

What Determines Services TFP : Services Trade or Services-Trade Regulation?

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Introduction

- Empirical estimation of:
What are the different types of services trade and services-trade regulation that determine Total Factor Productivity in services?

- Motivation / literature
- Broad “stylized” facts on TFP
- Empirical description
 - Economy-wide cross-sectoral
 - Sector-specific panel estimation
- Open issues for further estimation
- Concluding remarks

Motivation

- **A “perceived” productivity problem in services**
 - Notably personal services (Baumol, 1967; Nordhaus, 2008; Hartwig, 2010)
- **Services (market) driver of overall labor productivity growth (US)**
 - Triplett and Bosworth (2004); Blanchard (2004)
- **TFP essential factor in explaining productivity growth differences across countries**
 - Timmer, Inklaar and Ark (2008)
- **Literature favours factor intensities as explanators for TFP**
 - Aghion, Mehir and Vandenbussche (2006); Triplett and Bosworth (2006)
- **Entry barriers also determinant for services TFP growth**
 - Nicoletti and Scarpetta (2003); Timmer, Inklaar and Ark (2008)

Motivation (bis)

- **Services liberalisation and growth**
 - Eschenbach and Hoekman (2006);
 - Mattoo, Rathindran and Subramanian (2006)

- **Services FDI and manufacturing productivity**
 - Arnold, Javorcik and Mattoo (2007)

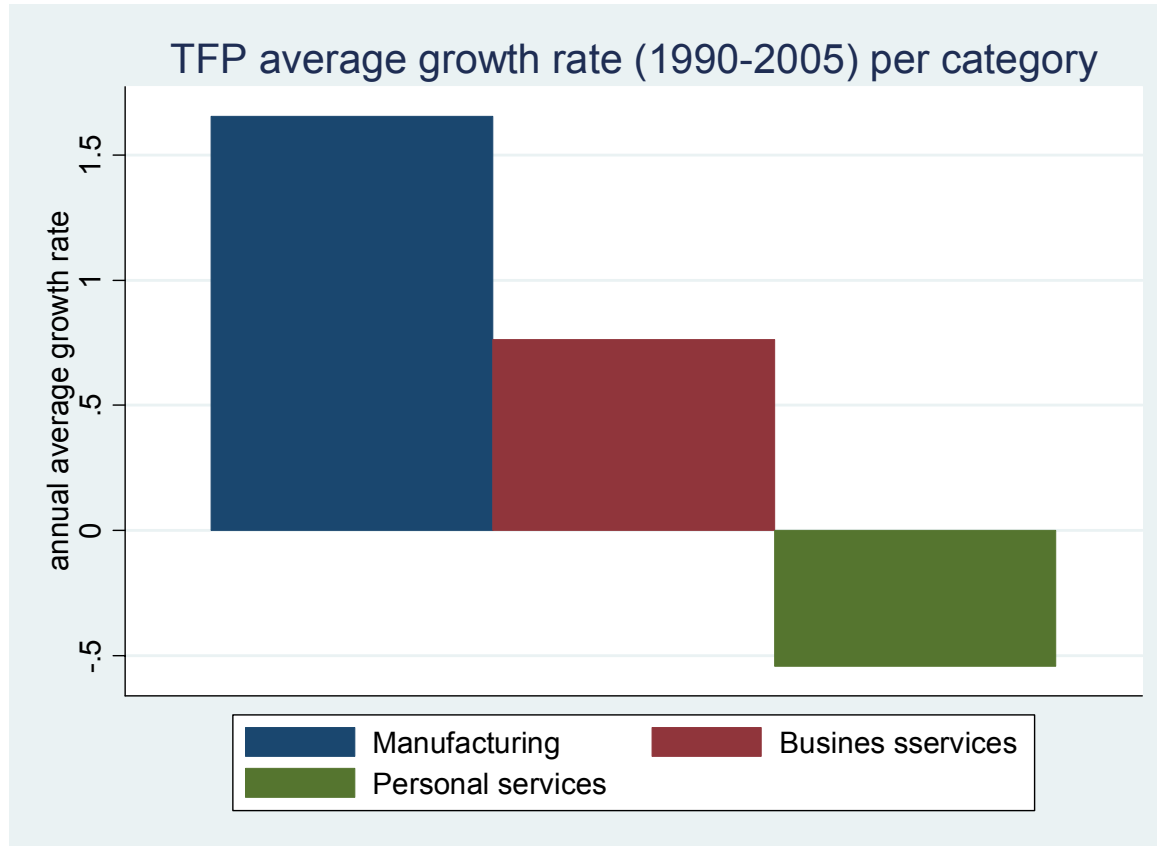
- **Domestic openness: privatization and domestic competition**
 - Fink, Mattoo and Rathindran (2003); Cammins and Rubio-Misas (2006)

- **International trade as a transmitter of efficiency-enhancing ideas, skills and ICT, which then becomes a determinant for services TFP**

- **Skills may be particularly important because of the nature of services stemming from their joint consumption and production, non-storability and organisational delivery**
 - Triplett and Bosworth (2006)

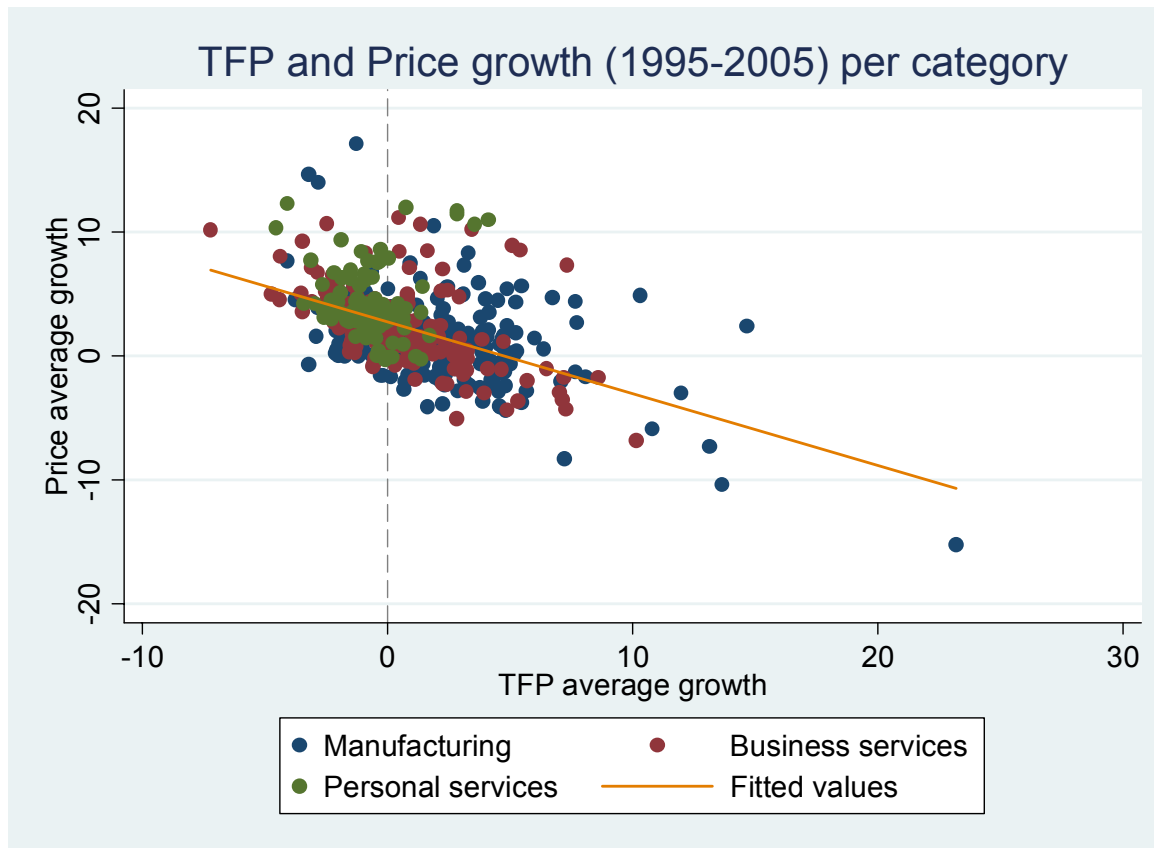
Stylized facts on TFP

Annual Average Growth Rate 1990-2005
of TFP per service category



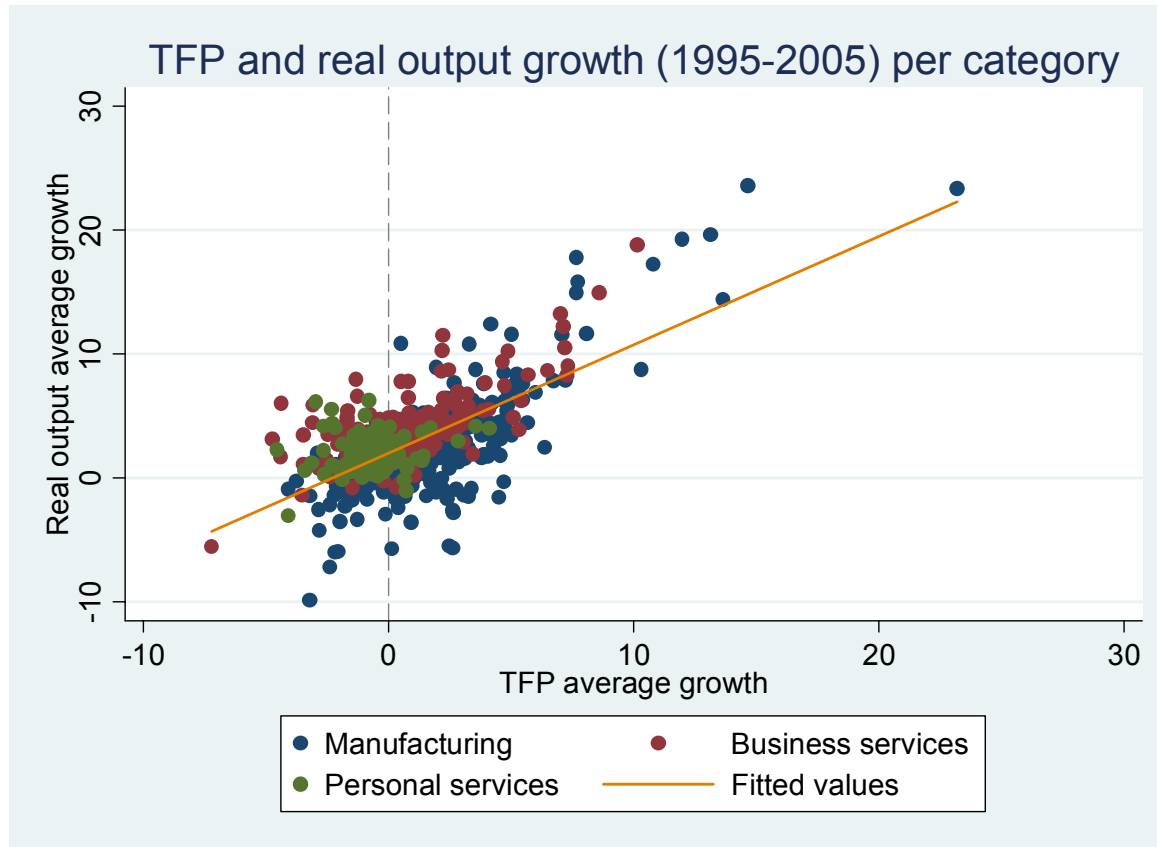
TFP and Prices

Annual Average Growth Rate in Cross-country



TFP and Real output

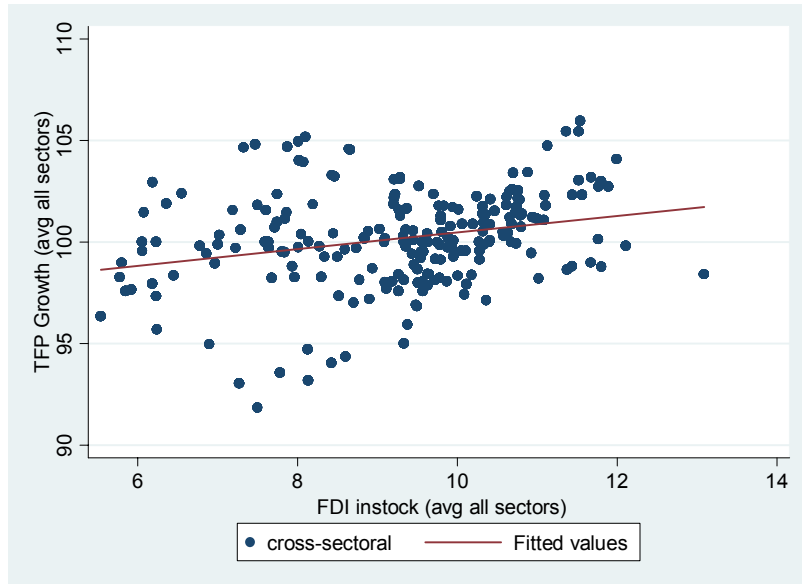
Annual Average Growth Rate in Cross-country



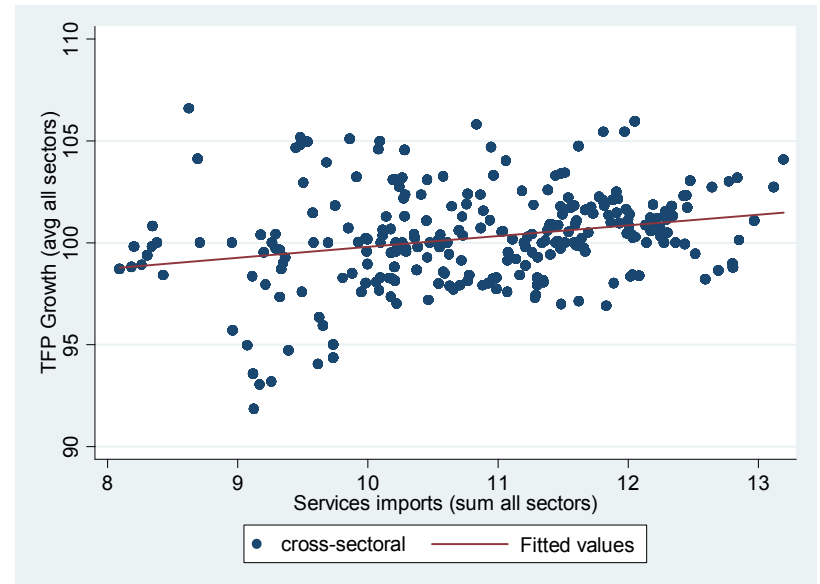
Cross-sectoral Patterns

Average TFP and trade across all services sectors

TFP level and FDI inward stock



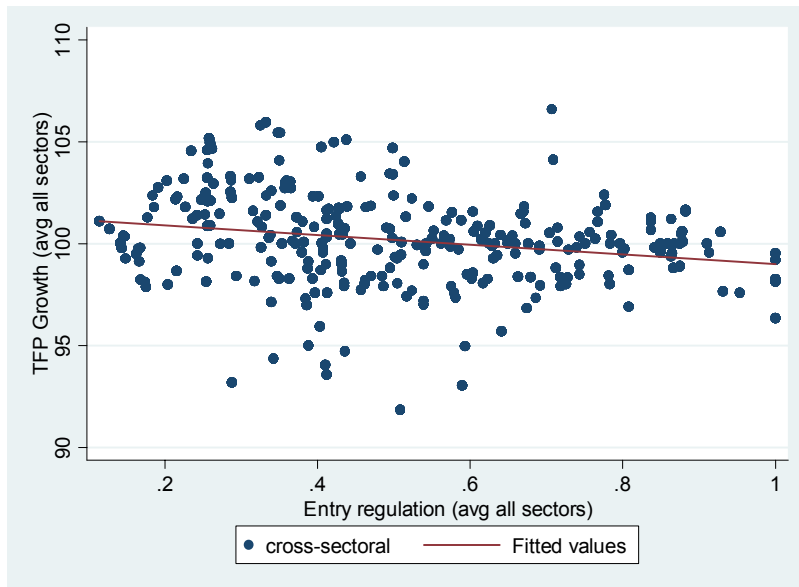
TFP level and Services Trade



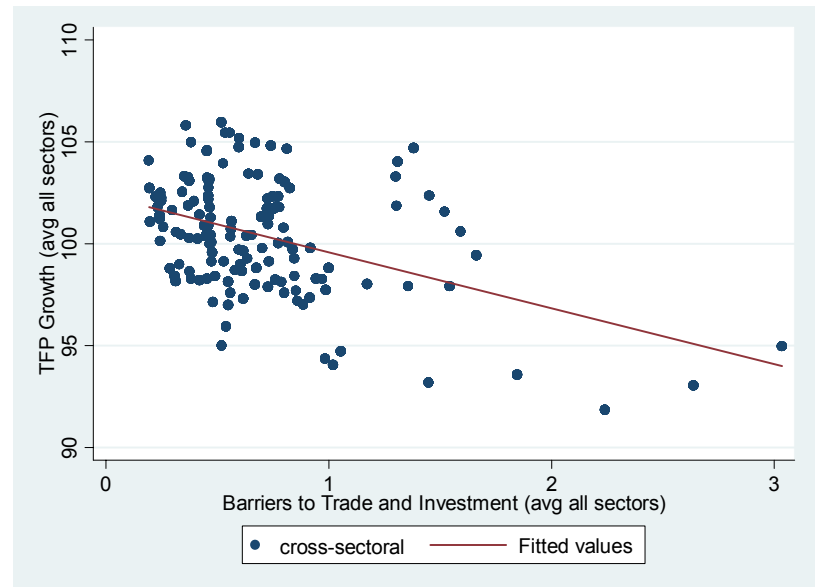
Cross-sectoral Patterns (bis)

Average TFP across all services sectors, economy-wide regulation

TFP level and barriers to trade and inv.



TFP level and product market regulation



Sector-specific Panel Data

Baseline specification

- TFP $ij t = \alpha +$
 - $\beta 1$ Techgap $ij t +$
 - $\beta 2$ High-skill $ij t +$
 - $\beta 3$ High-Skill*Techgap $ij t +$
 - $\beta 4$ ICT-Cap $ij t +$
 - $\beta 5$ ICT-Cap*Techgap $ij t +$
 - $\beta 6$ Trade -2 $ij t +$
 - $\beta 7$ Trade -2*Techgap $ij t +$
 - $\beta 8$ Entreg -2 $ij t +$
 - $\beta 9$ Entreg -2*Techgap $ij t +$
 - $\beta 10$ Conreg -2 $ij t +$
 - $\beta 11$ Conreg -2*Techgap $ij t +$
 - $\beta 12$ FDI Rest -2 $ij t +$
 - $\beta 13$ FDI Rest -2*Techgap $ij t +$

$$\gamma i + \delta j + \theta t + \varepsilon ij t$$

- Regression with country (γi), sector (δj) and year (θt) fixed effects
- Estimations for both the level and growth ($\Delta \ln$)
- Interactions with technology gap relative to the technology frontier
 - o if: - matters more closer to technology frontier
 - o If: + matters more further away from technology frontier
- Technology gap defined as in Timmer, Inklaar and van Ark (2008)

Sector-specific Panel Data

Estimation results for the TFP level and Trade

VARIABLES	1 TFP level	2 TFP level	3 TFP level	4 TFP level	5 TFP level
Technology gap					
FDI inward stock	0.443*** (0.157)				-0.785* (0.440)
Services imports		0.770*** (0.157)			1.750*** (0.516)
FATS sales			0.213 (0.190)		2.206*** (0.569)
FDI inflows				0.126 (0.111)	
Observations	1887	3018	1145	2135	416
R-squared	0.252	0.286	0.382	0.288	0.525

Sector-specific Panel Data

Estimation results for the TFP level and Trade & Regulation

VARIABLES	1 TFP level	2 TFP level	3 TFP level	4 TFP level	5 TFP level
Technology gap					
FDI inward stock	-0.978*** (0.279)				-2.962*** (0.621)
Services imports		-1.293** (0.585)			-3.923* (2.129)
FATS sales			-0.739* (0.400)		0.418 (1.085)
FDI inflows				-0.158 (0.193)	
Entry Barriers	-9.669*** (1.872)	-14.16*** (2.322)	-10.54*** (2.687)	-7.151*** (2.050)	-9.522 (6.219)
Conduct Regulation	-1.168 (2.948)	-5.808** (2.712)	-5.607* (3.071)	-5.552** (2.611)	5.049 (6.307)
FDI Restrictions	-2.543 (2.118)	-8.602** (3.567)	-6.751* (3.911)	-6.180*** (2.274)	13.91* (8.191)
Observations	739	829	612	886	151
R-squared	0.620	0.599	0.544	0.515	0.841

Sector-specific Panel Data

Estimation results for the TFP growth and Trade

VARIABLES	1	2	3	4	5
	TFPgrowth	TFPgrowth	TFPgrowth	TFPgrowth	TFPgrowth
Technolgy gap	0.00999** (0.00416)	0.0104*** (0.00280)	0.00311 (0.00350)	0.00873*** (0.00288)	0.0331*** (0.00978)
FDI inward stock	3.09e-05 (0.000888)				0.000692 (0.00280)
Services imports		1.32e-05 (0.00253)			0.00931** (0.00435)
FATSsales			-0.000156 (0.00188)		0.000675 (0.00275)
FDI inflows				-0.000303 (0.000429)	
Observations	1254	2307	654	1365	252
R-squared	0.141	0.170	0.231	0.138	0.311

Sector-specific Panel Data

Estimation results for the TFP growth, Trade & Regulation

VARIABLES	1 TFPgrowth	2 TFPgrowth	3 TFPgrowth	4 TFPgrowth	5 TFPgrowth
Technology gap	0.00249 (0.00544)	0.0128*** (0.00480)	-0.00144 (0.00488)	0.00704 (0.00574)	-0.0117 (0.0212)
FDI inward stock	-0.000385 (0.00142)				-3.15e-05 (0.00603)
Services imports		-0.00515 (0.00399)			0.00969 (0.0218)
FATSsales			0.00160 (0.00208)		0.0109* (0.00568)
FDI inflows				-0.000223 (0.000582)	
Entry Barriers	0.00268 (0.00634)	-0.00463 (0.00553)	-0.00743 (0.00790)	0.00472 (0.00611)	-0.00459 (0.0167)
Conduct Regulation	0.00200 (0.0126)	-0.00247 (0.0134)	0.00486 (0.0172)	-0.0197 (0.0133)	0.0452 (0.0484)
FDI Restrictions	-0.00465 (0.0110)	-0.0651** (0.0261)	-0.0193 (0.0207)	-0.0215** (0.0101)	-0.00655 (0.0536)
Observations	449	609	335	517	78
R-squared	0.271	0.300	0.312	0.273	0.515

Sector-specific Panel Data

TFP growth, Trade & Regulation and Technology gap

VARIABLES	1	2	3	4	5
	TFP growth	TFP growth	TFP growth	TFP growth	TFP growth
Type of services Trade	FDI Stock	Imports	FATS	FDI flow	All*
Technology gap	0.00713 (0.00639)	0.0105 (0.00747)	-0.000436 (0.00554)	0.0143** (0.00674)	0.00442 (0.0313)
Entry barriers	-0.00586 (0.0253)	-0.0218 (0.0155)	0.00613 (0.0224)	0.00185 (0.0170)	0.0824 (0.0884)
Entry barriers* Tech gap	0.0173 (0.0274)	0.0177 (0.0142)	-0.0125 (0.0207)	0.00420 (0.0174)	-0.0859 (0.0962)
Conduct regulation	-0.139*** (0.0472)	-0.0285 (0.0387)	-0.124* (0.0747)	-0.0984** (0.0439)	-0.175 (0.256)
Conduct regulation* Tech gap	0.170*** (0.0534)	0.0284 (0.0419)	0.139* (0.0803)	0.0861* (0.0496)	0.208 (0.236)
FDI restrictions	0.0505* (0.0285)	-0.0161 (0.0435)	0.0335 (0.0502)	-0.00550 (0.0336)	0.0985 (0.112)
FDI restrictions* Tech gap	-0.0744** (0.0313)	-0.0461 (0.0340)	-0.0701 (0.0618)	-0.0147 (0.0336)	-0.158 (0.158)
Observations	449	609	335	517	78
R-squared	0.300	0.322	0.329	0.293	0.543

Sector-specific Panel Data

TFP growth, Trade & Regulation, Technology gap & High-skilled

VARIABLES	1	2	3	4	5
	TFP growth	TFP growth	TFP growth	TFP growth	TFP growth
Type of services Trade	FDI Stock	Imports	FATS	FDI flow	All*
Entry barriers	-0.00679 (0.0284)	-0.0233 (0.0171)	0.0433* (0.0262)	0.00254 (0.0165)	0.0557 (0.103)
Entry barriers* Tech gap	0.0165 (0.0324)	0.0201 (0.0144)	-0.0394* (0.0218)	0.00575 (0.0175)	-0.0549 (0.111)
Entry barriers* High-skilled labor	0.0255 (0.0434)	0.00836 (0.0434)	-0.117** (0.0465)	-0.0125 (0.0219)	-0.197 (0.268)
Conduct regulation	-0.136*** (0.0457)	-0.0212 (0.0400)	-0.147* (0.0782)	-0.0990** (0.0441)	0.0114 (0.209)
Conduct regulation* Tech gap	0.171*** (0.0520)	0.0217 (0.0425)	0.159* (0.0824)	0.0868* (0.0501)	0.0272 (0.190)
Conduct reg.* High-skilled labor	-0.0436 (0.0944)	-0.205 (0.151)	-0.0600 (0.123)	0.000972 (0.116)	-0.673 (0.619)
FDI restrictions	0.0621** (0.0280)	-0.00863 (0.0421)	0.0416 (0.0477)	-0.00477 (0.0339)	0.0794 (0.119)
FDI restrictions* Tech gap	-0.0831*** (0.0302)	-0.0460 (0.0356)	-0.0589 (0.0610)	-0.0139 (0.0339)	-0.0636 (0.149)
FDI restrictions* High-skilled labor	-0.157*** (0.0594)	-0.181 (0.187)	-0.526*** (0.162)	-0.0242 (0.0680)	-1.585*** (0.508)
Observations	449	609	335	517	78
R-squared	0.306	0.331	0.370	0.295	0.632

Sector-specific Panel Data (business)

TFP growth, Trade & Regulation, Technology gap & High-skilled

VARIABLES	1	2	3	4	5
	TFPgrowth	TFPgrowth	TFPgrowth	TFPgrowth	TFPgrowth
Type of services Trade	FDI Stock	Imports	FATS	FDI flow	All*
Entry barriers	-0.00674 (0.0294)	-0.0230 (0.0171)	0.0409 (0.0274)	0.00774 (0.0172)	0.0695 (0.104)
Entry barriers* Tech gap	0.0186 (0.0335)	0.0200 (0.0144)	-0.0352 (0.0226)	0.00204 (0.0187)	-0.0643 (0.112)
Entry barriers* High-skilled labor	0.00474 (0.0446)	0.00709 (0.0434)	-0.0962* (0.0502)	-0.0156 (0.0234)	-0.192 (0.270)
Conduct regulation	-0.140*** (0.0524)	-0.0215 (0.0399)	-0.134* (0.0758)	-0.106** (0.0493)	-0.0185 (0.216)
Conduct regulation* Tech gap	0.167*** (0.0565)	0.0219 (0.0424)	0.129 (0.0786)	0.0909* (0.0544)	0.0446 (0.195)
Conduct reg.* High-skilled labor	0.00907 (0.102)	-0.206 (0.151)	0.00833 (0.140)	-0.0143 (0.128)	-0.584 (0.638)
FDI restrictions	0.0640* (0.0329)	-0.00951 (0.0420)	0.0292 (0.0566)	0.00514 (0.0386)	0.0941 (0.122)
FDI restrictions* Tech gap	-0.0771** (0.0343)	-0.0454 (0.0354)	-0.0254 (0.0707)	-0.0238 (0.0375)	-0.0863 (0.155)
FDI restrictions* High-skilled labor	-0.129* (0.0663)	-0.174 (0.187)	-0.520*** (0.175)	-0.00755 (0.0747)	-1.456** (0.545)
Observations	333	602	258	389	73
R-squared	0.265	0.328	0.348	0.276	0.643

Sector-specific Panel Data

TFP growth, Trade & Regulation using GMM estimator

VARIABLES	1	2	3	4	5
	TFPgrowth	TFPgrowth	TFPgrowth	TFPgrowth	TFPgrowth
Technology gap	0.0139*** (0.00521)	0.0428*** (0.00879)	0.0310* (0.0170)	0.0314** (0.0153)	0.0343 (0.0340)
FDI inward stock	-0.000763 (0.00252)				-0.00176 (0.0189)
Services imports		0.00741 (0.00456)			0.0426 (0.151)
FATSsales			0.00388 (0.0123)		-0.000114 (0.00926)
FDI inflows				-0.000886 (0.00649)	2.95e-05 (0.00656)
Entry Barriers	-0.0103* (0.00542)	-0.0136** (0.00651)	-0.0116* (0.00685)	-0.0191** (0.00748)	-0.0170 (0.0677)
Conduct Regulation	-0.0166 (0.0150)	-0.0218 (0.0188)	-0.00431 (0.0600)	-0.0112 (0.0249)	0.0228 (0.135)
FDI Restrictions	-0.0200** (0.00889)	-0.0318 (0.0219)	-0.0344 (0.0399)	-0.0124 (0.0143)	-0.0697 (0.134)
Observations	594	722	473	621	75
Number of cntrysctr	84	72	113	117	27

Further Estimation Issues

- TFP based on growth accounting method
 - Endogeneity in high-skilled and ICT investments?
 - Regress trade directly in the production function rather than TFP growth?
 - Business services (\neq materials) part of intermediate input use?
- Trade endogeneity problem partly resolved
- Stricter form of fixed effect
 - Importer \times sector fixed effects leaves little room for variation
- First GMM estimation reasonably well
 - How to treat interaction variables in GMM
- Splitting services sectors
 - Limitations on quantity of observations

Conclusions

- **Trade determines TFP level, inhibited by regulation**
- **Trade does not determines TFP growth, regulation does**
- **The type of regulation matters for which type of trade**
 - **Entry (imports), conduct (FDI, FATS), FDI restrictions (FDI, imports)**
- **Entry and conduct impact for industries lying further behind relative to the technology frontier**
- **FDI regulation matters at the technology frontier!**
- **FDI regulation matters relative more in combination with high-skilled labor**
- **FATS statistics performs reasonably well**
- **Any predictions for high-skilled intensive personal services?**

Thank you for your attention

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