



# Productivity, Misallocation 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 different types of trade activity
  - Role of labor and capital market imperfections
- ❑ Implications for trade policy and structural reforms
  - Gains from trade in the context of global production networks
  - Importance of flexible factor markets for realization of these gains

# This Paper

- ❑ Examine the effects of international trade and factor market imperfections on aggregate productivity
  - Unique data that captures underlying firm heterogeneity for 15 European countries and 20 manufacturing industries in 1998-2011
  - Distinguish different trade channels and productivity components
  
- ❑ Trade expansion significantly increases aggregate productivity
  - Exports operate mainly through improved allocative efficiency, while import competition and imported inputs act through higher average firm productivity
  
- ❑ Flexible labor and capital markets enhance aggregate productivity and modify effects of globalization

# Contribution to the Literature

- ❑ Macroeconomics: productivity dispersion and resource misallocation across firms contributes to productivity differences across countries
  - Hsieh-Klenow 2009, Bartelsman-Haltiwanger-Scarpetta 2013, ...
  
- ❑ Trade: debate about the role of firm heterogeneity for gains from trade
  - Pavcnik 2002, Bustos 2011, Arkolakis-Costinot-RodriguezClare 2012, Melitz-Redding 2014, ...
  
- ❑ Trade: impact of financial and labor market frictions on international trade
  - Manova 2013, Chor-Manova 2012, Helpman-Itskhoki-Redding 2010, Cuñat-Melitz 2012

# Outline

1. Economic mechanisms
2. Data and estimation
3. Empirical evidence
4. Conclusions

# Export Demand

- ❑ Falling trade costs and rising foreign demand improve export opportunities
  - Lower productivity cut-off for exporting and higher productivity cut-off for domestic production
  - Reallocation of activity towards more productive firms
  - Within-firm productivity upgrading with economies of scale

↑ Export demand → ↑ Aggregate productivity

# Import Competition

- Rise in import competition reduces local demand for domestic producers
  - Higher productivity cut-off for domestic production and lower domestic sales for all firms
  - Higher export revenues for productive firms if factor costs fall
  - Within-firm productivity upgrading due to removal of X-inefficiencies

↑ Import competition → ↑ Aggregate productivity

# Imported-Input Supply

- Improved access to imported inputs lowers the price and increases the variety and quality of inputs to production
  - More or less productive firms expand more depending on complementarity between productivity and imported inputs
  - Within-firm productivity upgrading with economies of scale or complementarity between productivity and imported inputs

↑ Imported-input supply → ? Aggregate productivity



# Factor Market Imperfections

- ❑ Factor market imperfections generate deviations from first best
  - Less efficient (re)allocation of resources across firms
  - Restricted levels of production, exporting and innovation
  
- ❑ Labor and capital market frictions affect aggregate productivity directly and indirectly by modifying impact of trade shocks

# Labor Market Frictions

- Flexible labor markets improve (re)allocation of workers to firms
  - Restricted scale of operations and productivity upgrading
  - All firms affected, but differentially across productivity distribution?

↑ Labor market flexibility → ↑ Aggregate productivity

# Capital Market Frictions

## ❑ Credit underprovision

- More constrained size and innovation in less productive firms
- Improved access to finance increases within-firm innovation and shifts activity towards less productive firms

## ❑ Credit misallocation

- More constrained size and innovation in more productive firms
- Improved access to finance increases within-firm innovation and shifts activity towards more productive firms

↑ Credit market size and efficiency → ? Aggregate productivity

# Productivity Decomposition

- Aggregate productivity decomposition (Olley and Pakes 1996)
  - Average log firm labor productivity
  - Covariance between log firm labor productivity and firm employment

$$Prod_t = \frac{1}{N_t} \sum_f Prod_{ft} + \sum_f (\theta_{ft} - \bar{\theta}_t) (Prod_{ft} - \overline{Prod}_t)$$

- Controlling for country and sector characteristics:
  - first term captures firm selection and within-firm innovation
  - second term reflects allocative efficiency

# Data: Productivity

## □ CompNet productivity indicators

- 15 European countries

Austria, Belgium, Croatia, Estonia, Finland, France, Germany, Hungary, Italy, Lithuania, Poland, Portugal, Slovakia, Slovenia, Spain

- 20 NACE-2 manufacturing sectors
- 1998-2011 unbalanced panel

	Prod	AvgProd	CovProd
#Obs	3205	3205	3205
Mean	3,17	2,94	0,23
St dev	1,14	1,20	0,22
Min	0,16	-0,14	-0,67
Max	5,56	5,47	1,35

# Productivity Decomposition (logs)

	AUS	BEL	HRV	EST	FIN	FRA	DEU	HUN	ITA	LTU	POL	PRT	SVK	SVN	ESP	Total	
<b>LProd</b>	Mean	<b>4,35</b>	<b>4,08</b>	<b>2,30</b>	<b>2,03</b>	<b>4,05</b>	<b>4,05</b>	<b>4,51</b>	<b>1,63</b>	<b>3,53</b>	<b>1,91</b>	<b>2,33</b>	<b>2,79</b>	<b>2,15</b>	<b>2,32</b>	<b>3,47</b>	<b>3,12</b>
	St dev	0,53	0,56	0,69	0,62	0,56	0,48	0,40	0,66	0,43	0,63	0,80	0,63	0,63	0,59	0,44	1,14
<b>AvgLProd</b>	Mean	<b>4,29</b>	<b>3,88</b>	<b>2,13</b>	<b>1,74</b>	<b>3,87</b>	<b>3,86</b>	<b>4,40</b>	<b>1,10</b>	<b>3,25</b>	<b>1,44</b>	<b>2,15</b>	<b>2,50</b>	<b>2,01</b>	<b>2,20</b>	<b>3,16</b>	<b>2,89</b>
	St dev	0,53	0,48	0,60	0,63	0,53	0,44	0,38	0,59	0,44	0,60	0,79	0,58	0,58	0,53	0,38	1,19
<b>CovLProd</b>	Mean	<b>0,06</b>	<b>0,20</b>	<b>0,17</b>	<b>0,29</b>	<b>0,18</b>	<b>0,19</b>	<b>0,11</b>	<b>0,53</b>	<b>0,28</b>	<b>0,47</b>	<b>0,18</b>	<b>0,28</b>	<b>0,14</b>	<b>0,12</b>	<b>0,31</b>	<b>0,23</b>
	St dev	0,10	0,17	0,27	0,25	0,21	0,15	0,09	0,31	0,09	0,26	0,15	0,11	0,20	0,19	0,15	0,23

# Productivity Decomposition (delta logs)

	AUS	BEL	HRV	EST	FIN	FRA	DEU	HUN	ITA	LTU	POL	PRT	SVK	SVN	ESP	Total	
LProd.	<b>Mean</b>	<b>0,01</b>	<b>0,02</b>	<b>0,01</b>	<b>0,08</b>	<b>0,02</b>	<b>0,03</b>	<b>0,02</b>	<b>0,03</b>	<b>0,01</b>	<b>0,04</b>	<b>0,07</b>	<b>0,01</b>	<b>0,09</b>	<b>0,07</b>	<b>0,00</b>	<b>0,03</b>
	St dev	0,13	0,08	0,13	0,29	0,17	0,10	0,07	0,18	0,09	0,24	0,12	0,08	0,16	0,12	0,07	0,15
AvgLProd	<b>Mean</b>	<b>0,01</b>	<b>0,01</b>	<b>-0,01</b>	<b>0,06</b>	<b>0,02</b>	<b>0,03</b>	<b>0,02</b>	<b>0,00</b>	<b>0,01</b>	<b>0,02</b>	<b>0,07</b>	<b>-0,01</b>	<b>0,09</b>	<b>0,06</b>	<b>0,00</b>	<b>0,03</b>
	St dev	0,10	0,07	0,10	0,23	0,11	0,09	0,06	0,15	0,07	0,20	0,14	0,08	0,14	0,10	0,04	0,13
CovLProd	<b>Mean</b>	<b>0,00</b>	<b>0,00</b>	<b>0,02</b>	<b>0,02</b>	<b>0,00</b>	<b>-0,01</b>	<b>0,00</b>	<b>0,04</b>	<b>0,00</b>	<b>0,03</b>	<b>0,00</b>	<b>0,02</b>	<b>-0,01</b>	<b>0,01</b>	<b>0,00</b>	<b>0,01</b>
	St dev	0,09	0,06	0,12	0,22	0,13	0,05	0,05	0,17	0,04	0,21	0,07	0,06	0,13	0,11	0,06	0,12

# Data: Trade

- World Input Output Database (NACE-2 sectors)
  - Export demand: exports in sector k
  - Import competition: total imports in sector k - imported inputs from k
  - Imported-input supply: imports of inputs by sector k from all sectors

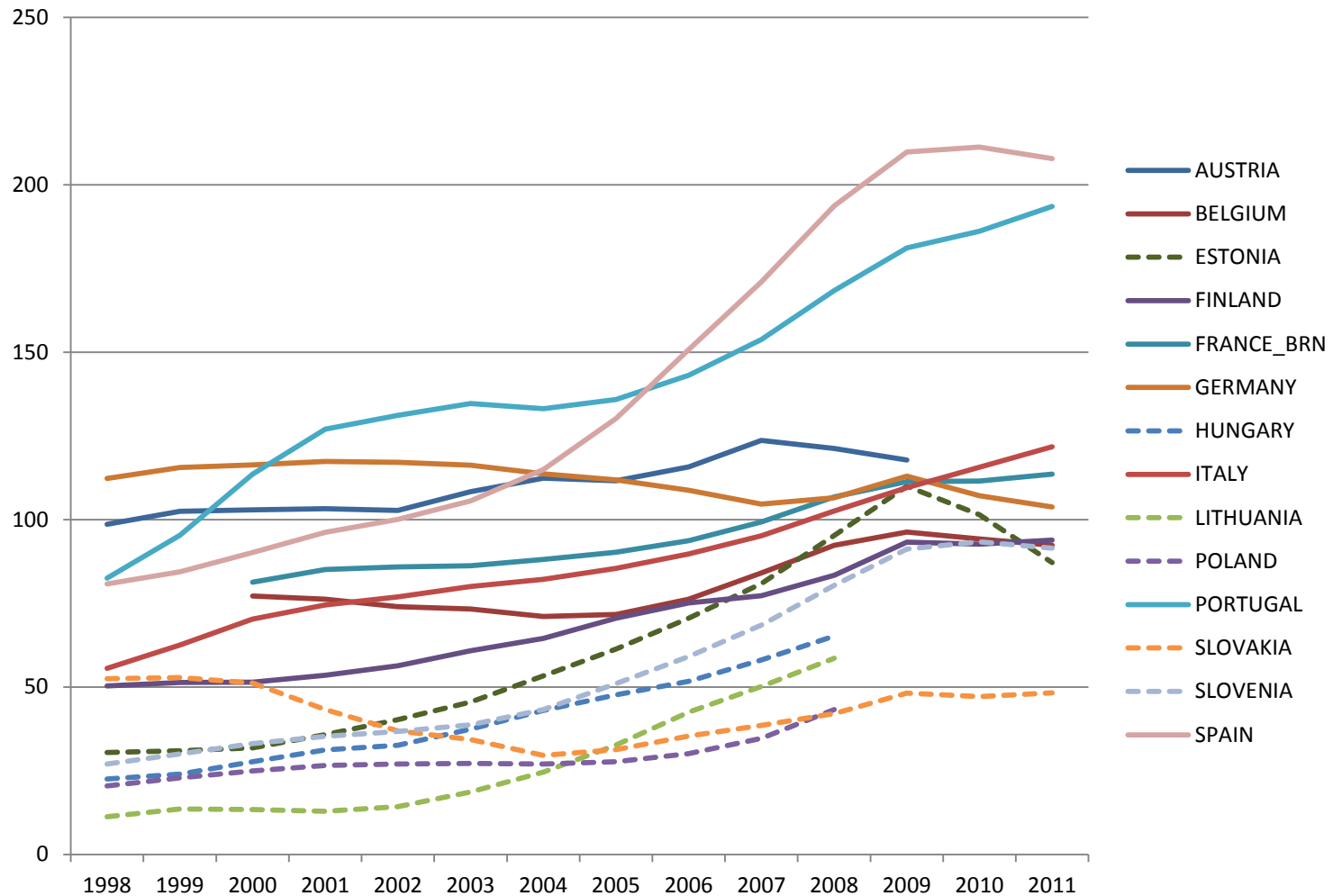
	Ln Exp.Dem.	Ln Imp.Comp.	Ln Imp.Input
#obs	3,918	3,920	3,920
Mean	7.367	7.270	6.527
St dev	1.771	1.609	1.689
Min	-0.821	3.175	1.316
Max	11.892	11.258	10.743



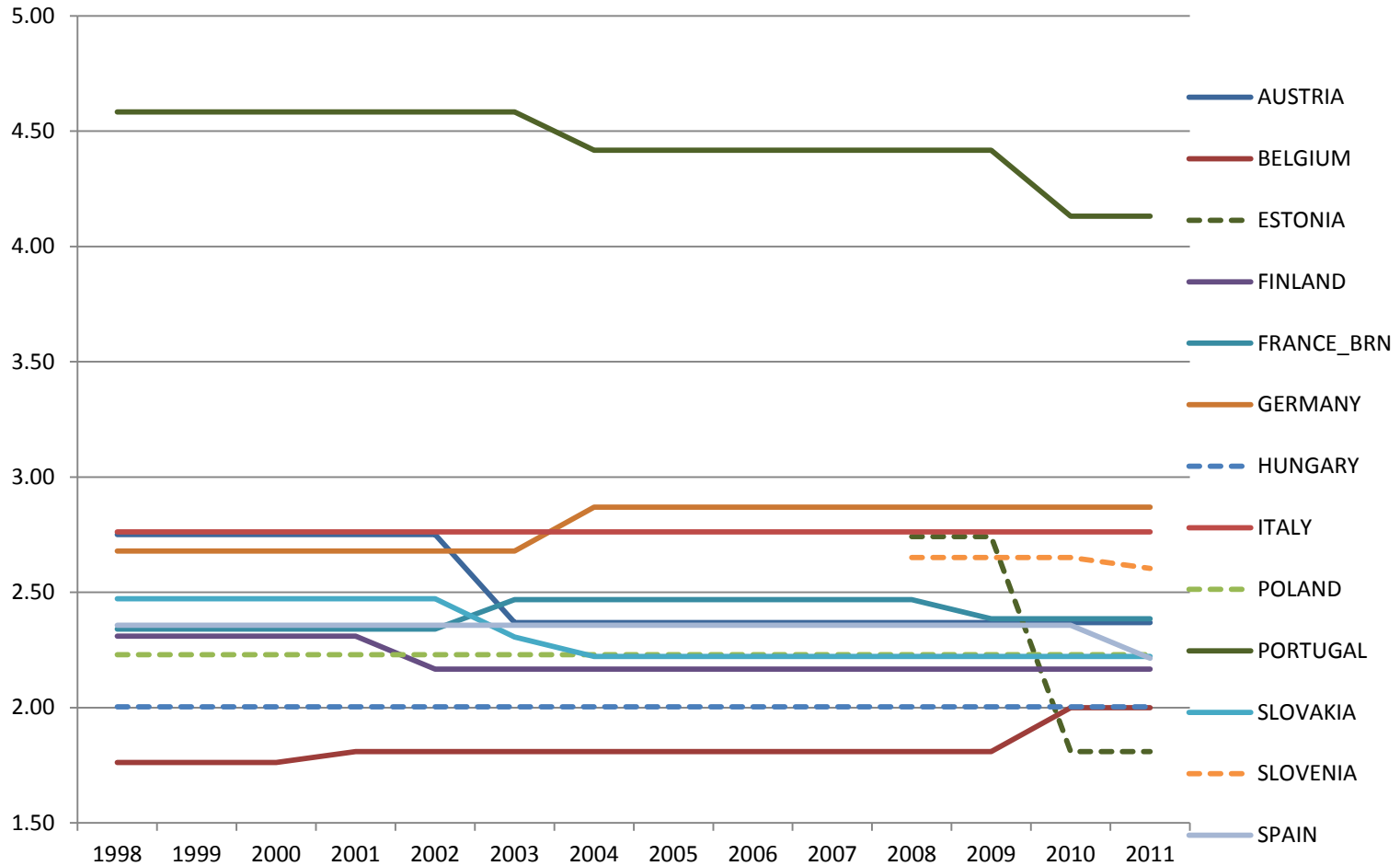
# Data: Market Frictions

- ❑ OECD employment database : index of 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
  - Outcome-based measure
  - Mean 0.78, st dev 0.42
  
- ❑ LLSV (1998) : creditor rights' protection
  - Institutional measure
  - Mean 1.86, st dev 0.91

## Private credit (% of GDP)



## Strictness of employment protection



# Empirical Strategy

- Estimate the long-run relationship of trade activity and market frictions with aggregate productivity

$$Y_{ikt} = \alpha + \beta_1 \cdot \ln \text{ExportDemand}_{ikt} + \beta_2 \cdot \ln \text{ImpComp}_{ikt} + \beta_3 \cdot \ln \text{ImpInputs}_{ikt} + \gamma_1 \cdot \text{LmktFrictions}_{ikt} + \gamma_2 \cdot \text{KmktFrictions}_{ikt} + \delta' \cdot Z_{ikt} + \varphi_i + \varphi_k + \varepsilon_{ikt}$$

- $Y_{ikt}$  : aggregate productivity in country  $i$ , sector  $k$ , year  $t$
- $\varphi_i, \varphi_k$  : 15 country FE, 20 NACE-2 industry FE
- $Z_{ikt}$  : population ( $\ln L_{it}$ ), # firms ( $\ln N_{ikt}$ ), sector trends ( $\ln N_{kt}, \ln L_{kt}$ )
- $\varepsilon_{ikt}$  : robust standard errors

# Trade and Productivity

- One-standard-deviation rise in export demand, import competition and imported inputs (1.77, 1.60 and 1.68 in log difference) associated with 0.11%, 0.40% and 0.07% higher aggregate productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	lnLProd	lnAvgLProd	CovLProd	lnLProd	lnAvgLProd	CovLProd	lnLProd	lnAvgLProd	CovLProd
In Exp Dem	0.063*** (0.014)	0.010 (0.013)	0.053*** (0.006)						
In Imp Comp				0.245*** (0.027)	0.194*** (0.025)	0.051*** (0.011)			
In Imp Inputs							0.041** (0.016)	-0.011 (0.015)	0.052*** (0.007)
In N Firms	-0.077*** (0.019)	-0.054*** (0.017)	-0.023*** (0.007)	-0.072*** (0.016)	-0.075*** (0.014)	0.002 (0.006)	-0.060*** (0.019)	-0.042** (0.017)	-0.018*** (0.007)
In Population	-0.671** (0.277)	-0.317 (0.259)	-0.354*** (0.122)	-0.814*** (0.282)	-0.389 (0.264)	-0.425*** (0.125)	-0.748*** (0.282)	-0.321 (0.261)	-0.426*** (0.124)
In N Firms (world)	0.643*** (0.070)	0.600*** (0.067)	0.043 (0.028)	0.469*** (0.072)	0.431*** (0.069)	0.038 (0.030)	0.671*** (0.070)	0.613*** (0.066)	0.058** (0.028)
In Labor (world)	-0.485*** (0.075)	-0.472*** (0.071)	-0.013 (0.028)	-0.391*** (0.075)	-0.380*** (0.071)	-0.011 (0.029)	-0.509*** (0.075)	-0.476*** (0.071)	-0.033 (0.029)
Observations	3,060	3,060	3,060	3,062	3,062	3,062	3,062	3,062	3,062
R-squared	0.87	0.895	0.529	0.874	0.897	0.517	0.87	0.895	0.525
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y	Y	Y	Y

# Trade and Productivity

- Effects of export demand operate mainly through allocative efficiency, while import competition acts through average firm productivity

	(1)	(2)	(3)	(4)	(5)	(6)
	lnLProd	lnAvgLProd	CovLProd	lnLProd	lnAvgLProd	CovLProd
In Exp Dem	-0.012 (0.016)	-0.065*** (0.015)	0.053*** (0.007)	0.092*** (0.028)	0.041 (0.025)	0.052*** (0.011)
In Imp Comp	0.257*** (0.031)	0.258*** (0.030)	-0.002 (0.013)	0.286*** (0.031)	0.288*** (0.030)	-0.002 (0.013)
In Imp Inputs				-0.144*** (0.031)	-0.147*** (0.028)	0.003 (0.013)
Observations	3,060	3,060	3,060	3,060	3,060	3,060
R-squared	0.874	0.898	0.529	0.875	0.899	0.529
Country FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y

# Market Frictions and Productivity

- One-standard-deviation reduction in capital and labor market frictions (0.42 pp and 0.66 index variation) associated with 0.10% and 0.24% higher aggregate productivity

	(1) lnLProd	(2) lnAvgLProd	(3) CovLProd	(4) lnLProd	(5) lnAvgLProd	(6) CovLProd	(7) lnLProd	(8) lnAvgLProd	(9) CovLProd
Labor Mkt Flex	0.239*** (0.079)	0.191*** (0.073)	0.049 (0.032)				0.218*** (0.080)	0.167** (0.074)	0.051 (0.033)
Priv Credit / GDP				0.361*** (0.054)	0.314*** (0.051)	0.047* (0.026)	0.344*** (0.055)	0.301*** (0.052)	0.043 (0.027)
Observations	3,262	3,262	3,262	3,022	3,022	3,022	3,022	3,022	3,022
R-squared	0.869	0.896	0.502	0.875	0.899	0.466	0.875	0.899	0.467
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y	Y	Y	Y

# Market Frictions and Productivity

- Differential effects of market frictions across sectors inform underlying mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)
	lnLProd	lnAvgLProd	CovLProd	lnLProd	lnAvgLProd	CovLProd
Labor Mkt Flex	0.149* (0.087)	0.102 (0.081)	0.047 (0.036)	0.216** (0.107)	0.174* (0.105)	0.042 (0.032)
Labor Mkt Flex * Volatility	0.046*** (0.017)	0.047*** (0.017)	-0.001 (0.006)	0.027* (0.015)	0.028* (0.015)	-0.001 (0.005)
Priv Credit / GDP	0.342*** (0.057)	0.300*** (0.052)	0.042 (0.028)	0.221** (0.093)	0.241*** (0.088)	-0.020 (0.037)
Priv Credit / GDP * Ext Fin Dep	-0.131*** (0.045)	-0.173*** (0.044)	0.042** (0.019)			
Priv Credit / GDP * Invent / Sales				0.801* (0.480)	0.400 (0.456)	0.401** (0.159)
Observations	2,883	2,883	2,883	2,848	2,848	2,848
R-squared	0.882	0.906	0.511	0.877	0.903	0.592
Country FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y



# Both Trade and Market Frictions Matter

	(1)	(2)	(3)	(4)	(5)	(6)
	lnLProd	lnAvgLProd	CovLProd	lnLProd	lnAvgLProd	CovLProd
In Exp Dem	0.034** (0.015)	-0.016 (0.014)	0.050*** (0.006)	0.049*** (0.015)	-0.001 (0.014)	0.050*** (0.006)
In Imp Comp (res)				0.233*** (0.033)	0.236*** (0.031)	-0.002 (0.014)
Labor Mkt Flex	0.228*** (0.081)	0.161** (0.074)	0.067** (0.033)	0.253*** (0.083)	0.186** (0.076)	0.067** (0.033)
Priv Credit / GDP	0.333*** (0.057)	0.339*** (0.054)	-0.006 (0.027)	0.198*** (0.060)	0.203*** (0.056)	-0.004 (0.028)
Observations	2,820	2,820	2,820	2,820	2,820	2,820
R-squared	0.878	0.900	0.494	0.881	0.902	0.494
Country FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y

# Both Trade and Market Frictions Matter

	(1) lnLProd	(2) lnAvgLProd	(3) CovLProd	(4) lnLProd	(5) lnAvgLProd	(6) CovLProd
In Exp Dem	0.085*** (0.015)	0.026* (0.014)	0.059*** (0.006)	0.087*** (0.015)	0.028** (0.014)	0.058*** (0.006)
In Imp Comp (res)	0.229*** (0.034)	0.234*** (0.032)	-0.004 (0.014)	0.234*** (0.034)	0.242*** (0.032)	-0.008 (0.014)
Labor Mkt Flex	0.174* (0.089)	0.114 (0.083)	0.060* (0.035)	0.169* (0.089)	0.123 (0.083)	0.045 (0.036)
Labor Mkt Flex * Volatility	0.054*** (0.015)	0.050*** (0.016)	0.004 (0.006)	0.057*** (0.015)	0.044*** (0.015)	0.013** (0.006)
Priv Credit / GDP	0.162*** (0.061)	0.177*** (0.057)	-0.015 (0.029)	0.063 (0.094)	0.153* (0.088)	-0.090** (0.037)
Priv Credit / GDP * Ext Fin Dep	-0.073* (0.044)	-0.126*** (0.044)	0.054*** (0.019)			
Priv Credit / GDP * Invent / Sales				0.631 (0.467)	0.132 (0.443)	0.499*** (0.162)
Observations	2,692	2,692	2,692	2,692	2,692	2,692
R-squared	0.886	0.909	0.532	0.886	0.908	0.532
Country FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y

## ... And Interact Nontrivially

- ... with different effects on average productivity and allocative efficiency

	(1)	(2)	(3)	(4)	(5)	(6)
	lnLProd	lnAvgLProd	CovLProd	lnLProd	lnAvgLProd	CovLProd
In Exp Dem	-0.336*** (0.072)	-0.477*** (0.069)	0.141*** (0.026)	0.139*** (0.021)	0.113*** (0.020)	0.026*** (0.009)
Labor Mkt Flex	-0.438*** (0.161)	-0.648*** (0.151)	0.210*** (0.063)			
In Exp Dem * Labor Mkt Flex	0.107*** (0.019)	0.128*** (0.018)	-0.021*** (0.007)			
Priv Credit / GDP				1.387*** (0.152)	1.578*** (0.143)	-0.190*** (0.052)
In Exp Dem * Priv Credit / GDP				-0.151*** (0.021)	-0.183*** (0.020)	0.032*** (0.007)
Observations	3,060	3,060	3,060	2,820	2,820	2,820
R-squared	0.874	0.898	0.534	0.880	0.903	0.496
Country FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y

# Robustness

- Baseline results robust to series of specification checks
  - Year fixed effects
  - Alternative measures of import competition and imported inputs
  - Alternative measures of financial market frictions
  - Controlling for rule of law and corruption
  - Bartik instruments for export demand and import competition
  - Medium-term effects: 5-year overlapping periods with country and sector-specific time trends

# Year Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	lnLProd	lnAvgLProd	CovLProd	lnLProd	lnAvgLProd	CovLProd
In Exp Dem	0.043*** (0.016)	-0.016 (0.015)	0.060*** (0.006)	0.046*** (0.016)	-0.013 (0.015)	0.059*** (0.006)
In Imp Comp (res)	0.098*** (0.036)	0.101*** (0.034)	-0.003 (0.016)	0.106*** (0.036)	0.113*** (0.034)	-0.007 (0.016)
Labor Mkt Flex	0.131 (0.088)	0.094 (0.082)	0.037 (0.036)	0.128 (0.088)	0.106 (0.082)	0.022 (0.036)
Labor Mkt Flex * Volatility	0.050*** (0.016)	0.046*** (0.016)	0.004 (0.006)	0.052*** (0.016)	0.039** (0.016)	0.013** (0.006)
Priv Credit / GDP	-0.057 (0.063)	-0.056 (0.059)	-0.001 (0.029)	-0.144 (0.097)	-0.067 (0.091)	-0.077** (0.038)
Priv Credit / GDP * Ext Fin Dep	-0.090** (0.044)	-0.144*** (0.044)	0.054*** (0.019)			
Priv Credit / GDP * Invent / Sales				0.559 (0.462)	0.056 (0.442)	0.503*** (0.162)
Observations	2,692	2,692	2,692	2,692	2,692	2,692
R-squared	0.890	0.912	0.536	0.890	0.912	0.535
Country FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y

# Bartik IV for Export Demand

	(1)	(2)	(3)	(4)	(5)	(6)
	lnLProd	lnAvgLProd	CovLProd	lnLProd	lnAvgLProd	CovLProd
In Exp Dem	0.609*** (0.095)	0.545*** (0.093)	0.064** (0.027)	0.593*** (0.093)	0.534*** (0.091)	0.059** (0.027)
Labor Mkt Flex	0.221** (0.103)	0.160 (0.099)	0.061* (0.035)	0.205** (0.103)	0.159 (0.099)	0.046 (0.035)
Labor Mkt Flex * Volatility	0.098*** (0.018)	0.094*** (0.018)	0.004 (0.006)	0.106*** (0.020)	0.092*** (0.019)	0.013* (0.007)
Priv Credit / GDP	-0.121 (0.103)	-0.100 (0.099)	-0.021 (0.034)	-0.247* (0.142)	-0.153 (0.135)	-0.095** (0.043)
Priv Credit / GDP * Ext Fin Dep	-0.035 (0.048)	-0.090* (0.046)	0.055*** (0.019)			
Priv Credit / GDP * Invent / Sales				0.909 (0.580)	0.412 (0.551)	0.498*** (0.161)
Observations	2,692	2,692	2,692	2,692	2,692	2,692
R-squared	0.823	0.851	0.532	0.827	0.853	0.532
Country FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y

# Medium-Term Effects: 5-Year Changes

	(1) Δ lnProd	(2) Δ lnAvgProd	(3) Δ CovProd
Δ ln Exp Dem	0.198*** (0.028)	0.156*** (0.024)	0.042** (0.018)
Δ Labor Mkt Flex	0.294*** (0.053)	0.216*** (0.053)	0.077*** (0.027)
Δ Priv Credit / GDP	-0.265*** (0.024)	-0.248*** (0.019)	-0.017 (0.015)
Observations	1,461	1,461	1,461
R-squared	0.293	0.321	0.048
Sector FE	Y	Y	Y

# Conclusions and Next Steps

- ❑ Evidence that export demand, import competition and imported inputs significantly increase aggregate productivity
- ❑ Labor and capital market imperfections play an important and complex role
- ❑ Way forward
  - Endogeneity of trade activity
  - TFP and capital productivity
  - Transmission channels for trade effects and market frictions
  - Asymmetric response during Great Recession