Productivity, (Mis)allocation and Trade

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Motivation

- Decline in trade, transportation and communication costs over past 20 years has triggered rapid expansion in international trade

- How does globalization affect aggregate productivity?
  - Reallocations across firms and innovation within firms
  - Impact of export expansion and import penetration
  - Role of imperfect institutions, factor and product market frictions

- Implications for trade policy and structural reforms
  - Gains from trade with firm heterogeneity
  - Importance of efficient resource allocation for realization of gains
Overview

- Examine effects of international trade on aggregate productivity
  - Export demand vs. import competition
  - Average firm productivity vs. reallocations across firms

- Theory: numerically simulate gains from trade in standard Melitz (2003) model with varying degree of allocative efficiency
  - Definite gains from bilateral and unilateral export liberalization, but ambiguous effects of unilateral import liberalization
  - Misallocation can amplify or dampen trade effects

- Empirics: exploit unique cross-country panel data that captures underlying firm heterogeneity
  - 14 European countries, 20 manufacturing industries, 1998-2011
  - Establish causality using IV strategy (tariffs, Bartik, China shock)
Empirical Results

- International trade significantly increases aggregate productivity
  - Export demand boosts both avg productivity and allocative efficiency
  - Import compet raises avg productivity but lowers allocative efficiency

- Mechanisms
  - Selection: export demand and import compet induce exit by less productive firms
  - Misallocation: efficient institutions, factor and product mkts amplify gains from import compet, but dampen gains from export expansion
Contribution to the Literature

- **Macro**: productivity dispersion and resource misallocation across firms contributes to productivity differences across countries

- **Trade**: role of firm heterogeneity, within-firm productivity upgrading and reallocations across firms for gains from trade

- **Trade**: impact of financial and labor market frictions
  - Manova 2013, Chor-Manova 2012, …
  - Helpman-Itsokoki-Redding 2010, Cuñat-Melitz 2012, …
Outline

1. Conceptual framework

2. Data

3. Empirical evidence
   a. OLS baseline
   b. IV baseline
   c. Robustness
   d. Other misallocation measures

4. Conclusions
Theoretical Approach

- Examine how trade liberalization affects aggregate productivity in a standard heterogeneous-firm model: Melitz (2003)
  - unilateral vs. bilateral reduction in trade costs
  - perfect vs. imperfect resource allocation across firms

- Evaluate contribution of three mechanisms
  - extensive margin: firm selection
  - intensive margin: allocation across firms
  - intensive margin: within-firm productivity upgrading

- Derive comparative statics based on closed-form analytical solutions and numerical calculations
  - Results extend to multi-sector economy
Theoretical Set-Up

- CES demand with monopolistic competition and free entry in differentiated sector + numeraire CRS outside good

- Production and trade technology
  - Sunk cost of entry
  - Fixed cost of domestic production, constant marginal production cost
  - Fixed cost of exporting, asymmetric iceberg trade costs $\tau_i$ and $\tau_e$

- No misallocation: firms draw productivity $\phi$ from a known lognormal distribution
  - Marginal production cost $= w / \phi$

- Misallocation: firms draw productivity $\phi$ and distortion $\eta$ from a known joint lognormal distribution
  - Marginal production cost $= w / \phi \eta$
Bilateral Trade Liberalization With No Misallocation

- A decline in trade costs $\tau = \tau_i = \tau_e$ increases both export demand and import competition
  - Lower productivity cut-off for exporting $\phi_X^* \rightarrow$ higher productivity cut-off for domestic production $\phi^*$ due to free entry
  - Reallocation of activity towards more productive firms

- With economies of scale in innovation / adoption, falling trade costs can induce endogenous within-firm productivity upgrading
  - Exporters expect higher export sales (Bustos 2011)
  - Innovation may become more or less attractive due to higher competition in domestic market

\[ \downarrow \tau \rightarrow \uparrow \text{Export demand, } \uparrow \text{Import competition} \rightarrow \uparrow \text{Aggregate productivity} \]
Unilateral Export Liberalization
With No Misallocation

- A unilateral decline in export costs $\tau_e$ increases export demand and has similar effects as bilateral liberalization
  - Lower export cut-off $\phi_X^*$ $\rightarrow$ higher production cut-off $\phi^*$
  - Reallocation of activity towards more productive firms
  - Within-firm productivity upgrading

$\downarrow \tau_e \rightarrow \uparrow$ Export demand $\rightarrow \uparrow$ Aggregate productivity

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Unilateral Import Liberalization With No Misallocation

- A unilateral decline in import costs $\tau_i$ still increases import competition, but has ambiguous aggregate effects
  - Lower foreign export cut-off $\rightarrow$ higher foreign production cut-off
  - Direct effect: increase home production cut-off $\varphi^*$ as home demand for home varieties falls
  - Indirect effect: increase home export cut-off $\varphi_X^*$ and decrease home production cut-off $\varphi^*$ as foreign market becomes more competitive
  - Metzler paradox: indirect effect dominates iff small or no decline in home wage (Demidova-RodriguezClare 2013, Bagwell-Lee 2016)
  - Within-firm productivity upgrading and reallocation of activity towards more productive firms possible, but not guaranteed

$\downarrow \tau_i \rightarrow \uparrow$ Import competition $\rightarrow \uparrow \downarrow$ Aggregate productivity
Resource Misallocation

- Firms draw both productivity $\phi$ and distortion $\eta$
  - Employment $= f + q / \phi$
  - Total cost $= (f + q / \phi \eta) w$

- 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: capital or labor market frictions, imperfect institutions, corruption

- Firm selection, production and export activity depend on $\phi \eta$, while optimal resource allocation would depend on $\phi$ alone
  - Misallocation arises from inefficient allocation of production resources and market shares across firms
  - With CES, there is no misallocation due to variable mark-ups (Dhingra-Morrow 2014)
Trade Liberalization with Misallocation

- Market frictions can amplify or dampen the effects of trade liberalization on aggregate productivity
  - Misallocation acts both on the extensive margin (firm selection) and on the intensive margin (allocation of activity across operating firms)
  - Trade can induce more or less efficient allocation of resources

- Trade can induce more or less efficient allocation of resources depending on the type and magnitude of market frictions
  - Correlation between productivity $\phi$ and distortion $\eta$, $\rho(\phi, \eta)$
  - Variance of distortion $\eta$, $\sigma_\eta$

- Theoretical ambiguity necessitates numerical simulations
From Theory to Empirics

- While theoretical notion of productivity is quantity based (TFPQ), empirical measures are revenue based (TFPR, LPR)
  - In principle, LPR = real value added per worker
  - Theory: TFPQ = LPR = \( \frac{q}{f + \frac{q}{\varphi}} \) increasing in \( \varphi \) despite constant mark-ups because of fixed costs
  - Data: TFPR is a revenue-based residual subject to simultaneity and omitted variable bias due to endogenous input choice
  - Data: TFPR and LPR are subject to measurement error due to unobserved variable mark-ups and use of sector-level price deflators

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From Theory to Empirics

- While theoretical notion of productivity is quantity based (TFPQ), empirical measures are revenue based (TFPR, LPR)

- Theoretical predictions for effects of trade liberalization pertain to changes in tariffs or trade costs
  - In reality, other supply and demand shocks also drive import competition and export expansion
From Theory to Empirics

- While theoretical notion of productivity is quantity based (TFPQ), empirical measures are revenue based (TFPR, LPR)

- Theoretical predictions for effects of trade liberalization pertain to changes in tariffs or trade costs
  - In reality, other supply and demand shocks also drive import competition and export expansion

- Distinguishing misallocation from efficient reallocation poses conceptual challenges
  - Different model assumptions about market structure and production technology lead to different sufficient statistics for misallocation

→ Need to bridge gap between theory and empirics
Measuring Misallocation

- The literature has proposed different indicators of resource misallocation across firms
  - TFPR dispersion (Hsieh-Klenow 2009, Bartelsman et al 2013)
  - MRPK and MRPL dispersion (Hsieh-Klenow 2009, Gopinath et al 2015)
  - PCM (price-cost mark-up) dispersion (Edmond et al 2015)
  - Productivity-size covariance (Olley-Pakes 1996, Bartelsman et al 2013)

- There are four concerns with interpreting these indicators and linking them to theoretical predictions for impact of trade with misallocation
Allocation vs. Misallocation

- Four concerns

1. Measurement error
   - ME in TFPR, MRPK, MRPL, PCM can inflate dispersion measures
   - Using dispersion measures based on estimated variables and parameters as outcome variables complicates regression analysis

2. Market structure
   - TFPR, MRPK, MRPL dispersion implies misallocation under constant mark-ups (e.g. HK 2009), but not under variable mark-ups (e.g. Foster et al 2008, Berman et al 2012)
   - Market-share misallocation arises with variable mark-ups even without distortions in factor markets (Dhingra-Morrow 2014)
Allocation vs. Misallocation

- Four concerns

3. Production technology
   - TFPR, MRPK, MRPL dispersion implies misallocation with CRS (e.g. HK 2009), but not with IRS (e.g. Bartelsman et al 2013, Foster et al 2015, 2016)

4. Firm dynamics
   - TFPR, MRPK, MRPL dispersion does not imply misallocation when there are demand or TFPQ shocks and adjustment costs (e.g. Bartelsman et al 2013, Foster et al 2015, 2016)
Productivity Decomposition

- Aggregate productivity can be decomposed into two components (Olley and Pakes 1996, Melitz-Polanec 2015)
  - Average firm productivity
  - Covariance between firm productivity and share of economic activity

\[ Prod_{ikt} = \frac{1}{N_{ikt}} \sum_f Prod_{fikt} + \sum_f (\theta_{fikt} - \overline{\theta}_{ikt})(Prod_{fikt} - \overline{Prod}_{ikt}) \]

- Implementation
  - \( Prod_{fikt} \): log real value added per worker
  - \( \theta_{fikt} \): employment share
  - \( Prod_{ikt} \) and \( \overline{Prod}_{ikt} \) are weighted and unweighted averages

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Interpreting Productivity Decomposition

\[ Prod_{ikt} = \frac{1}{N_{ikt}} \sum_f Prod_{fikt} + \sum_f (\theta_{fikt} - \theta_{ikt})(Prod_{fikt} - Prod_{ikt}) \]

\[ \Delta Prod_{ikt} = \Delta AvgProd_{ikt} + \Delta CovProd_{ikt} \]

- **Accounting interpretation**
  - \( AvgProd_{ikt} \) captures firm selection and within-firm productivity gains
  - \( CovProd_{ikt} \) reflects allocation of labor across firms
Interpreting Productivity Decomposition

\[ \text{Prod}_{ikt} = \frac{1}{N_{ikt}} \sum_{f} \text{Prod}_{fikt} + \sum_{f} (\theta_{fikt} - \bar{\theta}_{ikt})(\text{Prod}_{fikt} - \bar{\text{Prod}}_{ikt}) \]

\[ \Delta \text{Prod}_{ikt} = \Delta \text{AvgProd}_{ikt} + \Delta \text{CovProd}_{ikt} \]

- Economic interpretation: no market distortions
  - Optimal entry, exit, (re)allocation and productivity upgrading
  - \( \text{CovProd}_{ikt} \) optimally determined by market conditions (e.g. aggregate demand, degree of product differentiation, ...)
  - Control for \( \min \text{Prod}_{ikt} \) to isolate selection effect
Interpreting Productivity Decomposition

\[ Prod_{ikt} = \frac{1}{N_{ikt}} \sum_{f} Prod_{fikt} + \sum_{f} (\theta_{fikt} - \bar{\theta}_{ikt})(Prod_{fikt} - \bar{Prod}_{ikt}) \]

\[ \Delta Prod_{ikt} = \Delta Avg Prod_{ikt} + \Delta Cov Prod_{ikt} \]

- Economic interpretation: market distortions
  - Inefficient entry, exit, (re)allocation and productivity upgrading
  - Lower covariance term (Bartelsman-Haltiwanger-Scarpetta 2013)
  - Control for \( \min Prod_{ikt} \) to isolate selection effect and distinguish between misallocation along extensive and intensive margins
  - Use direct measures of market frictions to identify misallocation
From Theory to Empirics: Numerical Simulation

- No misallocation: log-normal productivity distribution with parameters $\mu_\phi = 1$, $\sigma_\phi = 1$

- Misallocation: joint log-normal distribution for productivity and distortion with parameters
  - $\mu_\eta = 1$, $\sigma_\eta \in \{0, 0.05, 0.15\}$
  - correlation $\rho(\phi, \eta) \in [-0.5, 0.5]$

- 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

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Numerical Simulation

- Counterfactual productivity gains with 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>Aggr Prod</td>
<td>Avg Prod</td>
<td>Cov Term</td>
</tr>
<tr>
<td>No Misallocation: $\sigma_{\eta} = 0$</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misallocation: $\sigma_{\eta} = 0.05$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\rho = -0.5$</td>
<td>1.37%</td>
<td>0.98%</td>
<td>0.38%</td>
</tr>
<tr>
<td>$\rho = 0$</td>
<td>3.31%</td>
<td>2.62%</td>
<td>0.69%</td>
</tr>
<tr>
<td>$\rho = 0.5$</td>
<td>5.31%</td>
<td>4.27%</td>
<td>1.03%</td>
</tr>
</tbody>
</table>
Numerical Simulation: Bilateral Trade Liberalization

- 20% reduction in bilateral variable trade cost $\tau$

![Graphs showing labor weighted average TFP change, unweighted average TFP change, and labor share and TFP covariance change.](image)
Numerical Simulation: Unilateral Export Liberalization

- 20% reduction in export variable trade cost $\tau_e$

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Labor weighted average TFP change

Unweighted average TFP change

Labor share and TFP covariance change
Numerical Simulation: Unilateral Import Liberalization

- 20% reduction in export variable trade cost $\tau_i$

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1. Conceptual framework

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   d. Other misallocation measures

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
## CompNet Data Coverage

<table>
<thead>
<tr>
<th>Country</th>
<th>Years</th>
<th># Sector-Years</th>
<th>Avg # Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUSTRIA</td>
<td>2000-2011</td>
<td>222</td>
<td>60</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>1998-2010</td>
<td>260</td>
<td>709</td>
</tr>
<tr>
<td>ESTONIA</td>
<td>1998-2011</td>
<td>274</td>
<td>166</td>
</tr>
<tr>
<td>FINLAND</td>
<td>1999-2011</td>
<td>260</td>
<td>585</td>
</tr>
<tr>
<td>FRANCE</td>
<td>1998-2009</td>
<td>240</td>
<td>3488</td>
</tr>
<tr>
<td>GERMANY</td>
<td>1998-2011</td>
<td>280</td>
<td>719</td>
</tr>
<tr>
<td>HUNGARY</td>
<td>2003-2011</td>
<td>180</td>
<td>1446</td>
</tr>
<tr>
<td>ITALY</td>
<td>2001-2011</td>
<td>220</td>
<td>4327</td>
</tr>
<tr>
<td>LITHUANIA</td>
<td>2000-2011</td>
<td>240</td>
<td>220</td>
</tr>
<tr>
<td>POLAND</td>
<td>2005-2011</td>
<td>140</td>
<td>717</td>
</tr>
<tr>
<td>PORTUGAL</td>
<td>2006-2011</td>
<td>120</td>
<td>1607</td>
</tr>
<tr>
<td>SLOVAKIA</td>
<td>2001-2011</td>
<td>218</td>
<td>102</td>
</tr>
<tr>
<td>SLOVENIA</td>
<td>1998-2011</td>
<td>249</td>
<td>211</td>
</tr>
<tr>
<td>SPAIN</td>
<td>1998-2011</td>
<td>280</td>
<td>3125</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>1238</strong></td>
</tr>
</tbody>
</table>
Covariance term ≈ 7.4% of aggregate productivity level and 20% of its variance

<table>
<thead>
<tr>
<th></th>
<th>Aggregate Productivity</th>
<th>Average Productivity</th>
<th>Covariance Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg across countries,</td>
<td>3.16</td>
<td>2.93</td>
<td>0.23</td>
</tr>
<tr>
<td>sectors, years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St dev across sector-years for avg country</td>
<td>1.14</td>
<td>1.20</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>0.10</td>
<td>0.09</td>
<td>0.01</td>
</tr>
<tr>
<td>Avg change: 5 years</td>
<td>0.18</td>
<td>0.16</td>
<td>0.02</td>
</tr>
</tbody>
</table>
WIOD Trade Data

- Annual bilateral trade data in value added by sector of final use
  - 14 countries, 20 NACE-2 sectors, 1998-2011

- Trade exposure in country $i$, sector $k$, year $t$
  - Export demand: mean 7.46, st dev 1.82
    \[ \text{ExpDemand}_{ikt} = \ln \text{Exports}_{ikt} \]
  - Import competition: mean 6.28, st dev 1.99
    \[ \text{ImpComp}_{ikt} = \ln (\text{Imports}_{ikt} - \text{ImpInputs}_{ikt}) \]
Trade Exposure over Time (Index 2000 = 1)

All countries

- Export demand
- Import competition
- Import competition from China
Trade Exposure over Time
(Index 2000 = 1)

New member states

EU 15 countries

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Empirical Strategy I: OLS Levels

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

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

- \( Y_{ikt} \): productivity measure in country \( i \), sector \( k \), year \( t \)
- \( Z_{ikt} \): # firms (\( \ln N_{ikt} \)), sector trends (\( \ln N_{kt}, \ln L_{kt} \))
- \( \varphi_{it} \): 14 country * 13 year FE
  (subsume GDP per capita, GDP, institutions, macro shocks)
- \( \varepsilon_{ikt} \): robust standard errors
Measurement Error & Sample Selection

- Size threshold varies across countries
  - Include country fixed effects
  - Control for $\ln N_{ikt}$

- $CovProd_{ikt}$ underestimated due to classical ME in $L_{fikt}$
  - 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 $ImpComp_{ikt}$
  - Drop one country at a time
Aggregate Performance

- High export demand associated with high productivity, output, employment
- High import competition also associated with high productivity, but low output and employment

<table>
<thead>
<tr>
<th></th>
<th>In Output (ikt)</th>
<th>In Value Added (ikt)</th>
<th>In Employment (ikt)</th>
<th>In Aggr Prod (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exp Dem (ikt)</strong></td>
<td>0.381***</td>
<td>0.371***</td>
<td>0.238***</td>
<td>0.122***</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.016)</td>
<td>(0.010)</td>
<td>(0.012)</td>
</tr>
<tr>
<td><strong>Imp Comp (ikt)</strong></td>
<td>-0.137***</td>
<td>0.040***</td>
<td>-0.067***</td>
<td>0.105***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.010)</td>
<td>(0.005)</td>
<td>(0.008)</td>
</tr>
<tr>
<td><strong>ln N Firms (ikt)</strong></td>
<td>0.565***</td>
<td>0.577***</td>
<td>0.738***</td>
<td>-0.160***</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.024)</td>
<td>(0.016)</td>
<td>(0.018)</td>
</tr>
<tr>
<td><strong>ln N Firms (kt)</strong></td>
<td>-0.990***</td>
<td>-0.718***</td>
<td>-0.730***</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td>(0.035)</td>
<td>(0.021)</td>
<td>(0.026)</td>
</tr>
<tr>
<td><strong>ln Employment (kt)</strong></td>
<td>1.301***</td>
<td>0.658***</td>
<td>0.860***</td>
<td>-0.180***</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.036)</td>
<td>(0.022)</td>
<td>(0.026)</td>
</tr>
</tbody>
</table>

- # Observations: 2,809
- R-squared: 0.924
- Country * Year FE: Y Y Y Y

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Productivity Decomposition

- High export demand and import competition $\leftrightarrow$ high aggregate productivity
  - Average firm productivity rises with both export demand and import competition
  - Covariance term rises with export demand but falls with import competition

- One-standard-deviation rise in export demand and import competition $\leftrightarrow$ 22% and 21% higher aggregate productivity

<table>
<thead>
<tr>
<th></th>
<th>In Aggr 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>0.084***</td>
<td>0.041***</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.011)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Imp Comp (ikt)</td>
<td>0.105***</td>
<td>0.123***</td>
<td>-0.018***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.007)</td>
<td>(0.003)</td>
</tr>
<tr>
<td># Observations</td>
<td>2,828</td>
<td>2,828</td>
<td>2,828</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.848</td>
<td>0.867</td>
<td>0.516</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Empirical Strategy II: OLS Changes

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

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

- \( \Delta Y_{ikt} \): 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
- \( \epsilon_{ikt} \): robust standard errors
Short- and Medium-Term Effects

- Qualitatively similar relationship between trade exposure and productivity at different horizons, with bigger magnitudes at longer horizons

<table>
<thead>
<tr>
<th></th>
<th>Δ = 1 year</th>
<th></th>
<th></th>
<th>Δ = 3 years</th>
<th></th>
<th></th>
<th>Δ = 5 years</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>ln Aggr Prod (ikt)</td>
<td>ln Avg Prod (ikt)</td>
<td>Cov Term (ikt)</td>
<td>ln Aggr Prod (ikt)</td>
<td>ln Avg Prod (ikt)</td>
<td>Cov Term (ikt)</td>
<td>ln Aggr Prod (ikt)</td>
<td>ln Avg Prod (ikt)</td>
<td>Cov Term (ikt)</td>
</tr>
<tr>
<td>Δ Exp Dem (ikt)</td>
<td>0.115***</td>
<td>0.033</td>
<td>0.082***</td>
<td>0.137***</td>
<td>0.049**</td>
<td>0.088***</td>
<td>0.157***</td>
<td>0.085***</td>
<td>0.072***</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.024)</td>
<td>(0.028)</td>
<td>(0.025)</td>
<td>(0.023)</td>
<td>(0.018)</td>
<td>(0.027)</td>
<td>(0.025)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>Δ Imp Comp (ikt)</td>
<td>0.082***</td>
<td>0.101***</td>
<td>-0.019</td>
<td>0.064***</td>
<td>0.103***</td>
<td>-0.039**</td>
<td>0.079***</td>
<td>0.108***</td>
<td>-0.029*</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.022)</td>
<td>(0.021)</td>
<td>(0.025)</td>
<td>(0.024)</td>
<td>(0.016)</td>
<td>(0.027)</td>
<td>(0.025)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,544</td>
<td>2,544</td>
<td>2,544</td>
<td>2,071</td>
<td>2,071</td>
<td>2,071</td>
<td>1,585</td>
<td>1,585</td>
<td>1,585</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.113</td>
<td>0.114</td>
<td>0.022</td>
<td>0.099</td>
<td>0.115</td>
<td>0.043</td>
<td>0.095</td>
<td>0.093</td>
<td>0.034</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>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Kalina Manova, Oxford
Endogeneity

- OLS results identify correlations rather than causal effects since aggregate productivity can endogenously affect trade activity.

- Reverse causality:
  - More productive countries may export more because they are more competitive on world markets $\rightarrow \beta_1$ biased up.
  - Lower local productivity may induce more entry by foreign exporters $\rightarrow \beta_2$ biased down.

- Omitted variable bias:
  - Country-year FE control for aggregate demand and supply shocks, remoteness, institutions, etc.
  - OVB must vary systematically across sectors within country-years.
Empirical Strategy III: 2SLS

- Use 2SLS to identify causal effect of trade exposure on aggregate productivity and its constituent parts

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

\[ \{\overline{\text{ExpDemand}}_{ikt}, \overline{\text{ImpComp}}_{ikt}\} = \gamma + \Lambda \cdot Z_{ikt} + \Theta \cdot IV_{ikt} + \phi_{it} + \epsilon_{ikt} \]

- Ideal instruments for trade exposure
  - \( \overline{\text{ExpDemand}}_{ikt} \): separate exogenous foreign demand for \( ik \) goods from \( i \)'s endogenous export supply of \( k \) goods
  - \( \overline{\text{ImpComp}}_{ikt} \): separate exogenous foreign supply of \( k \) goods to \( i \) from \( i \)'s endogenous import demand for \( k \) goods
  - Validity and exclusion restriction
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 $\text{ExpDemand}_{ikt}$
  - Foreign demand: weighted average absorption by $i$’s export partners, using $i$’s initial export shares as weights (WIOD)

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

- IV for $\text{ImpComp}_{ikt}$
  - Foreign supply: weighted average export value added for final consumption by $i$’s import partners, using $i$’s initial import shares as weights (WIOD)

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

- Import tariffs $\text{Tariff}_{ikt}$: average applied tariff (WITS)
# Valid Instruments (First Stage)

<table>
<thead>
<tr>
<th></th>
<th>Exp Dem (ikt)</th>
<th>Imp Comp (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foreign Demand (ikt)</strong></td>
<td>0.647*** (0.023)</td>
<td>0.117*** (0.012)</td>
</tr>
<tr>
<td></td>
<td>0.448*** (0.061)</td>
<td>-0.007 (0.028)</td>
</tr>
<tr>
<td><strong>Foreign Supply (ikt)</strong></td>
<td>0.127*** (0.010)</td>
<td>0.874*** (0.005)</td>
</tr>
<tr>
<td></td>
<td>0.148** (0.060)</td>
<td>0.420*** (0.027)</td>
</tr>
<tr>
<td><strong>Import Tariff (ikt)</strong></td>
<td>-4.090*** (0.417)</td>
<td>3.078*** (0.351)</td>
</tr>
<tr>
<td></td>
<td>0.233 (0.603)</td>
<td>-0.958** (0.475)</td>
</tr>
<tr>
<td><strong>ln N Firms (ikt)</strong></td>
<td>0.557*** (0.026)</td>
<td>0.007 (0.014)</td>
</tr>
<tr>
<td></td>
<td>0.566*** (0.024)</td>
<td>0.007 (0.013)</td>
</tr>
<tr>
<td><strong>ln N Firms (kt)</strong></td>
<td>-0.708*** (0.031)</td>
<td>-0.046** (0.019)</td>
</tr>
<tr>
<td></td>
<td>-0.539*** (0.205)</td>
<td>0.110 (0.085)</td>
</tr>
<tr>
<td><strong>ln Employment (kt)</strong></td>
<td>0.307*** (0.043)</td>
<td>0.059*** (0.019)</td>
</tr>
<tr>
<td></td>
<td>0.497*** (0.160)</td>
<td>-0.042 (0.068)</td>
</tr>
</tbody>
</table>

- # Observations: 2,775
- R-squared: 0.893
- Country*Year FE: Y
- Sector FE: N

Kalina Manova, Oxford
Causal Effects of Trade (Second Stage)

- One-standard-deviation rise in export demand and import competition → 72% and 10% higher aggregate productivity

<table>
<thead>
<tr>
<th></th>
<th>ln Aggregate Productivity (ikt)</th>
<th>ln Average Productivity (ikt)</th>
<th>Covariance Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.408***</td>
<td>0.316***</td>
<td>0.092***</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.026)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.049***</td>
<td>0.077***</td>
<td>-0.028***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.009)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,775</td>
<td>2,775</td>
<td>2,775</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.817</td>
<td>0.849</td>
<td>0.489</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Mechanisms: Firm Selection

- Controlling for min observed productivity across firms reduces estimated coefficients on export demand and import competition.
  - Consistent with impact of trade on the extensive margin of firm selection: less productive firms exit.

<table>
<thead>
<tr>
<th></th>
<th>In min Prod (ikt)</th>
<th>In Aggr Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.225***</td>
<td>0.264***</td>
<td>0.151***</td>
<td>0.113***</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.019)</td>
<td>(0.016)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.066***</td>
<td>0.011</td>
<td>0.031***</td>
<td>-0.020***</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.007)</td>
<td>(0.006)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>In min Prod (ikt)</td>
<td></td>
<td></td>
<td>0.652***</td>
<td>-0.085***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.018)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,749</td>
<td>2,749</td>
<td>2,749</td>
<td>2,749</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.910</td>
<td>0.913</td>
<td>0.948</td>
<td>0.482</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

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Mechanisms: Productivity Upgrading

- Controlling for R&D activity reduces (increases) estimated coefficients on export demand (import competition)
  - Consistent with export demand (import competition) stimulating (depressing) within-firm productivity upgrading

<table>
<thead>
<tr>
<th></th>
<th>In Aggr Prod (ikt)</th>
<th>In Avg Prod (ikt)</th>
<th>Cov Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.332***</td>
<td>0.263***</td>
<td>0.069***</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.026)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.068***</td>
<td>0.104***</td>
<td>-0.036***</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.010)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>In R&amp;D (ikt)</td>
<td>-0.028***</td>
<td>-0.061***</td>
<td>0.033***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.009)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,164</td>
<td>2,164</td>
<td>2,164</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.796</td>
<td>0.827</td>
<td>0.631</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Kalina Manova, Oxford
Robustness: Sector FE

- Sector FE control for systematic variation in global supply and demand conditions across sectors

<table>
<thead>
<tr>
<th></th>
<th>In Aggregate Productivity (ikt)</th>
<th>In Average Productivity (ikt)</th>
<th>Covariance Term (ikt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.315***</td>
<td>0.207**</td>
<td>0.108***</td>
</tr>
<tr>
<td></td>
<td>(0.100)</td>
<td>(0.090)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.294**</td>
<td>0.306***</td>
<td>-0.012</td>
</tr>
<tr>
<td></td>
<td>(0.117)</td>
<td>(0.107)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,775</td>
<td>2,775</td>
<td>2,775</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.868</td>
<td>0.895</td>
<td>0.633</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: Import Competition Measure

- Import penetration relative to domestic turnover or employment

\[ \text{ImpCompRatio}_{ikt} = \left\{ \ln \frac{\text{Imports}_{ikt} - \text{ImpInputs}_{ikt}}{\text{Turnover}_{ik}}, \ln \frac{\text{Imports}_{ikt} - \text{ImpInputs}_{ikt}}{\text{Employment}_{ik}} \right\} \]

<table>
<thead>
<tr>
<th></th>
<th>Imp Comp Ratio: Turnover</th>
<th>Imp Comp Ratio: Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In Aggr Prod (ikt)</td>
<td>In Avg Prod (ikt)</td>
</tr>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.416***</td>
<td>0.319***</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.022)</td>
</tr>
<tr>
<td>^Imp Comp Ratio (ikt)</td>
<td>0.058***</td>
<td>0.093***</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,794</td>
<td>2,794</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.817</td>
<td>0.853</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Kalina Manova, Oxford
Robustness: 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)

- \( \text{ChinaImpComp}_{ikt} = \ln(\text{Imports}_{\text{China} \rightarrow i,kt} - \text{ImpInputs}_{\text{China} \rightarrow i,kt}) \)

- IV for \( \text{ChinaImpComp}_{ikt} \)
  - Import tariffs \( \text{Tariff}_{ikt} \): average applied tariff
  - China’s global export supply: weighted average Chinese export value added for final consumption, using China’s share in \( i \)’s initial imports as weights
  - China’s export supply to the US: weighted average Chinese exports to the US by NACE-4 product, using \( i \)’s initial global import shares as weights

\[
\text{ChinaSupply}_{ikt} = \left\{ \ln \left[ \frac{M_{\text{China} \rightarrow i,k,t=0}}{M_{ik,t=0}} \right] XVA_{\text{final,China,kt}} \right\}, \ln \left[ \sum_{p \in k} \frac{M_{ip,t=0}}{M_{ik,t=0}} X_{\text{China} \rightarrow US,kt} \right]
\]
Robustness: Chinese Import Competition

- More nuanced effects of Chinese import competition on productivity across vs. within sectors

<table>
<thead>
<tr>
<th></th>
<th>No Sector FE</th>
<th></th>
<th>Sector FE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In Aggr Prod (ikt)</td>
<td>In Avg Prod (ikt)</td>
<td>Cov Term (ikt)</td>
<td>In Aggr Prod (ikt)</td>
</tr>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.431***</td>
<td>0.384***</td>
<td>0.047***</td>
<td>0.316***</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.022)</td>
<td>(0.006)</td>
<td>(0.084)</td>
</tr>
<tr>
<td>^China Imp Comp (ikt)</td>
<td>-0.001</td>
<td>0.023***</td>
<td>-0.024***</td>
<td>0.104***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.008)</td>
<td>(0.002)</td>
<td>(0.036)</td>
</tr>
<tr>
<td># Observations</td>
<td>2,775</td>
<td>2,775</td>
<td>2,775</td>
<td>2,775</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.811</td>
<td>0.835</td>
<td>0.542</td>
<td>0.876</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Sector FE</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

Kalina Manova, Oxford
Alternative Misallocation Measures

- The literature has proposed other indicators of resource (mis)allocation across firms
  - 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)

- Recall conceptual and practical challenges with distinguishing between efficient allocation and misallocation
**Alternative Misallocation Measures**

- Compared to OP cov term, alternative misallocation measures deliver different results for the effects of export demand and import competition.

<table>
<thead>
<tr>
<th></th>
<th>MRPK St Dev</th>
<th>MRPL St Dev</th>
<th>TFPR St Dev</th>
<th>PCM p80 / p20</th>
</tr>
</thead>
<tbody>
<tr>
<td>^Exp Dem (ikt)</td>
<td>-0.137***</td>
<td>0.279***</td>
<td>0.127**</td>
<td>0.026***</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.025)</td>
<td>(0.052)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.213***</td>
<td>0.081***</td>
<td>-0.037***</td>
<td>-0.011***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.009)</td>
<td>(0.013)</td>
<td>(0.003)</td>
</tr>
<tr>
<td># Observations</td>
<td>2,775</td>
<td>2,775</td>
<td>2,272</td>
<td>2,773</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.560</td>
<td>0.809</td>
<td>0.387</td>
<td>0.695</td>
</tr>
<tr>
<td>Country * Year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
Imperfect Institutions & Market Frictions

- World Justice Project: rule of law
  - Index of overall institutional capacity
  - Mean 1.86, st dev 0.91

- OECD Employment: labor market flexibility
  - Average of 21 indicators for firing and hiring costs
  - Mean 3.47, st dev 0.66

- Beck et al (2013): private credit / GDP
  - Commonly used outcome-based measure
  - Mean 0.78, st dev 0.42

- OECD Market Regulation: product market regulation
  - Average of 18 indicators for state control, barriers to entrepreneurship, and barriers to trade and investment
  - Mean 1.84, st dev 0.25
Imperfect Institutions & Market Frictions

- Strong institutions and efficient factor and product markets amplify gains from import competition, but dampen gains from export expansion.

<table>
<thead>
<tr>
<th>Efficiency Measure</th>
<th>Rule of Law (World Justice Project Index)</th>
<th>Labor Market Flexibility (OECD Index)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In Aggr Prod (ikt)</td>
<td>In Avg Prod (ikt)</td>
</tr>
<tr>
<td>^Exp Dem (ikt)</td>
<td>1.099***</td>
<td>0.924***</td>
</tr>
<tr>
<td></td>
<td>(0.084)</td>
<td>(0.078)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>-0.168***</td>
<td>-0.102***</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>^Exp Dem (ikt) x</td>
<td>-0.490***</td>
<td>-0.432***</td>
</tr>
<tr>
<td>Efficiency Measure (it=0)</td>
<td>(0.048)</td>
<td>(0.044)</td>
</tr>
<tr>
<td>^Imp Comp (ikt) x</td>
<td>0.163***</td>
<td>0.132***</td>
</tr>
<tr>
<td>Efficiency Measure (it=0)</td>
<td>(0.024)</td>
<td>(0.022)</td>
</tr>
</tbody>
</table>

Observations: 2,775 2,775 2,775 2,775 2,775 2,775
R-squared: 0.784 0.827 0.471 0.766 0.806 0.465
Ctry*Year FE, Controls: Y Y Y Y Y Y
Imperfect Institutions & Market Frictions

- Strong institutions and efficient factor and product markets amplify gains from import competition, but dampen gains from export expansion

<table>
<thead>
<tr>
<th>Efficiency Measure</th>
<th>Financial Market Development (Private Credit / GDP)</th>
<th>Product Market Regulation (OECD Index)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In Aggr Prod (ikt)</td>
<td>In Avg Prod (ikt)</td>
</tr>
<tr>
<td>^Exp Dem (ikt)</td>
<td>0.371***</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td>(0.160)</td>
</tr>
<tr>
<td>^Imp Comp (ikt)</td>
<td>0.057**</td>
<td>0.179***</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.061)</td>
</tr>
<tr>
<td>^Exp Dem (ikt) x Efficiency Measure (it=0)</td>
<td>-0.058</td>
<td>-1.450</td>
</tr>
<tr>
<td></td>
<td>(0.314)</td>
<td>(0.890)</td>
</tr>
<tr>
<td>^Imp Comp (ikt) x Efficiency Measure (it=0)</td>
<td>-0.003</td>
<td>0.363</td>
</tr>
<tr>
<td></td>
<td>(0.089)</td>
<td>(0.250)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,775</td>
<td>2,775</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.821</td>
<td>0.610</td>
</tr>
<tr>
<td>Ctry*Year FE, Controls</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Kalina Manova, Oxford
Conclusions and Next Steps

- Evidence that export demand and import competition both increase aggregate productivity, but through different channels
  - Firm entry and exit
  - Within-firm productivity upgrading
  - Reallocation of market shares across firms

- Puzzle?
  - What form of resource misallocation, market structure and parameter space can reconcile theory with data?
Pros & Cons of OP Approach

- **Advantages**
  - Welfare relevance: link between aggregate productivity & (mis)allocation
  - Attractive accounting properties: linear additivity and first-differencing
  - Agnostic decomposition: no assumptions on market structure, production technology, productivity distribution, demand/supply dynamics
  - Versatility: no restriction on firm productivity and market share measures
  - Practicality: no need for TFPQ, MRK, MPL, PCM estimates

- **Disadvantages**
  - Agnostic decomposition: cannot confirm specific economic mechanisms
  - Static decomposition: cannot separate entry/exit from within-firm productivity upgrading

- Our estimation approach capitalizes on advantages and uses different techniques to overcome disadvantages
Private credit (% of GDP)
### Strictness of employment protection

- **AUSTRIA**
- **BELGIUM**
- **ESTONIA**
- **FINLAND**
- **FRANCE BRN**
- **GERMANY**
- **HUNGARY**
- **ITALY**
- **POLAND**
- **PORTUGAL**
- **SLOVAKIA**
- **SLOVENIA**
- **SPAIN**