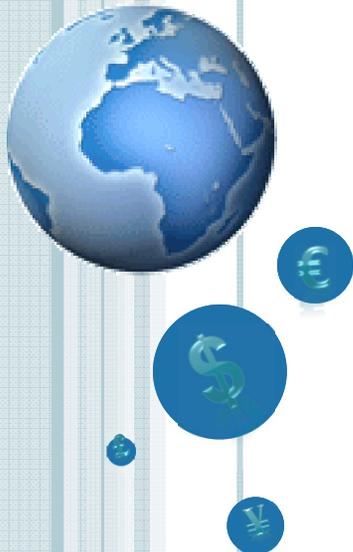


TRADE AND GROWTH REVISITED: NEW SECTOR-LEVEL EVIDENCE



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GLOBAL TRADE SLOWDOWN



Sources: IMF, *World Economic Outlook* and IMF staff calculations.

Note: World trade includes goods and services.

- Possible underlying factors include:
 - Weaker demand; rising protectionism; changing patterns in GVC; tougher trade financing, etc (IMF 2016 Oct WEO; Constantinescu, Mattoo, and Ruta, 2015).
- Does it matter?

TRADE: AN ENGINE OF GROWTH FOR ALL



at the IMF-WTO-World Bank Group Event, Oct. 2016

Trade is essential to deliver growth and to eliminate poverty

(President Jim Yong Kim)

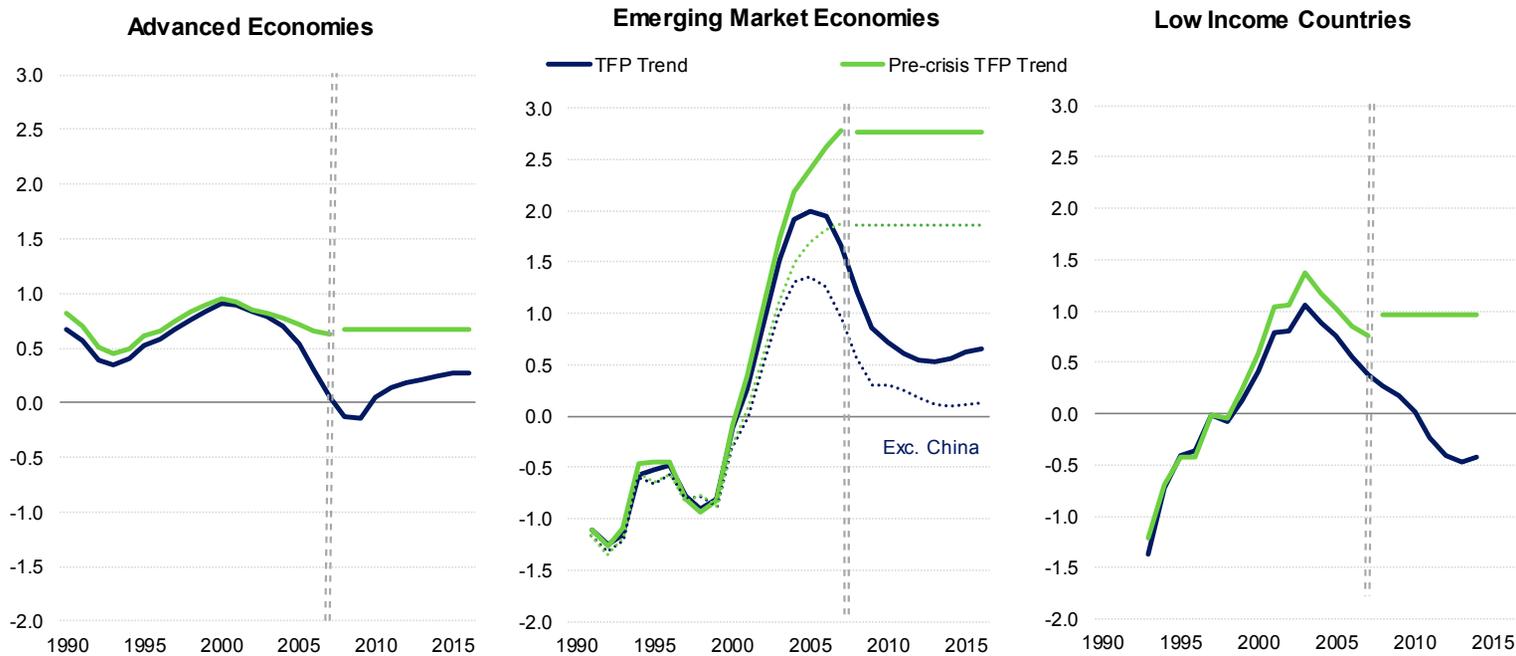
Trade is essential for economic growth and development around the world

(Director General Roberto Azevêdo)

We all stand for trade

(Managing Director, Christine Lagarde)

GLOBAL PRODUCTIVITY SLOWDOWN



Sources: PWT 9.0 and IMF staff calculations.

Note: HP trends estimated up to 2007 and 2016 are reported. Group averages are weighted using PPP-GDP, and composed of the 20 largest economies in the corresponding WEO income category.

Adler et al., forthcoming, IMF Staff Discussion Note

- This paper tries to link the recent global trade and productivity slowdown
 - Identifying the causal relationship
 - Effect of trade on productivity

TRADE AND GROWTH: THEORY

- Firm-level productivity gains from import channels
 - Import competition channel
 - Scale economies (Helpman and Krugman, 1985)
 - Innovation incentives (Aghion et al, 2005)
 - cf. Rodrik (1988, 1991)
 - Input variety / quality channel
 - Kasahara and Rodrigue (2008); Gopinath and Neiman (2014); Halpern, Koren, and Szeidl (2015)
 - Ethier (1982); Grossman and Helpman (1991)
- Firm-level productivity gains from export channels
 - Learning by exporting / technological spillover / quality upgrading channel
 - Bustos (2011); Lileeva and Trefler (2010); Verhoogen (2008)
- Industry-level productivity gains from trade
 - Resource reallocation within a sector across firms (e.g., Melitz, 2003)

TRADE AND GROWTH: EVIDENCE

○ Country-level studies

- Sachs and Warner (1995, *BPEA*); Frankel and Romer (1999, *AER*); Noguer and Siscart (2005, *JIE*); Wacziarg and Welch (2008, *WBEB*), etc.
- IVs to address endogeneity issues
- Findings can be broad and general
- Difficult to identify specific channels:
 - e.g., import or export?

○ Firm-level studies

- Amiti and Konings (2007, *AER*); Fernandes (2007, *JIE*); Topalova and Khandelwal (2011, *ReStat*)
 - Separately identify output and input market effects from unilateral trade liberalization
- Bustos (2011, *AER*); Lileeva and Trefler (2010, *QJE*); De Loecker (2013, *AEJ*)
 - Productivity gains from improved access to foreign markets
- Difficult to quantify aggregate productivity gains from trade

THIS PAPER

- Trade and TFP growth at the country-sector level:
 - Within country-sector variation over time
 - Identifying both channels separately
 - Import and export
 - Employing a set of novel instruments
 - Typical challenges in empirical investigation
 - Endogeneity issues (i.e., trade can be a function of TFP)
 - Following the strategy in Autor, Dorn, and Hanson (2013, *AER*)
- Narrowing down the question to the productivity effect of :
 - **Chinese** import penetration in domestic market
 - Exploiting the exogenous nature of China's supply shock
 - Improved market access to **China**
 - Exploiting the exogenous nature of China's demand shock

PREVIEW OF MAIN FINDINGS

- Significant and positive impacts of both import and export channels
 - Up to 10 percent of TFP growth over the last decade can be explained by trade channels *vis-a-vis* China
 - Suggesting non-negligible effects of global trade slowdown on global productivity slowdown

DATA

- Sector-level TFP data from EU KLEMS and World KLEMS
 - 18 countries with up to 18 sectors over the period 1995-2011
 - Australia, Austria, Canada, Czech Republic, Germany, Spain, Finland, France, United Kingdom, Hungary, Ireland, Italy, Japan, Korea, Netherlands, Slovenia, Sweden, United States
 - Including non-manufacturing sectors (i.e., agriculture and service sectors)
- Trade data from WIOD
 - Sector-level import, export, and total output data with destination and source country information

EMPIRICAL STRATEGY

- Baseline specification

$$\ln TFP_{ist} = \beta_1 IMP_{is,t-l} + \beta_2 EXP_{is,t-l} + FE_{is} + FE_{it} + \varepsilon_{ist},$$

where $\ln TFP_{ist}$ denotes log total factor productivity (TFP) in country i and sector s in year t , while $IMP_{is,t-l}$ and $EXP_{is,t-l}$ are the corresponding country-sector-level imports (as a ratio to total domestic output) and exports (as a ratio to total domestic output), both lagged ℓ years.

- Empirical challenges

- Endogeneity
- Omitted variables
- Measurement error

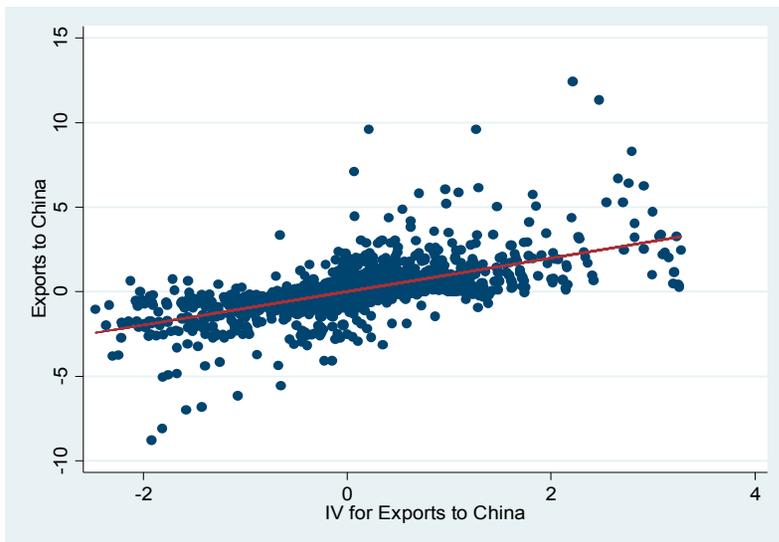
PROPOSED IV APPROACH

- Tweaking the question to China-specific Trade
 - Difficulty in finding valid IVs for import and export
 - E.g., output tariff hardly exogenous due to prevalent industry lobbying
 - Imports from China:
 - Average Chinese import penetration in other countries in the sample as an IV *a la* Autor, Dorn, and Hanson (2013)
 - Exports to China:
 - Average exports to China from other countries in the sample as an IV
- Econometric justification
 - China-specific trade can be regarded as more exogenously driven in recent decades
- Economic justification
 - The rise of protectionism in advanced economies is frequently triggered by concerns on losses from trade with China

FIRST STAGE REGRESSION RESULTS

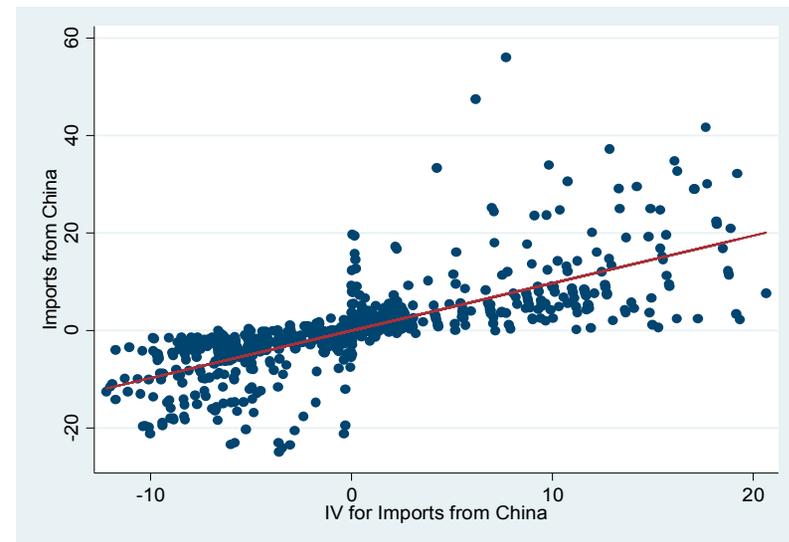
Export

(In deviation from country-sector avg)



Import

(In deviation from country-sector avg)



- Strong relationship in the first stage

OLS vs 2SLS REGRESSION RESULTS

Dependent variable: $[\ln(\text{TFP})_{ist}]$	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
(Imports from China/Total output)*100 $_{ist-1}$	0.006 ** (0.003)		0.005 * (0.003)	0.017 *** (0.006)		0.009 *** (0.003)
(Exports to China/Total outputs)*100 $_{ist-1}$		0.051 *** (0.012)	0.048 *** (0.011)		0.129 *** (0.040)	0.112 *** (0.037)
First stage F-stats				62.4	36.9	32.9; 22.4
First stage p-value				0.00	0.00	0.00; 0.00
Obs	3,543	3,543	3,543	3,543	3,543	3,543

Note: The dependent variable is log total factor productivity (TFP) in country i and sector s in year t . Independent variables are corresponding country-sector-level imports from China (as a ratio to total domestic output) and total exports to China (as a ratio to total domestic output), both lagged one year. The average value of imports from China relative to domestic output in all other countries and the average value of exports to China relative to domestic output in all other countries, both lagged one year, are used as IVs for corresponding variables in columns (4)-(6). Country-sector as well as country-year fixed effects are included in all columns. Robust standard errors clustered at country-sector level are provided in parentheses.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

- Coefficient estimates double in 2SLS

- 1pp increase in imports from (exports to) China relative to total output leads 0.9% (11.2%) increase in TFP

ROBUSTNESS

- Results are robust to:
 - Alternative lags (2, 3, etc.)
 - Post-2001 sample (China's WTO accession in 2001)
 - Non-EU country sample (common demand/supply conditions?)
 - Manufacturing sample
 - Long difference
 - ...etc.

BACK-OF-THE-ENVELOPE CALCULATION

- Since 1995 in our sample, median country-sector experienced
 - 14.7 percent growth in TFP
 - 0.8 pp increase in Chinese import penetration
 - 0.3 pp increase in the share of exports to China
- Given that around 30 percent of exports to China and 70 percent of Chinese import penetration are explained by exogenous factors (*a la* Autor et al, 2013), we may infer that up to **10** percent of TFP growth over the period can be explained by exogenous growth in trade with China
 - $(0.8*0.7)*0.9+(0.3*0.3)*11.2=1.5$ percent growth in TFP

EMPLOYMENT REGRESSION RESULTS

Dependent variable: [ln (EMP) _{ist}]	OLS			2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
(Imports from China/Total output)*100 _{ist-1}	-0.013 *** (0.002)		-0.014 *** (0.002)	-0.020 *** (0.003)		-0.023 *** (0.003)
(Exports to China/Total outputs)*100 _{ist-1}		0.015 * (0.008)	0.023 *** (0.008)		0.004 (0.012)	0.049 *** (0.018)
First stage F-stats				62.4	36.9	32.9; 22.4
First stage p-value				0.00	0.00	0.00; 0.00
Obs	3,543	3,543	3,543	3,543	3,543	3,543

Note: The dependent variable is log total employment in country i and sector s in year t . Independent variables are corresponding country-sector-level imports from China (as a ratio to total domestic output) and total exports to China (as a ratio to total domestic output), both lagged one year. The average value of imports from China relative to domestic output in all other countries and the average value of exports to China relative to domestic output in all other countries, both lagged one year, are used as IVs for corresponding variables in columns (4)-(6). Country-sector as well as country-year fixed effects are included in all columns. Robust standard errors clustered at country-sector level are provided in parentheses.

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

- Adverse impacts on employment from Chinese import penetration
- Positive impacts on employment from exports to China
- Ensuring that losses (losers) are compensated by gains (winners)

SUMMARY AND POLICY IMPLICATIONS

- Revisiting trade and growth
 - Country-sector level data to assess aggregate effects while relying on solid identification strategy
 - Separately identifying import and export channels *vis-a-vis* China
 - 2SLS with a set of IVs
- Productivity gains from trade
 - Significant effects from both channels
 - Possibly enough to compensate potential employment losses from imports