( P_i, \chi_i, \varphi_{ii}^* \) and \( \tilde{\eta}_i \)
From Theory to Empirics

1. Log real value added per worker $\propto \varphi \eta$ conditional on export status

2. Aggregate productivity decomposition (Olley-Pakes 1996)

$$AggProd_{ikt} = \frac{1}{N_{ikt}} \sum_{f} \left( Prod_{fikt} - \overline{AvgProd}_{ikt} \right) + \sum_{f} \left( \theta_{fikt} - \overline{\theta}_{ikt} \right) \left( Prod_{fikt} - \overline{Prod}_{ikt} \right)$$

3. No observable summary statistic for misallocation or $\sigma_\eta$ & $\rho(\varphi, \eta)$
   - $\{AggProd_i, AvgProd_i, CovProd_i\}$ response can reveal misallocation

4. Welfare $\propto$ agg prod of firms selling in $i \neq$ agg prod of $i$ firms
   - $W \propto AggProd$ only with symmetry, Pareto & efficient allocation

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Welfare vs. OP Covariance

Welfare

OP Covariance
Trade Liberalization with Flexible Wages and No Misallocation

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

\[ (\tau_{ij}, \tau_{ji}), \ \downarrow \tau_{ij}, \ \downarrow \tau_{ji} \rightarrow \uparrow W_i, \ \uparrow AggProd_i, \ \uparrow \downarrow AvgProd_i, \ \uparrow \downarrow CovProd_i \]

- Reallocation of activity towards more productive firms \( \rightarrow \) ex-post productivity distribution shifts right

- Lower export cost \( \tau_{ij} \) increases export demand
  - Lower export cut-off \( \varphi_{ij}^* \rightarrow \) higher production cut-off \( \varphi_{ii}^* \)

- Lower import cost \( \tau_{ji} \) increases import competition
  - Lower domestic demand \( \rightarrow \) higher production cut-off \( \varphi_{ii}^* \)
Trade Liberalization with Fixed Wages and No Misallocation

**Proposition 2** With fixed wages and no misallocation,
\[
\downarrow (\tau_{ij}, \tau_{ji}), \downarrow \tau_{ij} \rightarrow \uparrow W_i, \uparrow AggProd_i, \uparrow \downarrow AvgProd_i, \uparrow \downarrow CovProd_i
\]
\[
\downarrow \tau_{ji} \rightarrow \downarrow W_i, \downarrow AggProd_i, \uparrow \downarrow AvgProd_i, \uparrow \downarrow CovProd_i
\]

- Lower import cost $\tau_{ji} \rightarrow$ lower foreign export cut-off $\varphi_{ji}^* \rightarrow$ higher foreign production cut-off $\varphi_{jj}^*$
  - Direct effect: tougher home market $\rightarrow$ higher home production cut-off $\varphi_{ii}^*$
  - Indirect effect: tougher foreign market $\rightarrow$ higher home export cut-off $\varphi_{ij}^* \rightarrow$ lower home production cut-off $\varphi_{ii}^*$
- Metzler paradox: when $w_i$ cannot fall, indirect effect dominates (Demidova-RodriguezClare 2013, Bagwell-Lee 2016)
Trade Liberalization with Misallocation

**Proposition 3**  With misallocation,
\[ (\tau_{ij}, \tau_{ji}), \tau_{ij}, \tau_{ji} \rightarrow \uparrow\downarrow W_i, \uparrow\downarrow AggProd_i, \uparrow\downarrow AvgProd_i, \uparrow\downarrow CovProd_i \]

- Theory of second best: economy transitions between distorted states
- Misallocation can amplify, dampen or reverse the gains from trade
  - Reallocation depends on distorted productivity
  - Ex-post marginal productivity distribution differs from no-misallocation case, even if same ex-ante
  - Impact not monotonic in initial misallocation or parameters \( \sigma, \rho \)
Trade with vs. without Misallocation

Gains from trade depend on how different firms respond

- No misallocation: activity shifts towards more productive firms → ex-post productivity distribution shifts right

- Misallocation: reallocation depends on distorted productivity → ambiguous impact on ex-post marginal productivity distribution
  - Gains dampened if more productive firms cannot fully respond to growth opportunity, while less productive firms are not forced to exit
  - Gains amplified if cleansing on the extensive margin and improved allocative efficiency on the intensive margin
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
Numerical Simulation: Flexible Wages

- Counterfactual effects of 20% fall in variable trade costs

<table>
<thead>
<tr>
<th></th>
<th>Bilateral Liberalization</th>
<th>Export Liberalization</th>
<th>Import Liberalization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Welfare</td>
<td>Agg Prod</td>
<td>Avg Prod</td>
</tr>
<tr>
<td>No Misallocation: $\sigma_\eta=0$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.92%</td>
<td>3.50%</td>
<td>2.75%</td>
</tr>
<tr>
<td>Misallocation: $\sigma_\eta=0.15$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\rho=0.4$</td>
<td>3.92%</td>
<td>3.49%</td>
<td>2.65%</td>
</tr>
<tr>
<td>$\rho=0$</td>
<td>3.87%</td>
<td>3.47%</td>
<td>2.80%</td>
</tr>
<tr>
<td>$\rho=0.4$</td>
<td>3.85%</td>
<td>3.47%</td>
<td>2.94%</td>
</tr>
</tbody>
</table>
Numerical Simulation: Fixed Wages

- Counterfactual effects of 20% fall in variable trade costs

| Welfare  | Agg Prod | Avg Prod | Cov Term | Welfare  | Agg Prod | Avg Prod | Cov Term | Welfare  | Agg Prod | Avg Prod | Cov Term |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Bilateral Liberalization |          |          |          | Export Liberalization |          |          |          | Import Liberalization |          |          |          |
| No Misallocation: $\sigma_\eta=0$ |          |          |          | 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% |
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
Outline

1. Theory
2. Data
3. Empirics
4. Conclusions
ECB CompNet Productivity Data

- Cross-country, cross-sector panel data on macro aggregates and micro heterogeneity 1998-2011 (Lopez-Garcia et al 2015)
  - Standardized aggregation of firm-level data
  - 14 countries: Austria, Belgium, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Poland, Portugal, Slovakia, Slovenia, Spain

- Indicators for firm labor productivity, capital productivity, TFP, size
  - Multiple moments of each distribution and joint distributions
  - Olley-Pakes (1996) decomposition of aggregate productivity
  - Annual growth: mean 3.21, st dev 1.13
WIOD Trade Data

- Annual bilateral trade data in value added by export sector and import sector of final use
  \[ X_{ijkst} \]: 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
    \[ \text{ExpDemand}_{ikt} = \ln \left[ \sum_{j\neq i,s} X_{ijkst} \right] \]
  - Import competition: mean 6.41, st dev 1.97
    \[ \text{ImpComp}_{ikt} = \ln \left[ \sum_{j\neq i,s\neq k} X_{jikst} \right] \]
Outline

1. Theory

2. Data

3. Empirics
   a. OLS correlation
   b. IV causality
   c. Robustness
   d. Mechanisms

4. Conclusions
OLS Correlations

- Long-run correlation between aggregate productivity and trade exposure

\[ Y_{ikt} = \alpha + \beta_1 \cdot \text{ExpDemand}_{ikt} + \beta_2 \cdot \text{ImpComp}_{ikt} + \Gamma \cdot Z_{ikt} + \phi_{it} + \varepsilon_{ikt} \]

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

- Size threshold varies across countries
  - Include country 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 $Y_{ikt}$, $ExpDemand_{ikt}$, $ImpComp_{ikt}$, $\ln N_{ikt}$
OLS Correlations

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

<table>
<thead>
<tr>
<th></th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp Dem (ikt)</td>
<td>0.125***</td>
<td>0.080***</td>
<td>0.045***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.016)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Imp Comp (ikt)</td>
<td>0.106***</td>
<td>0.124***</td>
<td>-0.019***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>N</td>
<td>2,811</td>
<td>2,811</td>
<td>2,811</td>
</tr>
<tr>
<td>R2</td>
<td>0.849</td>
<td>0.868</td>
<td>0.519</td>
</tr>
<tr>
<td>Country*Year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Bin Scatter Correlations

- Aggregate productivity and trade activity across country-sector-year triplets in 100 bins, after demeaning by country-year FE
OLS Endogeneity

\[ Y_{ikt} = \alpha + \beta_1 \cdot \text{ExpDemand}_{ikt} + \beta_2 \cdot \text{ImpComp}_{ikt} + \Gamma \cdot Z_{ikt} + \varphi_{it} + \varepsilon_{ikt} \]

- Reverse causality
  - More productive countries may export more because they are more competitive on world markets \( \rightarrow \beta_1 \) biased +
  - Lower local productivity may induce more entry by foreign exporters \( \rightarrow \beta_2 \) biased −

- Omitted variable bias
  - Country-year FE control for aggregate supply and demand shocks
  - OVB must vary systematically across sectors within country-years
IV Causality

\[ Y_{ikt} = \alpha + \beta_1 \cdot \text{ExpDemand}_{ikt} + \beta_2 \cdot \text{ImpComp}_{ikt} + \Gamma \cdot Z_{ikt} + \phi_{it} + \epsilon_{ikt} \]

\{\text{ExpDemand}_{ikt}, \text{ImpComp}_{ikt}\} = \alpha_{IV} + \Gamma_{IV} \cdot Z_{ikt} + \Theta \cdot IV_{ikt} + \phi_{it} + \epsilon_{ikt} \]

- Ideal instruments: relevance and validity
  - \text{ExpDemand}_{ikt} : exogenous foreign demand for \(ik\) goods, not \(i\)'s endogenous export supply of \(k\) goods
  - \text{ImpComp}_{ikt} : exogenous foreign supply of \(k\) goods to \(i\), not \(i\)'s endogenous import demand for \(k\) goods
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)

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

- 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)

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

- Import tariffs $MTariff_{ikt}$: average applied tariff (WITS)
### IV Relevance (First Stage)

<table>
<thead>
<tr>
<th></th>
<th>Exp Dem (ikt)</th>
<th>Imp Comp (ikt)</th>
</tr>
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<tbody>
<tr>
<td><strong>Foreign Demand (ikt)</strong></td>
<td>0.638***</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.022)</td>
</tr>
<tr>
<td><strong>Foreign Supply (ikt)</strong></td>
<td>0.087***</td>
<td>0.868***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.007)</td>
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<tr>
<td><strong>Import Tariff (ikt)</strong></td>
<td>-4.693***</td>
<td>-2.802***</td>
</tr>
<tr>
<td></td>
<td>(0.847)</td>
<td>(0.507)</td>
</tr>
<tr>
<td><strong>In N Firms (ikt)</strong></td>
<td>0.555***</td>
<td>0.036**</td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.018)</td>
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<tr>
<td><strong>Avg In N Firms (kt)</strong></td>
<td>-0.741***</td>
<td>-0.112***</td>
</tr>
<tr>
<td></td>
<td>(0.033)</td>
<td>(0.025)</td>
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<tr>
<td><strong>Avg In Employment (kt)</strong></td>
<td>0.344***</td>
<td>0.113***</td>
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<tr>
<td></td>
<td>(0.065)</td>
<td>(0.042)</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>2,777</td>
<td>2,777</td>
</tr>
<tr>
<td>R2</td>
<td>0.889</td>
<td>0.974</td>
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<tr>
<td><strong>Country*Year FE</strong></td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Sector*Year FE</strong></td>
<td>N</td>
<td>N</td>
</tr>
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IV Causal Effects (Second Stage)

- 20% ↑ exp demand (imp compet) → 7.3-8% (1.4-10%) ↑ agg prod
  - Exp demand: ↑ avg prod (~ 3/4), ↑ prod-size covariance (~ 1/4)
  - Imp compet: ↑ avg prod (~ 5/4), ↓ prod-size covariance (~ -1/4)

<table>
<thead>
<tr>
<th></th>
<th>ln Agg Prod (ikt)</th>
<th>ln Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
<th>ln Agg Prod (ikt)</th>
<th>ln Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.398***</td>
<td>0.295***</td>
<td>0.103***</td>
<td>0.367***</td>
<td>0.226**</td>
<td>0.141***</td>
</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td>(0.039)</td>
<td>(0.014)</td>
<td>(0.109)</td>
<td>(0.098)</td>
<td>(0.050)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.068***</td>
<td>0.090***</td>
<td>-0.021***</td>
<td>0.502***</td>
<td>0.585***</td>
<td>-0.083</td>
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<tr>
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<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.005)</td>
<td>(0.185)</td>
<td>(0.166)</td>
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</table>

N: 2,777
R2: 0.820

Ctry*Year FE, Controls: Y Y Y Y Y Y
Sector*Year FE: N N N Y Y Y
Sensitivity & Extensions

- **Sensitivity**
  - Single trade dimension
  - 1-year lagged effects
  - Import penetration ratio
  - Winsorize at 1st and 99th perc

- **Extensions**
  - Sector weights
  - China vs. ROW
  - Skill dispersion
  - Markup dispersion
## Sector Weights

<table>
<thead>
<tr>
<th>Dep Variable:</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.427***</td>
<td>0.360***</td>
<td>0.067***</td>
<td>0.467***</td>
<td>0.359***</td>
<td>0.108***</td>
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<td>(0.039)</td>
<td>(0.036)</td>
<td>(0.011)</td>
<td>(0.102)</td>
<td>(0.090)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
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<td>0.092***</td>
<td>-0.017***</td>
<td>0.498***</td>
<td>0.494***</td>
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<td>(0.005)</td>
<td>(0.151)</td>
<td>(0.141)</td>
<td>(0.043)</td>
</tr>
</tbody>
</table>

**Panel A. Country-Sector Weights: Initial Share of Manuf Employment, L (ikt=0) / L^M (it=0)**

| ^Exp Dem (ikt) | 0.385***          | 0.288***          | 0.097***       | 0.436***          | 0.267***          | 0.168***       |
|               | (0.037)           | (0.036)           | (0.013)        | (0.112)           | (0.101)           | (0.052)        |
| ^Imp Comp (ikt) | 0.069***         | 0.091***         | -0.022***      | 0.703***         | 0.811***         | -0.108*        |
|               | (0.014)           | (0.014)           | (0.005)        | (0.193)           | (0.175)           | (0.063)        |

**Panel B. Country-Year Weights: Manufacturing Share of Total Employment, L^M (it) / L (it)**
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

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

- IV for \( \text{ChinaImpComp}_{ikt} \)
  - Import tariffs \( \text{Tariff}_{ikt} \)
  - Chinese export supply: Chinese export value added for final consumption, weighted by China’s share in \( i \)’s initial imports

\[
\text{ChinaSupply}_{ikt} = \ln \left[ \frac{M_{\text{China} \rightarrow i, k, t=0}}{M_{ik, t=0}} \times XVA^{\text{final}}_{i, \text{China}, kt} \right]
\]
## China vs. ROW Import Competition

<table>
<thead>
<tr>
<th>Dep Variable:</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
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<td><strong>Panel C. Import Competition from China vs. ROW</strong></td>
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<tr>
<td>^Exp Dem (ikt)</td>
<td>0.371***</td>
<td>0.290***</td>
<td>0.082***</td>
<td>0.337***</td>
<td>0.200**</td>
<td>0.137***</td>
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<td>(0.038)</td>
<td>(0.038)</td>
<td>(0.013)</td>
<td>(0.104)</td>
<td>(0.093)</td>
<td>(0.047)</td>
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<td>^Imp Comp ROW (ikt)</td>
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<td>0.398**</td>
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<td>(0.182)</td>
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<td>-0.019***</td>
<td>0.136**</td>
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<td>(0.014)</td>
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### Skill and Mark-Up Dispersion

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<th>Cov Term (ikt)</th>
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<th>In Avg Prod (ikt)</th>
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<tr>
<td><strong>Panel D. OVB: Skill Dispersion</strong></td>
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<tr>
<td>^Exp Dem (ikt)</td>
<td>0.394***</td>
<td>0.291***</td>
<td>0.103***</td>
<td>0.364***</td>
<td>0.224**</td>
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<td>(0.038)</td>
<td>(0.014)</td>
<td>(0.109)</td>
<td>(0.099)</td>
<td>(0.050)</td>
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<tr>
<td>^Imp Comp (ikt)</td>
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<td>0.088***</td>
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<td>0.584***</td>
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<td>(0.014)</td>
<td>(0.005)</td>
<td>(0.184)</td>
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<td>(0.059)</td>
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<tr>
<td>90-10 Wage Ratio (ikt)</td>
<td>-0.001**</td>
<td>-0.001**</td>
<td>-0.000</td>
<td>-0.001**</td>
<td>-0.001*</td>
<td>-0.000***</td>
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<tr>
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<tr>
<td><strong>Panel E. OVB: Mark-Up Dispersion</strong></td>
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<tr>
<td>^Exp Dem (ikt)</td>
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<td>0.294***</td>
<td>0.103***</td>
<td>0.367***</td>
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<tr>
<td>^Imp Comp (ikt)</td>
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<td>-0.022***</td>
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<td>0.591***</td>
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<td>(0.014)</td>
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<td>(0.165)</td>
<td>(0.059)</td>
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<tr>
<td>90-10 PCM Ratio (ikt)</td>
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<td>-0.000</td>
<td>-0.000*</td>
<td>-0.000</td>
<td>-0.000</td>
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</tbody>
</table>
Mechanisms

Interpretation: 
*Trade shapes aggregate productivity via the reallocation of activity across heterogeneous firms in the presence of resource misallocation.*

Justification: three testable and falsifiable predictions

1. Empirical results for \{AggProd, AvgProd, CovProd\} are consistent only with numerical simulations of the model with misallocation

2. Measured min firm productivity is not a summary statistic for the effect of trade, but it should be without misallocation

3. Institutions modify trade impact, and they could only if misallocation
Firm Selection

- Trade increases min firm productivity
- Firm selection = 1/3 (2/3) ExpDem (ImpComp) effect on AggProd = 1/2 effect on AvgProd

<table>
<thead>
<tr>
<th></th>
<th>In min Prod (ikt)</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
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<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.198***</td>
<td>0.275***</td>
<td>0.152***</td>
<td>0.124***</td>
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<td>(0.040)</td>
<td>(0.027)</td>
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<td>^Imp Comp (ikt)</td>
<td>0.073***</td>
<td>0.026***</td>
<td>0.039***</td>
<td>-0.013**</td>
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<td>(0.015)</td>
<td>(0.010)</td>
<td>(0.007)</td>
<td>(0.005)</td>
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<tr>
<td>ln min Prod (ikt)</td>
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<td>0.913</td>
<td>0.948</td>
<td>0.473</td>
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<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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</tbody>
</table>

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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.

<table>
<thead>
<tr>
<th>Institution Measure:</th>
<th>Rule of Law (Inverse)</th>
<th>Corruption</th>
<th>Labor Market Flexibility</th>
<th>Creditor Rights Protection (Inverse)</th>
<th>Product Market Regulation</th>
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<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
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<tr>
<td>^Exp Dem (ikt)</td>
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<td>0.850***</td>
<td>1.121***</td>
<td>0.718***</td>
<td>1.314***</td>
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<td>(0.126)</td>
<td>(0.096)</td>
<td>(0.261)</td>
<td>(0.158)</td>
<td>(0.172)</td>
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<tr>
<td>^Imp Comp (ikt)</td>
<td>-0.113**</td>
<td>-0.063*</td>
<td>-0.202**</td>
<td>-0.108*</td>
<td>-0.045</td>
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<td>(0.050)</td>
<td>(0.038)</td>
<td>(0.096)</td>
<td>(0.061)</td>
<td>(0.061)</td>
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<tr>
<td>^Exp Dem (ikt) x Institution (it)</td>
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<td>-0.302***</td>
<td>-0.218***</td>
<td>-0.048**</td>
<td>-0.769***</td>
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<td>(0.067)</td>
<td>(0.042)</td>
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<td>^Imp Comp (ikt) x Institution (it)</td>
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<td>(0.009)</td>
<td>(0.046)</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

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Conclusions

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

- Empirically, export demand and import competition both increase aggregate productivity, but through different channels:
  - Reallocation across firms matters
  - Misallocation matters, and it matters asymmetrically

- Policy implications:
  - Impact of trade shocks (Brexit, US-China trade war, TPP, TIPP)
  - Optimal design of trade policy and structural reforms
Equilibrium with No Misallocation

- Zero-profit productivity cut-offs
  \[ \pi_{ij}(\varphi^*_{ij}) = 0 \]

- Free entry
  \[ w_{if_i}^E = \sum_j E[\pi_{ij}(\varphi)\mathbb{1}(\varphi \geq \varphi^*_{ij})] \]

- Labor market clearing (if no outside sector)
  \[ L_i = \sum_j M_i E[l_{ij}(\varphi)\mathbb{1}(\varphi \geq \varphi^*_{ij})] + M_if_i^E \]

- Income-expenditure balance
  \[ \beta Y_j = \beta w_j L_j = \sum_i R_{ij} = \sum_i M_i E[r_{ij}(\varphi)\mathbb{1}(\varphi \geq \varphi^*_{ij})] \]
Equilibrium with Misallocation

- Zero-profit profitability $\varphi = \varphi \eta$ cut-offs $\pi_{ij} (\varphi^*_{ij}) = 0$
  -Free entry and labor market clearing conditions adjusted accordingly

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

- Income-expenditure balance
  $$\beta Y_j = \beta (w_j L_j - T_j) = \sum_i R_{ij} = \sum_i M_i E [r_{ij} (\varphi, \eta) \mathbb{I} (\varphi \eta \geq \varphi^*_{ij})]$$
1. Theoretical vs. measured firm productivity

- Theoretical notion $\phi$ is quantity-based (TFPQ), while empirical measures are revenue-based (TFPR, LPR)
- Measured real value added per worker $\Phi$ is monotonic in $\phi \eta$ conditional on export status

$$
\Phi_i(\phi) = \frac{r_i(\phi)}{P_i^{1/\beta} l_i(\phi)} = \frac{w_i}{\alpha P_i^{1/\beta}} \left[ 1 - \frac{\sum_j f_{ij} II(\phi \geq \phi_{ij}^*)}{\sum_j l_{ij}(\phi) II(\phi \geq \phi_{ij}^*)} \right]
$$

$$
\Phi_i(\phi, \eta) = \frac{r_i(\phi, \eta)}{P_i^{1/\beta} l_i(\phi, \eta)} = \frac{w_i}{\alpha P_i^{1/\beta} \eta} \left[ 1 - \frac{\sum_j f_{ij} II(\phi \eta \geq \phi_{ij}^*)}{\sum_j l_{ij}(\phi) II(\phi \eta \geq \phi_{ij}^*)} \right]
$$
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)

\[
\tilde{\Phi}_i = \bar{\Phi}_i + \dot{\Phi}_i = \int_{\varphi_{ii}^*}^{\infty} \Phi_i(\varphi) \frac{d G_i(\varphi)}{1 - G_i(\varphi_i^*)} + \int_{\varphi_{ii}^*}^{\infty} \left[ \Phi_i(\varphi) - \bar{\Phi}_i \right] \left[ \theta_i(\varphi) - \bar{\theta}_i \right] \frac{d G_i(\varphi)}{1 - G_i(\varphi_i^*)}
\]

\[\Leftrightarrow \text{AggProd}_{ikt} = \frac{1}{N_{ikt}} \sum_f \text{Prod}_{fikt} + \sum_f (\theta_{fikt} - \bar{\theta}_{ikt}) \left( \text{Prod}_{fikt} - \text{Prod}_{ikt} \right) \frac{\sigma_f}{\text{CovProd}_{ikt}}\]

- \(\tilde{\Phi}_i > 0\) without misallocation, \(\dot{\Phi}_i \geq 0\) with misallocation
- \(f, i, k, t\) : firm, country, sector, year
From Theory to Empirics

3. No observable summary statistic for misallocation or $\sigma_\eta$ & $\rho(\phi,\eta)$
   - Optimal resource allocation depends on demand / cost / market structure and productivity distribution
   - $\text{CovProd}_i$ is not monotonic in misallocation and $\Delta \text{CovProd}_i > 0$ does not imply improvement in allocative efficiency (Bartelsman et al 2013)
   - But numerical exercises indicate that trade effect on $\{\text{AggProd}_i, \text{AvgProd}_i, \text{CovProd}_i\}$ can reveal misallocation
From Theory to Empirics

4. Welfare vs. measured aggregate productivity

- Welfare $\propto \text{agg prod across firms selling in } i \neq \text{agg prod across } i$ firms

$$\text{AggProd}_i = \begin{cases} \frac{\sigma \theta}{\sigma \theta - (\sigma - 1)} \frac{w_i}{p_i^{1/\beta}} & \text{without misallocation} \\ \frac{\sigma \theta}{(\sigma - 1)\theta \tilde{\eta}_i + \theta - (\sigma - 1)} \frac{w_i}{p_i^{1/\beta}} & \text{with misallocation} \end{cases}$$

- Size-weighted avg distortion across firms $\tilde{\eta}_i = \frac{\sum_j \int_{\phi \eta \geq \phi_{ij}^*} \eta r_{ij}(\phi, \eta) dH_i(\phi, \eta)}{\sum_j \int_{\phi \eta \geq \phi_{ij}^*} r_{ij}(\phi, \eta) dH_i(\phi, \eta)}$

- $W_i \propto \text{AggProd}_i$ only with symmetry, Pareto and no misallocation

- $W_i$ and $\text{AggProd}_i$ tend to comove in simulations with efficient allocation

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## CompNet Data Coverage

<table>
<thead>
<tr>
<th>Country</th>
<th>Years</th>
<th># Sector-Years</th>
<th>Avg # Firms per Sector-Year</th>
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<td>178</td>
<td>68</td>
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<tr>
<td>BELGIUM</td>
<td>1998-2010</td>
<td>254</td>
<td>709</td>
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<td>1999-2011</td>
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<td>573</td>
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<td>1998-2009</td>
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<td>GERMANY</td>
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<td>1998-2011</td>
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<td>216</td>
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<tr>
<td>SPAIN</td>
<td>1998-2011</td>
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<td>3,192</td>
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</table>
Summary Statistics

- Cov term ≈ 7.2% of agg productivity level and 19% of its variance

<table>
<thead>
<tr>
<th></th>
<th>Aggregate Productivity</th>
<th>Average Productivity</th>
<th>Covariance Term</th>
</tr>
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<tbody>
<tr>
<td>Avg across countries, sectors, years</td>
<td>3.21</td>
<td>2.98</td>
<td>0.23</td>
</tr>
<tr>
<td>St dev across countries, sectors, years</td>
<td>1.13</td>
<td>1.19</td>
<td>0.22</td>
</tr>
<tr>
<td>Avg change: 1 year</td>
<td>0.04</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Avg change: 3 years</td>
<td>0.11</td>
<td>0.09</td>
<td>0.02</td>
</tr>
<tr>
<td>Avg change: 5 years</td>
<td>0.18</td>
<td>0.16</td>
<td>0.02</td>
</tr>
</tbody>
</table>
ECB CompNet Productivity Data

- 14 countries: Austria, Belgium, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Poland, Portugal, Slovakia, Slovenia, Spain
  - Annual growth by country-sector 1998-2011: mean 3.21, st dev 1.13

3-year pre-crisis growth rates, 2003-2007

Kalina Manova, UCL
Trade Exposure over Time
(Index 2000 = 1)

All countries

- Export demand
- Import competition
- Import competition from China

Kalina Manova, UCL
WIOD Trade Data

- Large variation in trade exposure across countries, sectors, years
  - Exports: mean 7.65, st dev 1.74
  - Imports: mean 6.41, st dev 1.97

New member states
EU 15 countries

Kalina Manova, UCL
Aggregate Performance

- \( \uparrow \) exports \( \leftrightarrow \) \( \uparrow \) output, value added, employment
- \( \uparrow \) imports \( \leftrightarrow \) \( \downarrow \) output & employment, \( \uparrow \) value added

<table>
<thead>
<tr>
<th></th>
<th>In Output (ikt)</th>
<th>In Value Added (ikt)</th>
<th>In Employment (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp Dem (ikt)</td>
<td>0.403***</td>
<td>0.380***</td>
<td>0.243***</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.022)</td>
<td>(0.014)</td>
</tr>
<tr>
<td>Imp Comp (ikt)</td>
<td>-0.139***</td>
<td>0.041***</td>
<td>-0.066***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.015)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>ln N Firms (ikt)</td>
<td>0.552***</td>
<td>0.573***</td>
<td>0.736***</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>Avg ln N Firms (kt)</td>
<td>-0.969***</td>
<td>-0.710***</td>
<td>-0.727***</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.033)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>Avg ln Employment (kt)</td>
<td>1.285***</td>
<td>0.653***</td>
<td>0.858***</td>
</tr>
<tr>
<td></td>
<td>(0.065)</td>
<td>(0.045)</td>
<td>(0.028)</td>
</tr>
<tr>
<td>N</td>
<td>2,811</td>
<td>2,811</td>
<td>2,811</td>
</tr>
<tr>
<td>R2</td>
<td>0.927</td>
<td>0.928</td>
<td>0.949</td>
</tr>
<tr>
<td>Country*Year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
OLS First Differences

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

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

- \( \Delta Y_{ikt} \): 1-, 3- or 5-year change in productivity, overlapping periods
- \( \Delta ExpDemand_{ikt}, \Delta ImpComp_{ikt}, \Delta Z_{ikt} \): concurrent or lagged change
- country x sector FE differenced out
- \( \varphi_t \): trends in productivity growth
- \( \varepsilon_{ikt} \): robust standard errors
## Trade-Productivity Nexus in the Short to Medium Term

<table>
<thead>
<tr>
<th></th>
<th>Δ = 1 year</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Δ ln Agg Prod (ikt)</td>
<td>Δ ln Avg Prod (ikt)</td>
<td>Δ Cov Term (ikt)</td>
<td>Δ ln Agg Prod (ikt)</td>
<td>Δ ln Avg Prod (ikt)</td>
<td>Δ Cov Term (ikt)</td>
</tr>
<tr>
<td>Δ Exp Dem (ikt)</td>
<td>0.116***</td>
<td>0.034</td>
<td>0.082***</td>
<td>0.142***</td>
<td>0.053*</td>
<td>0.089***</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.025)</td>
<td>(0.027)</td>
<td>(0.027)</td>
<td>(0.027)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Δ Imp Comp (ikt)</td>
<td>0.083***</td>
<td>0.102***</td>
<td>-0.019</td>
<td>-0.062**</td>
<td>0.102***</td>
<td>-0.040**</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.022)</td>
<td>(0.019)</td>
<td>(0.025)</td>
<td>(0.024)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>N</td>
<td>2,546</td>
<td>2,546</td>
<td>2,546</td>
<td>2,073</td>
<td>2,073</td>
<td>2,073</td>
</tr>
<tr>
<td>R2</td>
<td>0.114</td>
<td>0.115</td>
<td>0.022</td>
<td>0.101</td>
<td>0.117</td>
<td>0.044</td>
</tr>
<tr>
<td>Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Kalina Manova, UCL
## Robustness: Sector FE

<table>
<thead>
<tr>
<th></th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.300***</td>
<td>0.197**</td>
<td>0.103**</td>
</tr>
<tr>
<td></td>
<td>(0.097)</td>
<td>(0.085)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.294**</td>
<td>0.296**</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.131)</td>
<td>(0.118)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>N</td>
<td>2,777</td>
<td>2,777</td>
<td>2,777</td>
</tr>
<tr>
<td>R2</td>
<td>0.869</td>
<td>0.897</td>
<td>0.635</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Sector FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
## Robustness: Single Trade Dimension

<table>
<thead>
<tr>
<th>Panel A. Only Export Demand</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.461***</td>
<td>0.350***</td>
<td>0.111***</td>
<td>0.417***</td>
<td>0.304***</td>
<td>0.114**</td>
</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td>(0.041)</td>
<td>(0.018)</td>
<td>(0.112)</td>
<td>(0.097)</td>
<td>(0.047)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B. Only Import Competition</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.148***</td>
<td>0.149***</td>
<td>-0.001</td>
<td>0.730***</td>
<td>0.728***</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.015)</td>
<td>(0.005)</td>
<td>(0.150)</td>
<td>(0.142)</td>
<td>(0.050)</td>
</tr>
</tbody>
</table>

Ctry*Year FE, Controls           | Y                | Y                | Y              | Y                | Y                | Y              |
Sector*Year FE                   | N                | N                | N              | Y                | Y                | Y              |
### Robustness: Lagged Trade Effects

<table>
<thead>
<tr>
<th></th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt-1)</td>
<td>0.395***</td>
<td>0.292***</td>
<td>0.103***</td>
<td>0.297***</td>
<td>0.179*</td>
<td>0.118**</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.041)</td>
<td>(0.014)</td>
<td>(0.102)</td>
<td>(0.092)</td>
<td>(0.049)</td>
</tr>
<tr>
<td>^Imp Comp (ikt-1)</td>
<td>0.069***</td>
<td>0.091***</td>
<td>-0.022***</td>
<td>0.500***</td>
<td>0.569***</td>
<td>-0.069</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.014)</td>
<td>(0.006)</td>
<td>(0.180)</td>
<td>(0.163)</td>
<td>(0.062)</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Sector*Year FE</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Robustness: Import Penetration Ratio

\[ \text{ImpCompRatio}_{ikt} = \ln \frac{\sum_{j,s \neq k} X_{jikst}}{\text{Turnover}_{ik}} \]

<table>
<thead>
<tr>
<th></th>
<th>ln Agg Prod (ikt)</th>
<th>ln Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
<th>ln Agg Prod (ikt)</th>
<th>ln Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.433***</td>
<td>0.329***</td>
<td>0.104***</td>
<td>0.465***</td>
<td>0.345***</td>
<td>0.121**</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
<td>(0.038)</td>
<td>(0.013)</td>
<td>(0.140)</td>
<td>(0.124)</td>
<td>(0.058)</td>
</tr>
<tr>
<td>^Imp Comp Ratio (ikt)</td>
<td>0.101***</td>
<td>0.144***</td>
<td>-0.043***</td>
<td>0.153***</td>
<td>0.181***</td>
<td>-0.028</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.010)</td>
<td>(0.053)</td>
<td>(0.047)</td>
<td>(0.024)</td>
</tr>
</tbody>
</table>

- N: 2,777
- R2: 0.811

Ctry*Year FE, Controls: Y Y Y Y Y Y
Sector*Year FE: N N N Y Y Y
## Robustness: Winsorizing Outliers

<table>
<thead>
<tr>
<th></th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Winsorizing Outliers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.393***</td>
<td>0.301***</td>
<td>0.092***</td>
<td>0.206*</td>
<td>0.078</td>
<td>0.127*</td>
</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td>(0.039)</td>
<td>(0.014)</td>
<td>(0.120)</td>
<td>(0.122)</td>
<td>(0.067)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.073***</td>
<td>0.094***</td>
<td>-0.021***</td>
<td>0.637***</td>
<td>0.792***</td>
<td>0.154*</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.006)</td>
<td>(0.245)</td>
<td>(0.236)</td>
<td>(0.087)</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Sector*Year FE</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Firm selection and productivity upgrading are not the whole story

<table>
<thead>
<tr>
<th></th>
<th>In R&amp;D (ikt)</th>
<th>In Agg Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.103</td>
<td>0.282***</td>
<td>0.154***</td>
<td>0.129***</td>
</tr>
<tr>
<td></td>
<td>(0.115)</td>
<td>(0.027)</td>
<td>(0.019)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.164***</td>
<td>0.016*</td>
<td>0.038***</td>
<td>-0.022***</td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
<td>(0.009)</td>
<td>(0.007)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>In min Prod (ikt)</td>
<td></td>
<td>0.657***</td>
<td>0.736***</td>
<td>-0.079***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.022)</td>
<td>(0.016)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>In R&amp;D (ikt)</td>
<td>-0.000</td>
<td>-0.018***</td>
<td>0.017***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.006)</td>
<td>(0.003)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>2,777</td>
<td>2,750</td>
<td>2,750</td>
<td>2,750</td>
</tr>
<tr>
<td>R2</td>
<td>0.999</td>
<td>0.915</td>
<td>0.949</td>
<td>0.501</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Efficient institutions, factor and product markets amplify gains from import competition, but dampen gains from export expansion.

<table>
<thead>
<tr>
<th>Rule of Law</th>
<th>(Inverse) Corruption</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Agg Prod (ikt)</td>
<td>In Avg Prod (ikt)</td>
</tr>
<tr>
<td>^Exp Dem (ikt)</td>
<td>1.066***</td>
</tr>
<tr>
<td></td>
<td>(0.126)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>-0.113**</td>
</tr>
<tr>
<td></td>
<td>(0.050)</td>
</tr>
<tr>
<td>^Exp Dem (ikt) x Institution (it)</td>
<td>-0.476***</td>
</tr>
<tr>
<td></td>
<td>(0.067)</td>
</tr>
<tr>
<td>^Imp Comp (ikt) x Institution (it)</td>
<td>0.136***</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Labor Market Flexibility</th>
<th>Creditor Rights Protection</th>
<th>(Inverse) Product Market Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln Agg Prod (ikt)</td>
<td>1.121***</td>
<td>0.718***</td>
</tr>
<tr>
<td>ln Avg Prod (ikt)</td>
<td>0.763***</td>
<td>0.511***</td>
</tr>
<tr>
<td>Cov Term (ikt)</td>
<td>0.358***</td>
<td>0.207***</td>
</tr>
<tr>
<td></td>
<td>(0.261)</td>
<td>(0.158)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>-0.202**</td>
<td>-0.108*</td>
</tr>
<tr>
<td>ln Agg Prod (ikt)</td>
<td>-0.102</td>
<td>(0.061)</td>
</tr>
<tr>
<td>ln Avg Prod (ikt)</td>
<td>-0.100***</td>
<td>(0.055)</td>
</tr>
<tr>
<td>Cov Term (ikt)</td>
<td>-0.045**</td>
<td>(0.015)</td>
</tr>
<tr>
<td></td>
<td>(0.096)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>^Exp Dem (ikt) x Institution (it)</td>
<td>-0.218***</td>
<td>-0.048**</td>
</tr>
<tr>
<td>ln Agg Prod (ikt)</td>
<td>-0.143**</td>
<td>(0.019)</td>
</tr>
<tr>
<td>ln Avg Prod (ikt)</td>
<td>-0.075***</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Cov Term (ikt)</td>
<td>-0.015***</td>
<td>(0.005)</td>
</tr>
<tr>
<td></td>
<td>(0.069)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>^Imp Comp (ikt) x Institution (it)</td>
<td>0.083***</td>
<td>0.028***</td>
</tr>
<tr>
<td>ln Agg Prod (ikt)</td>
<td>0.060**</td>
<td>(0.009)</td>
</tr>
<tr>
<td>ln Avg Prod (ikt)</td>
<td>0.024***</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Cov Term (ikt)</td>
<td>0.003</td>
<td>(0.002)</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.008)</td>
</tr>
</tbody>
</table>

- N: 2,777
- R2: 0.747
- Ctry*Year FE, Controls: Y Y Y Y Y Y Y Y Y

Kalina Manova, UCL
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
  - 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

<table>
<thead>
<tr>
<th>Dep Variable:</th>
<th>MRPK St Dev</th>
<th>MRPL St Dev</th>
<th>TFPR St Dev</th>
<th>PCM p90 / p10</th>
<th>MRPK St Dev</th>
<th>MRPL St Dev</th>
<th>TFPR St Dev</th>
<th>PCM p90 / p10</th>
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<td>^Exp Dem (ikt)</td>
<td>-0.203***</td>
<td>0.272***</td>
<td>0.297***</td>
<td>0.407***</td>
<td>0.425***</td>
<td>0.059</td>
<td>0.125</td>
<td>-0.738</td>
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<tr>
<td></td>
<td>(0.069)</td>
<td>(0.038)</td>
<td>(0.035)</td>
<td>(0.138)</td>
<td>(0.145)</td>
<td>(0.082)</td>
<td>(0.155)</td>
<td>(0.527)</td>
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<tr>
<td>^Imp Comp (ikt)</td>
<td>0.193***</td>
<td>0.095***</td>
<td>0.059***</td>
<td>-0.031</td>
<td>0.408*</td>
<td>0.483***</td>
<td>0.981***</td>
<td>2.077***</td>
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<tr>
<td></td>
<td>(0.026)</td>
<td>(0.012)</td>
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<td>(0.229)</td>
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