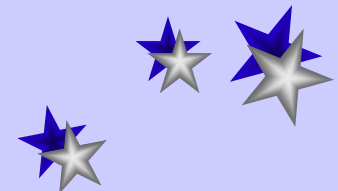




The EU-US Total Factor Productivity Gap - An Industry Perspective -

K. Mc Morrow, W. Röger & A. Turrini

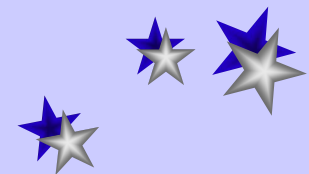
ECFIN's Annual Research Conference
(October 2008)





1. Basic motivation for paper

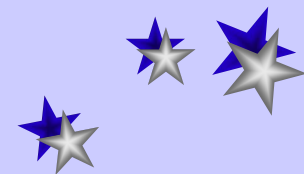
1. To understand what is driving EU-US GDP growth differentials & to exploit EU KLEMS in answering this fundamental question
2. Paper uses the EU KLEMS growth accounting approach :
 - Firstly, to highlight TFP as the key driver of the EU-US GDP gap
 - Secondly, to highlight the role played by a small number of industries in driving the Total Factor Productivity (TFP) gap
3. Paper uses an innovation-imitation model
 - to analyse the role of traditional TFP determinants (R&D, ICT, Human Capital & Regulations) in driving TFP growth &
 - to analyse the specific TFP determinants of the key lagging / leading industries





2. Introductory Remarks

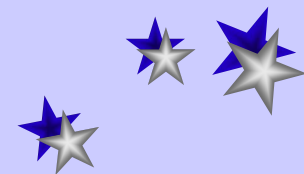
- **EU-US TFP Differences**
 - Builds on earlier work
 - Structural component of productivity
- **EU KLEMS**
 - Identify most potent policy measures for narrowing the existing EU-US TFP gaps
- **Growth Accounting + Panel Regressions**
 - Sources of industry level TFP divergences
 - Statistical support for major TFP hypotheses
- **Caution is needed regarding policy conclusions**
 - TFP is a residual measure





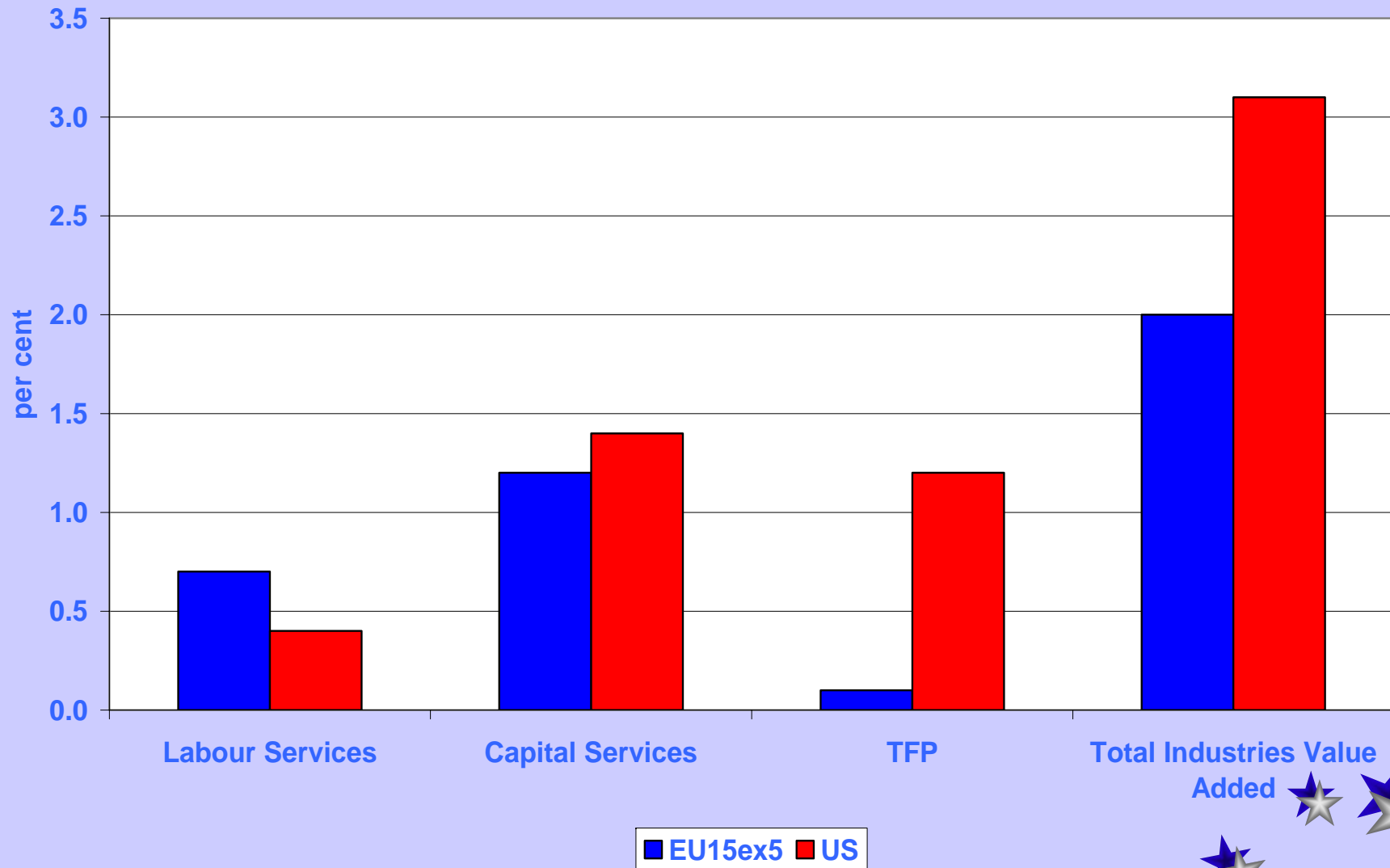
3 : Why is EU KLEMS so important ?

- **Importance of EU KLEMS**
 - Industry level investment series
 - 7 different types of capital (ICT, Non-ICT Capital)
 - Widely different marginal productivities
 - Industry level labour breakdown by skills
 - High, medium & low skilled workers
- **EU KLEMS growth accounting methodology**
 - Labour services, capital services, TFP
 - Data for 10 of the « old » EU15 countries





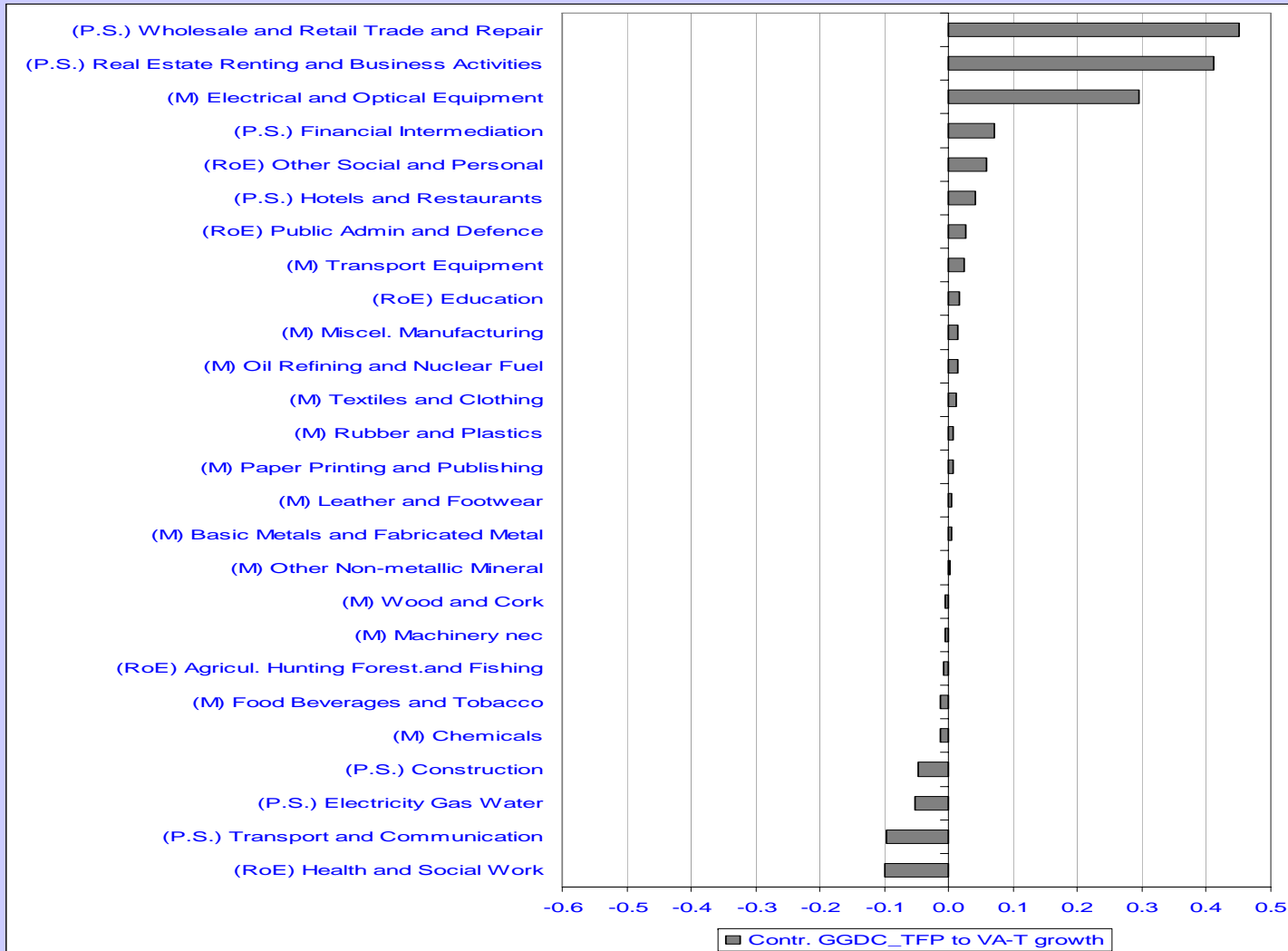
TFP drives EU-US growth differences (1996-2004)





Small number of industries driving EU-US TFP gap

Industry contributions to EU-US TFP gap : 1996-2004
(US industry TFP contributions minus equivalent EU contributions)

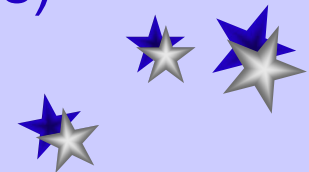




4. Understanding the determinants of TFP growth (Panel Regressions)

4.1 : Conceptual Framework

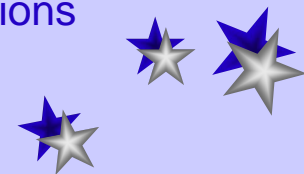
- « Traditional » growth theory: TFP as a residual
- “AK” endogenous growth models
 - Promote savings & investment
 - Inconsistent with recent stylised facts
- Innovation-Imitation models (e.g., Aghion & Howitt – 2006 JEEA)
 - Innovation
 - Institutions & policies (Framework conditions)





4.2 : Overview of relevant existing literature

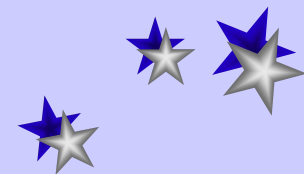
- **TFP determinants in an innovation-imitation model**
- **Basic model**
 - Key explanatory variables
 - Technology gap
 - TFP growth rate at frontier
 - Framework Conditions
 - Direct impact
 - Indirect impact (Interaction with technology gap or with spillovers from TFP growth at frontier)
- **Important studies**
 - Nicoletti & Scarpetta (2003) – Entry liberalisation + privatisation
 - Aghion, Bloom, Blundell, Griffith & Howitt (2003) – Product market competition
 - Vandenbussche, Aghion & Méghir (2005) – High skilled human capital
 - Griffith, Redding & Van Reenen (2004) – R&D
 - Inklaar, Timmer & Van Ark (2008) – ICT, Human Capital, Regulations





4.3 Research strategy

- **Differences with Inklaar, Timmer & Van Ark (2008)**
 - Not just market services (all sectors of the economy are included)
 - Industry specific TFP models for Electrical & Optical Equipment; Wholesale & Retail Trade; and Utilities
 - Relaxation of fixed effects assumption (important in assessing the TFP effects of a number of traditional TFP drivers)
- **Sample**
 - 9 EU countries + US (1980-2004)
 - 26 Industries
- **Panel regressions : Similar approach to that found in existing analyses**
- **Baseline specification + Framework conditions**



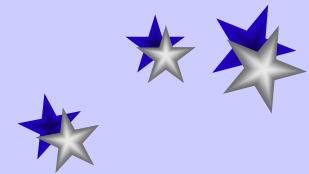


4.4 Regression specification

$$\begin{aligned} \hat{TFP}_{i,j,t} = & \alpha + \beta \hat{TFP}_{i,j,t}(\text{frontier}) + \beta_2 [(\log(TFP_{i,j,t-1})) - \log(TFP_{leader,j,t-1})] + \\ & + \sum_{k \in K} \gamma_k X_{i,j,t}^k + \sum_{k \in K} \sum_{h \in H} \delta_{k,h} X_{i,j,t}^k Y_{i,j,t}^h + \mu_1 D_i + \mu_2 D_j + \mu_3 D_t + \varepsilon_{i,j,t} \end{aligned}$$

$i = \text{country}, j = \text{sector}, t = \text{year}$

$$Y^h = \{ \hat{TFP}_{i,j,t}(\text{frontier}), [(\log(TFP_{i,j,t-1})) - \log(TFP_{leader,j,t-1})] \}$$



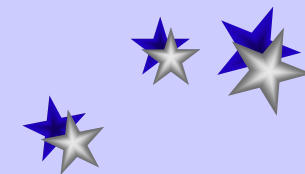


5. Regression Results

5.1 Baseline Specification

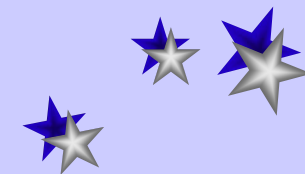
Baseline specification : All Industries

	All industries and years	All industries ("ex-ante" TFP)	All industries ("raw" TFP)
TFP growth at the frontier	0.159** (2.98)	0.113** (2.61)	0.060 (0.54)
Technological gap	-0.046*** (4.48)	-0.038*** (5.12)	-0.036*** (-4.96)
N. obs.	6619	6059	6677
R ²	0.13	0.12	0.10



**Baseline specification : Sectoral analysis**

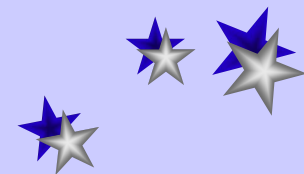
	Only manufacturing sector	Only market services sector	Only ICT-related sector
TFP growth at the frontier	0.164** (2.38)	0.135** (3.39)	0.138*** (4.70)
Technological gap	-0.060*** (3.81)	-0.029*** (4.14)	-0.027*** (4.85)
N. obs.	3058	2133	2371
R²	0.16	0.10	0.50



**Baseline specification : Only years after 1995**

TFP growth at the frontier	0.158*
	(2.08)
Technological gap	-0.046
	(1.20)

N. obs.	2796
R ²	0.12

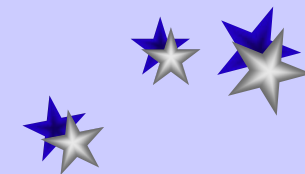




5.2.1 : Role of human capital, ICT capital and R&D

Role of human capital, ICT capital, and R&D : Direct Effects

	All industries	All industries	All industries	All industries ("raw" TFP)
	(1)	(2)	(3)	(4)
Human capital	-0.003 (-0.65)	0.004 (1.08)	0.002 (0.50)	0.007*** (3.92)
R&D flows	0.002 (0.67)	0.004 (1.25)	0.004*** (4.98)	0.006** (2.23)
ICT/ non ICT real capital stock ratio	0.002 (0.74)	-0.000 (0.21)	0.006*** (3.70)	0.000 (0.20)
Country fixed effects	Yes	No	Yes	No
Industry fixed effects	Yes	Yes	No	Yes
Year fixed effects	Yes	Yes	Yes	Yes

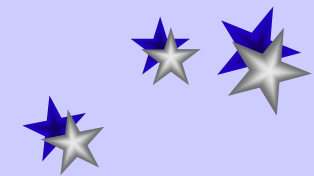




Role of human capital : Indirect effects

Only market services sector

Interaction TFP growth at the frontier with human capital	0.189*** (5.59)
Interaction technological gap with human capital	0.011 (1.38)
Country fixed effects	Yes
Industry fixed effects	Yes
Year fixed effects	Yes

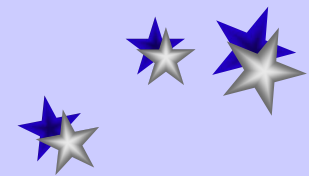




5.2.2 : Role of Regulations

Role of regulations (Direct Effects)

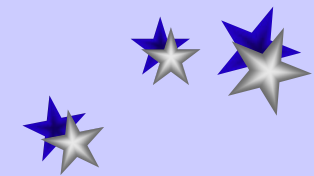
	All Industries	Only market services sector
Product market regulation	-0.002 (0.96)	-0.008 (1.65)
Labour market regulation	0.008 (1.45)	0.002 (0.36)
Financial market regulation	0.005 (1.31)	0.009 (1.73)





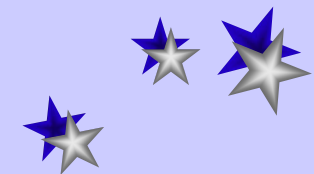
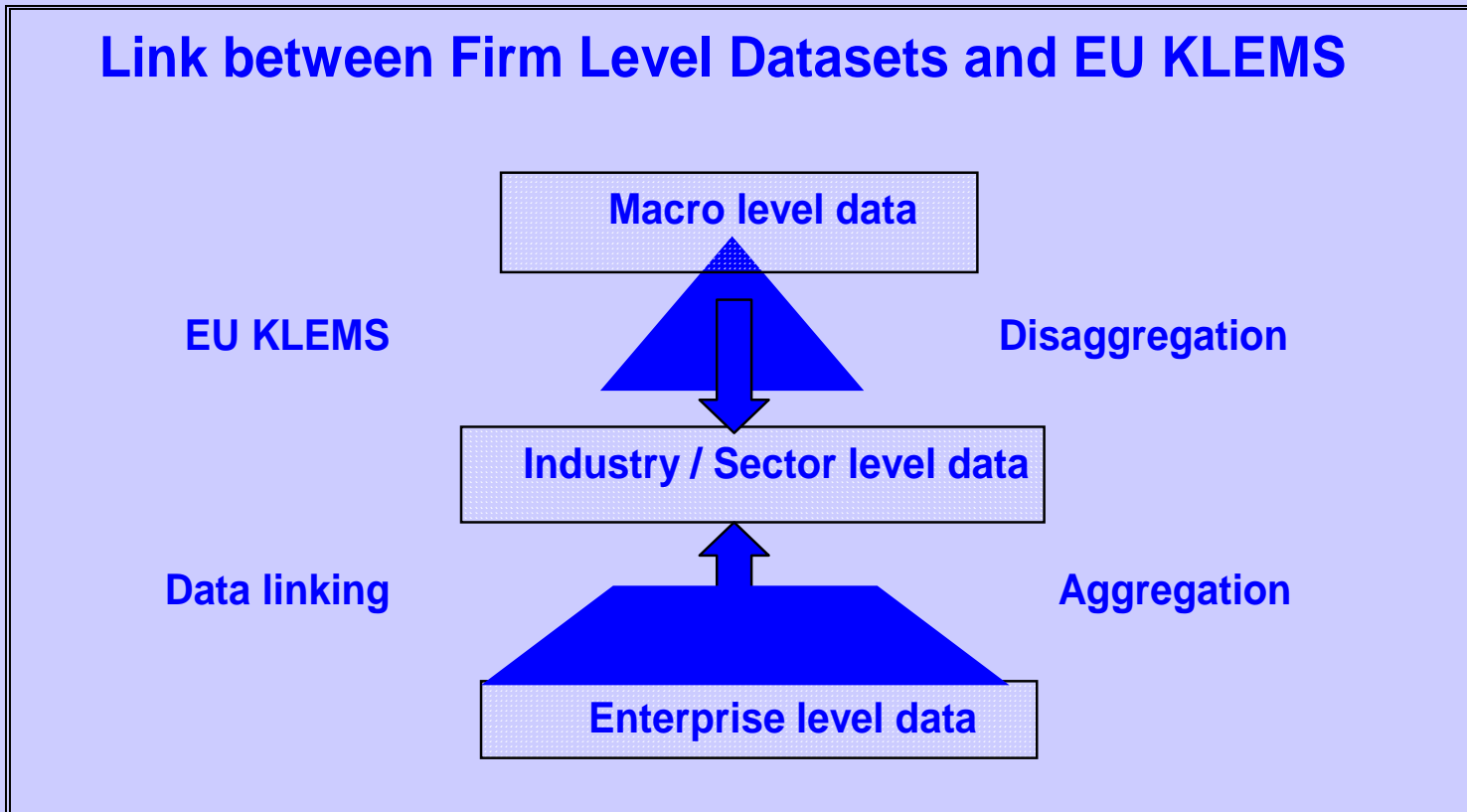
Role of regulations : Indirect effects

	Only market services sector
Interaction TFP growth at the frontier with product market regulation	-0.005 (0.23)
Interaction technological gap with product market regulation	-0.013* (2.07)





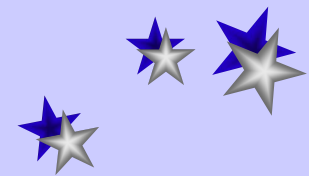
Firm Level Datasets (Augmented EU KLEMS Databank)





5.3 : Industry-specific results

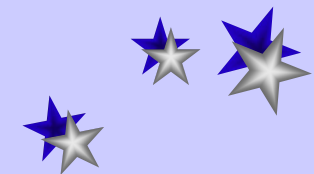
- **Earlier results driven by use of broad sectoral aggregates**
- **Need to adapt empirical model of TFP determinants to the specificities of different industries**
- **3 Industries**
 - Optical & electrical equipment
 - Wholesale & retail trade
 - Utilities





Industry-specific models – Electrical & Optical Equipment
(ICT producing manufacturing)

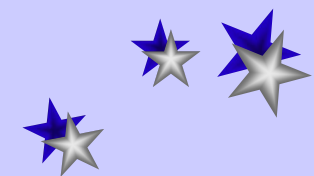
	Only ICT producing manufacturing	Only remaining industries
TFP growth at the frontier	0.007 (0.05)	0.168** (2.34)
Technological gap	0.010 (0.67)	-0.082** (3.28)
Interaction TFP growth at the frontier with R&D	0.130*** (3.50)	0.016 (0.38)
N. obs.	141	2497
R ²	0.56	0.18





Industry-specific models : Retail & affiliated industries

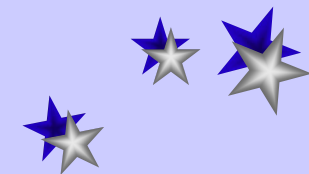
	Only retail and affiliated industries	Only remaining industries
TFP growth at the frontier	0.152** (2.61)	0.194** (2.37)
Technological gap	-0.034*** (4.26)	-0.0544*** (4.03)
Relative contribution of private consumption to GDP growth	0.004*** (5.08)	0.001 (1.80)
N. obs.	836	5030
R ²	0.17	0.14





Industry-specific models : Utilities

	Only utilities	Only remaining industries
	(5)	(6)
TFP growth at the frontier	0.086 (0.47)	0.190*** (4.08)
Technological gap	-0.022 (0.84)	-0.048*** (4.92)
Product market regulation	-0.010* (2.00)	0.004 (0.063)
Interaction TFP growth at the frontier with product market regulation	0.032 (0.33)	0.043 (1.32)
Interaction technological gap with product market regulation	-0.115 (1.06)	0.005 (0.90)
N. obs.	684	5656
R ²	0.22	0.13





6. Concluding Remarks

- **Combination of growth accounting & panel regression analysis**
- **Focus on TFP drivers at frontier rather than catching-up effects**
- **Need for caution**
- **Strong support for Innovation-Imitation Model**
- **Traditional TFP drivers**
 - R&D and ICT (Taking the industry dimension into account is crucial in directly linking these variables to TFP growth)
 - Human capital (Indirect role)
 - Regulations (Market services – most notably utilities)
- **Industry specific models (Digging deeper)**
 - Electrical & optical equipment (R&D)
 - Retail & wholesale trade (Cyclical effects + Scale Economies)
 - Utilities (product market regulations)
- **Results are consistent with Inklaar, Timmer & Van Ark and extend their analysis in a number of directions**
 - Policy significance of EU KLEMS and « Augmented » EU KLEMS datasets

