

Regulations and technology diffusion in Europe: The role of business dynamics

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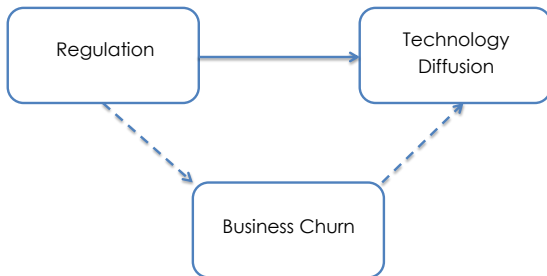
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25 September 2019

“Market competition and business churning (i.e. the rate of entry and exit of firms)—which are affected by country-specific framework conditions—influence the incentives and costs for firms to invest in new technology or adapt existing technologies.”

(ECB, 2018)



- ▶ Direct and indirect effects of regulatory frameworks
- ▶ New measure of technology diffusion

Outline of the presentation

- 1 Background
- 2 Our measure of technology diffusion
- 3 Data
- 4 Empirical model
- 5 Main results and limitations

- ▶ Labour flexibility ↓ firms incentives to invest in human capital formation
- ▶ Product market regulation may stimulate innovation in sectors lacking technology (e.g. green/sustainable technologies)

(Lucidi 2012, Égert 2016)



- ▶ Strict product market regulations discourage competition and investment
- ▶ Financial constraints and difficult access to capital slow down catch-up process
- ▶ Labour market rigidities slow down labour reallocation

(Scarpetta & Tressel 2002, 2004, Crafts 2006, Mc Gowan & Andrews 2015, Thum-Thysen et al. 2017)

Many ways to measure technology diffusion (Keller 2004)

- ▶ Market transactions (**trade**)
 - use of technology embodied in intermediate goods (Rivera-Batiz & Romer 1991, GH 1991, Eaton & Kortum 2002)

- ▶ Externalities (**R&D spillovers**)
 - R&D and TFP (Coe & Helpman 1995)
 - Patent citations (Jaffe et al. 1993)
 - FDI flows (Lichtenberg and van Pottelsberghe 1998)

- ▶ Catch-up (**distance to frontier**)
 - Disembodied technology flows from leader to follower at a rate proportional to level of human capital (Nelson-Phelps 1966, Benhabib & Spiegel 2005)

Our methodology to measure technology diffusion

$$TT_{ijt} = \sum_j w_{jkt} [\ln(TFP_{ikt}) - \ln(\overline{TFP}_{jt})]$$

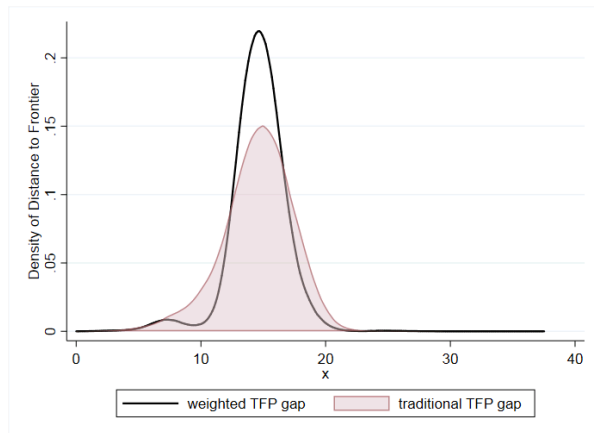
where \overline{TFP}_{jt} is the TFP of the frontier firm in sector j

$$w_{jkt} = \frac{Z_{jkt}}{\sum_j Z_{jkt}} \quad \text{and} \quad \sum_j w_{jkt} = 1,$$

where w_{jkt} measures the global intermediate use by sector k of products Z of sector j (of the leader firm) at time t

Traditional DTF + all the other DTFs that are trade-related to firms in sectors that import products of the frontier's sector

$$TT_{ijt} = w_{jtt} [\ln(TFP_{ijt}) - \ln(\overline{TFP}_{jt})] + \sum_{j \neq k} w_{jkt} [\ln(TFP_{ikt}) - \ln(\overline{TFP}_{jt})]$$



Data

- TFP calculated as $\frac{Y}{L^\alpha K^{1-\alpha}}$ with firm-level data from Orbis for 18 EU countries (2007–2017)
- Labour and capital markets flexibility calculated as principal component-based weighted indices from country-level data (WEF)
- Product market regulation is OECD 2013 REGIMPACT sector-level indicator
- Business churn calculated with sector-level entry/exit data from SBS-Eurostat
- Human capital is growth rate of people with tertiary education at the sector-level (HRST, Eurostat)
- Intermediate inputs trade at sector level from WIOD

- ▶ Mediated regression analysis (Preacher & Hayes 2008)

$$TT_{it} = \beta_0 + \beta_1 TT_{it-1} + \beta_2 Churn_{jt-1} + \beta_R^* Reg_{jct-1} + \beta_4 HC + e_{it}$$

$$Churn_{jt} = \beta_R Reg_{jct-1} + u_{jt}$$

- ▶ Moderation regression analysis (low-churn VS high-churn)

- $Reg = (LabFlex, CapFlex, ProdMarkReg)'$ are labour, capital and product market regulation
- HC is the growth rate of human capital
- sector, year, country dummies in each equation

$\beta_R \beta_2$ is the **indirect effect** of regulations on technology diffusion

$\beta_R^* + \beta_R \beta_2$ is the **total effect**

Aim&Motivation	Background ○○	Technology diffusion ○○	Data	Empirical model	Main results	Limitations
Dep.var. TT_{it}	3SLS Mediated model	2SLS	GLS Churn: Low	GLS Churn: High	GLS	
TT_{it-1}	0.713*** (0.001)	0.688*** (0.001)	0.564*** (0.002)	0.642*** (0.002)	0.585*** (0.001)	
LabFlex Index	-0.033*** (0.001)	-0.041*** (0.002)	-0.041*** (0.002)	0.010*** (0.002)	0.010*** (0.001)	
Prod Mark Reg	-0.157*** (0.023)	0.907*** (0.059)	2.700*** (0.124)	-1.153*** (0.060)	-0.160*** (0.054)	
CapFlex Index	0.109*** (0.001)	0.203*** (0.001)	0.131*** (0.002)	0.217*** (0.002)	0.180*** (0.001)	
Churn	0.139*** (0.002)	0.290*** (0.034)			0.484*** (0.033)	
HC growth	0.009*** (0.001)	0.011** (0.001)	0.053*** (0.001)	0.011*** (0.001)	0.014*** (0.001)	
<i>Indirect effects</i>						
LabFlex Index	0.001*** (0.000)					
Prod Mark Reg	-0.001*** (0.000)					
CapFlex Index	-0.001*** (0.000)					
N	3,260,637	3,345,298	1,952,775	1,171,121	3,350,416	
R-sq	0.57/0.93	0.44	0.58	0.63	0.57	

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- ▶ Moderating > mediating role
 - firms in high-churn sectors catch up faster
 - HC growth has a larger impact on tech diffusion in low-churn sectors
 - more labour market regulation favourable for low-churn sectors (Lucidi 2012, Égert 2016)
 - more product market regulation hinders the tech diffusion process of firms in high-churn sectors (Andrews et al. 2015)

- ▶ One-size-fits-all regulatory model does not lead to broader technology diffusion

- ▶ Under-representation of firms with less than 20 employees (more subject to entry/exit)
- ▶ Better measures of TFP
- ▶ No national frontiers
- ▶ No additional control of market structure (concentration, fwd/bck linkages, capital intensity)

Thank you!
Questions?