Market imperfections, skills and total factor productivity: Firm-level evidence on Belgium and the Netherlands

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NBB Conference on Total Factor Productivity :

Measurement, determinants and effects

Brussels - October 17, 2014

Outline

Outline (1)

Outline (2)

Introduction

Motivation (1)

The Single Market Program and the Lisbon Strategy were based on the premise that costs, prices and mark-ups would fall and that **more competition would foster productivity** (Cecchini *et al.*, 1988)

Over the past decade, there has been a growing interest in the **role of institutions in explaining different patterns of productivity growth** across countries and industries (Scarpetta &Tressel, 2004; Storm & Naastepad, 2007; Bas & Causa, 2013)

By **affecting the degree of competition in product and labor markets** and/or affecting the allocation of resources, policy institutions might greatly influence the productivity of an economic entity

Motivation (2)

French economist **Jean Tirole** 2014 Winner of the **Nobel Prize in Economics** for **research on market power and regulation**

- He applied the tools of game theory and the theory of mechanism design to the major issues of imperfect competition, regulation and competition policy
- He showed that the best regulation or competition policy should be carefully adapted to every industry's specific conditions

Research approach (3)

This paper examines the joint effect of market power in the output and the labor market on firms' TFP growth within a modified production function framework

<u>Part 1</u> : Identifying and quantifying product and labor market imperfections

- Using econometric production functions as a tool for testing the type and the degree of imperfection using firm-level data
- Focusing on both *cross-country* (BE vs. NL) and *cross-industry* (19 ind. in Manufacturing, 11 ind. in Services) differences
- Distinguish 6 regimes of competitiveness : $R \in \Re = \{PC\text{-}PR, IC\text{-}PR, PC\text{-}EB, IC\text{-}EB, PC\text{-}MO, IC\text{-}MO\}$:
  - 2 product market settings (*PC* and *IC*) and
  - 3 labor market settings (*PR*, *EB* and *MO*)

Research approach (4)

This paper examines the joint effect of market power in the output and the labor market on firms' TFP growth within a modified production function framework (ctd)

<u>Part 2</u> : Revisiting the potential relationship between the type and the degree of product and labor market imperfections and firms' TFP growth

- Measuring *TFP* as the residual of a *SYS-GMM* estimation of industry-specific standard Cobb-Douglas production functions
- Exploiting variation in the prevalence of regimes characterizing the type of competition prevailing in product and labor markets in each country
- Evaluating how *TFP* distributional characteristics vary across countries and regimes, taking into account skill heterogeneity

Research questions - Part 1 (5)

- Do we observe large cross-country variation in the prevalence of *regimes* characterizing the type of competition prevailing in product and labor markets?
- Are the revealed regimes compatible with institutional differences in terms of product market environment and the industrial relations system in the two countries?
- Do we uncover important cross-country differences in the *composition of industries* making up the regimes ?
- Do we observe heterogeneity in the *degree* of industry-specific product and labor market imperfections within regimes?

Aim : Evaluating how actual product and labor markets deviate from their perfectly competitive or economically efficient counterparts in a comparative setting

Research questions - Part 2 (6)

- Does our analysis reveal any *pattern in the moments of regime-specific TFP distributions*?
- Which role do skill heterogeneity and the compositional variation within regimes play in shaping *TFP* distributions?
- Do we discern a *link between the degree of market imperfections* and *TFP distributional characteristics*?

Aim : Examining the potential relationship between the type & degree of product and labor market imperfections and firm-level TFP growth

Policy relevance (7)

From a policy perspective, our study contributes to an understanding of the institutional context of TFP growth

- By consistently analyzing the indirect impact of the Single Market Program and the Lisbon Strategy on *TFP* growth, we investigate whether increasing flexibility is conducive to *TFP* growth
- Examining a novel indirect channel through which human capital might influence firm-level *TFP* growth

Contribution (8)

This paper makes contact with two strands of the literature

- Econometric literature on estimating simultaneously market imperfections in product and labor markets
- Recent literature on the impact of misallocation of resources

Threefold contribution

- Focusing on both Manufacturing and Services
- Revisiting the relationship between competition and *TFP* growth
- Performing a detailed cross-country industry comparison within a microeconometric framework

Preview of main findings (9)

The **prevalent product and labor market settings** and hence regimes are **to some extent comparable** in *BE* and *NL*

- proportion of industries that is characterized by *IC* in the product market amounts to more than 90% in *BE* & *NL*
- dominant regime : *IC-EB* in *BE* & *NL*
- most pronounced difference : higher prevalence of *MO* and lower prevalence of *PR* in *BE*

Preview of main findings (10)

We observe **cross-country differences in the composition of industries making up the regimes**

We find **cross-country variation in the levels of product and labor market imperfection parameters** within the dominant *IC-EB*-regime

- the median price-cost mark-up is estimated to be significantly higher in *NL* (1.305 vs. 1.153 in *BE*) whilst the median absolute extent of rent sharing is estimated to be significantly higher in *BE* (0.428 vs. 0.262 in *NL*)

Preview of main findings (11)

TFP distributional characteristics are found to vary :

- by the *type of competition* prevailing in product and labor markets
  - average *TFP* growth rates are rel. large but *TFP* is more unequally distributed in *IC-PR*
  - average *TFP* growth rates are rel. small but *TFP* is more equally distributed in *IC-EB*
- by the *firm's skill type* within regimes
  - largest gap in average *TFP* growth rates between *HS* and *LS* amounts to 1.6 pp. in *BE* and 2.0 pp. in *NL*
- by the *compositional variation* within regimes
  - largest gap in average *TFP* growth rates between *Services* and *Manufacturing* amounts to 1.8 pp. in *BE* and 1.0 pp. in *NL*
- to some extent by the *degree of imperfections* in product and labor markets

Comparative setting

Comparative setting - TFP (1)

Total Factor Productivity

Using EUKLEMS data for the period 1995-2008, we observe :

- Cross-country variation in the contribution of *TFP* growth to real output growth
- Large cross-country cross-industry variation in *TFP* growth rates
  E.g.: average *TFP* growth in Finance & Business industry :
  -3.47% in *BE* while 0.18% in *NL*

Comparative setting - Product market setting (2)

Product market setting

- Higher level of import competition in Manufacturing and to a lesser extent in Services in *BE*
- Stronger pro-competitive impact of imports in *BE*
- Differences in the intra-sectoral composition of exports
  - *BE* : Semi-finished goods and components oriented towards competitive world markets
  - *NL* : Finished, high-tech goods flowing through a few MNEs with Dutch origin
- Determinants of price stickiness
  - *BE* : Labor and other factor costs main driver for price increases while competitive behavior main determinant of price decreases

Comparative setting - Labor market setting (3)

Labor market setting

Industrial relations in *BE* and *NL* share some similar wage bargaining institutional characteristics :

Broadly regulated system characterized by :

- Dominance of industry-level wage bargaining
- Existence and widespread use of extension procedures for industry-level wage agreements
  - Collective bargaining coverage rate : 96% in *BE* and 83% in *NL*
- Statutory minimum wages

Comparative setting - Labor market setting (4)

Labor market setting (ctd)

Industrial relations in *BE* and *NL* also differ on important aspects :

- Employee representation
  - *BE* : Trade unions $\Longrightarrow$ Very high trade union membership (52%)
  - *NL* : Works councils $\Longrightarrow$ Low trade union membership (21%)
- State-imposed automatic wage indexation in *BE*
- Modest wage increases and agreements based on consensus central in wage negotiations in *NL*
  - Collective bargaining system conducive to social stability

Higher employment protection in terms of stricter regulation on permanent contracts in *BE*

Theoretical framework

Theoretical framework (1)

Following Dobbelaere-Mairesse (2013), we extend Hall's (1988) econometric framework for estimating price-cost margins and scale economies by considering three labor market settings (LMS) :

- perfect competition or right-to-manage bargaining (PR)
- efficient bargaining (EB)
- monopsony (MO)

Theoretical framework (2)

Production function :

$$Q_{it} = \Theta_{it} F(N_{it}, M_{it}, K_{it}) \quad \text{where} \quad \Theta_{it} = A e^{\eta_i + u_t + v_{it}} \tag{1}$$

Logarithmic specification :

$$q_{it} = (\varepsilon_N^Q)_{it} n_{it} + (\varepsilon_M^Q)_{it} m_{it} + (\varepsilon_K^Q)_{it} k_{it} + \theta_{it} \tag{2}$$

where $(\varepsilon_J^Q)_{it}$ $(J = N, M, K)$ is the elast. of output w.r.t. input factor J

Theoretical framework (3)

Each firm operates under **imperfect competition in the product market**

We assume that material input and labor are variable factors

Short-run profit maximization implies the following *FOC* w.r.t. material input :

$$\left(\varepsilon_M^Q\right)_{it} = \mu_{it} \left(\alpha_M\right)_{it} \tag{3}$$

where $\left(\alpha_M\right)_{it} = \frac{j_{it} M_{it}}{P_{it} Q_{it}}$ is the share of material costs in total revenue and

$\mu_{it} = \frac{P_{it}}{\left(C_Q\right)_{it}}$ the mark-up of output price P_{it} over marginal cost $\left(C_Q\right)_{it}$

Theoretical framework (4)

Depending on the prevalent *LMS*, short-run profit maximization implies the following *FOC* with respect to labor :

$$
\begin{aligned}
(\varepsilon_N^Q)_{it} &= \mu_{it}(\alpha_N)_{it} \quad \text{if } LMS = PR && (4)\\
&= \mu_{it}(\alpha_N)_{it} - \mu_{it}\gamma_{it}\left[1-(\alpha_N)_{it}-(\alpha_M)_{it}\right] \quad \text{if } LMS = EB && (5)\\
&= \frac{\mu_{it}(\alpha_N)_{it}}{\beta_{it}} \quad \text{if } LMS = MO && (6)
\end{aligned}
$$

where $(\alpha_N)_{it} = \frac{w_{it}N_{it}}{P_{it}Q_{it}}$ is the share of labor costs in total revenue,

$\gamma_{it} = \frac{\phi_{it}}{1-\phi_{it}}$ the relative extent of rent sharing,

$\phi_{it} \in [0,1]$ the absolute extent of rent sharing,

$\beta_{it} = \frac{(\varepsilon_w^N)_{it}}{1+(\varepsilon_w^N)_{it}}$ and

$(\varepsilon_w^N)_{it} \in \Re_+$ the wage elasticity of the labor supply

Theoretical framework (5)

From the *FOCs* with respect to material input and labor, it follows that the parameter of joint market imperfections ψ_{it} :

$$\psi_{it} = \frac{(\varepsilon_M^Q)_{it}}{(\alpha_M)_{it}} - \frac{(\varepsilon_N^Q)_{it}}{(\alpha_N)_{it}} \tag{7}$$

$$= 0 \quad \text{if } LMS = PR \tag{8}$$

$$= \mu_{it}\gamma_{it}\left[\frac{1-(\alpha_N)_{it}-(\alpha_M)_{it}}{(\alpha_N)_{it}}\right] > 0 \quad \text{if } LMS = EB \tag{9}$$

$$= -\mu_{it}\frac{1}{(\varepsilon_w^N)_{it}} < 0 \quad \text{if } LMS = MO \tag{10}$$

Theoretical framework (6)

Assuming that the elasticity of scale, $\lambda_{it} = (\varepsilon_N^Q)_{it} + (\varepsilon_M^Q)_{it} + (\varepsilon_K^Q)_{it}$, is known, the capital elasticity can be expressed as :

$$(\varepsilon_K^Q)_{it} = \lambda_{it} - (\varepsilon_N^Q)_{it} - (\varepsilon_M^Q)_{it} \tag{11}$$

Inserting Eqs. (3), (7) and (11) in Eq. (2) and rearranging terms gives :

$$\begin{aligned} q_{it} &= \mu_{it}\left[(\alpha_N)_{it}\left(n_{it} - k_{it}\right) + (\alpha_M)_{it}\left(m_{it} - k_{it}\right)\right] \\ &\quad + \psi_{it}(\alpha_N)_{it}\left(k_{it} - n_{it}\right) + \lambda_{it}k_{it} + \theta_{it} \end{aligned} \tag{12}$$

Data

Data - Production function variables (1)

BE

- Source : Belfirst (Bureau van Dijck)
- Period : 2003-2011 (Robustness check : 2003-2008)
- **# obs. = 37,876**
- **N = 5,285 firms** (41% Manufacturing, 59% Services)
- Median # participations = 8

NL

- Source : Production Surveys (Statistics Netherlands)
- Period : 1999-2008
- **# obs. = 60,499**
- **N = 9,653 firms** (67% Manufacturing, 33% Services)
- Median # participations = 6

We only select firms having at least 3 consecutive observations and consider **30 comparable industries** (19 in Manuf. and 11 in Services)

Data - Skill heterogeneity (2)

Source :

- *BE* : National Social Security Office (RSZ)
- *NL* : Social Statistics Database (SSB) & Labor Force Study (EBB)

Our approach of defining skill heterogeneity is based on the concept of **knowledge workers** (Horwitz *et al.*, 2003)

- Classify employees as having
  - a high-paid-job if wage is $\geq$ p(81)
  - a high-medium-paid job if p(56) $\leq$ wage $<$ p(80)
  - a low-medium-paid job if p(31) $\leq$ wage $<$ p(56) and
  - a low-paid job if wage $<$ p(31)

Data - Skill heterogeneity (3)

A firm is defined to be *HS* (*LS*) if its employment share of *HS* employees $\geq$ ($<$) median value of the share of *HS* labor in firm size class *s* of industry *j* (NACE 2-digit classification) in year *t*

- We observe strong firm-level persistence in skill types :

  $>$ 80% of both skill types remain in their initial state

Two validation exercises using Dutch employer-employee data :

- Confirming a positive correlation between individual wages and the level of education, controlling for age groups and industry dummies
- Comparing our measure of the share of *HS* employees with the measure of the share of *HS* employees that is derived from the education type of employees as used in Bartelsman-Dobbelaere-Peters (2014)

Econometric framework :

Estimation method

Estimation method

- We use **econometric production functions** as a **tool for testing the competitiveness** of product and labor markets and for assessing their degree of imperfection
- Since our study aims at (i) comparing regime differences across *BE* and *NL* and (ii) evaluating whether *TFP* distributional characteristics differ across regimes and firms' skill types, we estimate average parameters :

$$\begin{aligned} q_{it} &= \mu\left[\alpha_N\left(n_{it}-k_{it}\right)+\alpha_M\left(m_{it}-k_{it}\right)\right]+\psi\alpha_N\left(k_{it}-n_{it}\right) \\ &\quad +\lambda k_{it}+u_t+\zeta_{it} \end{aligned} \tag{13}$$

- Main estimator : *SYS-GMM*

  Robustness check : *OLS*, *FE*, *Wooldridge-Levinsohn-Petrin* estimators

Econometric framework :

Classification procedure

Classification procedure (1)

- Classification procedure : Based on confidence intervals around estimated parameters
- On pragmatic grounds, we consider that defining perfect competition in both product and labor markets as respectively implying $\mu_j = 1$ and $\psi_j = 0$ is too excessive

  We have chosen $\mu_{j0} = 1.10$ and $|\psi_{j0}| = |0.20|$ as reasonable threshold values for our comparison
- To determine the **relevant product market setting**, we choose *IC* as the null hypothesis, which can be interpreted as believing more strongly in (some degree of) imperfect competition in the product market
- To determine the **relevant labor market setting**, we choose *EB/MO* as the null hypothesis, which can be interpreted as believing more strongly that the marginal employee receives a wage that differs from his/her marginal revenue

Classification procedure (2)

Classification procedure:	Null hypothesis not rejected
Test for product market setting (PMS): H_{10}: $\mu_j - 1 > 0.10$ against H_{1a}: $\mu_j - 1 \leq 0.10$	$PMS = PC$
Test for EB-labor market setting (LMS): H_{10}: $\psi_j > 0.20$ against H_{1a}: $\psi_j \leq 0.20$	$LMS = EB$
Test for MO-labor market setting (LMS): H_{10}: $\psi_j \leq -0.20$ against H_{1a}: $\psi_j > -0.20$	$LMS = MO$

- Robustness check : Examining the prevalent *PMS/LMS/regime* to the choice of estimator (*OLS, FE, W-LP*)

Differences in regimes and market imperfections :

Prevalent regimes

Prevalent regimes

% ind.	LABOR MARKET					
PRODUCT	*BE*			*NL*		
MARKET	**PR**	**EB**	**MO**	**PR**	**EB**	**MO**
PC	3	0	7	7	0	0
IC	10	53	27	20	57	17
% firms	LABOR MARKET					
PRODUCT	*BE*			*NL*		
MARKET	**PR**	**EB**	**MO**	**PR**	**EB**	**MO**
PC	0	0	3	3	0	0
IC	18	51	19	21	64	12

- Predominant regimes :

  BE : *IC-EB*, *IC-MO* and *IC-PR*

  NL : *IC-EB*, *IC-PR* and *IC-MO*

Differences in regimes and market imperfections :

Within-regime industry differences

Within-regime industry differences (1)

Minor cross-country regime differences mask **important cross-country differences in the composition of industries making up the regimes**

- 68% of the industries (13 out of 19) in Manufacturing are characterized by a different regime
  - in most of the 6 common *IC-EB*-industries, $\widehat{\mu}_j$ is estimated to be larger in *NL* while $\widehat{\phi}_j$ is estimated to be larger in *BE*
- 55% of the industries (6 out of the 11) in Services are characterized by a different regime
  - in the common *IC-PR*-industry, $\widehat{\mu}_j$ is not sign. different in *BE* and *NL*
  - in the common *IC-MO*-industry, both $\widehat{\mu}_j$ and $\left(\widehat{\varepsilon}_w^N\right)_j$ are estimated to be larger in *BE*
  - in the 3 common *IC-EB*-industries, $\widehat{\mu}_j$ is estimated to be larger in *NL* while $\widehat{\phi}_j$ is estimated to be larger in *BE*

Within-regime industry differences (2)

Compositional variation of predominant regimes

prop. of ind. (%)	IC-EB		IC-MO		IC-PR	
	BE	NL	BE	NL	BE	NL
MANUFACTURING	62	76	50	60	67	50
HTM	6	6	0	20	33	0
MHTM	6	23	37	0	33	17
MLTM	19	18	12	0	0	17
LTM	31	0	0	40	0	17
SERVICES	37	23	50	40	33	50
HTKIS	12	12	12	20	0	0
KIMS	19	12	25	20	0	17
LKIMS	6	0	12	0	33	33

- **IC-EB** : Higher prevalence of Manufacturing industries in *BE* and *NL*
- **IC-MO** : Only higher prevalence of Manufacturing industries in *NL*
- **IC-PR** : Only higher prevalence of Manufacturing industries in *BE*

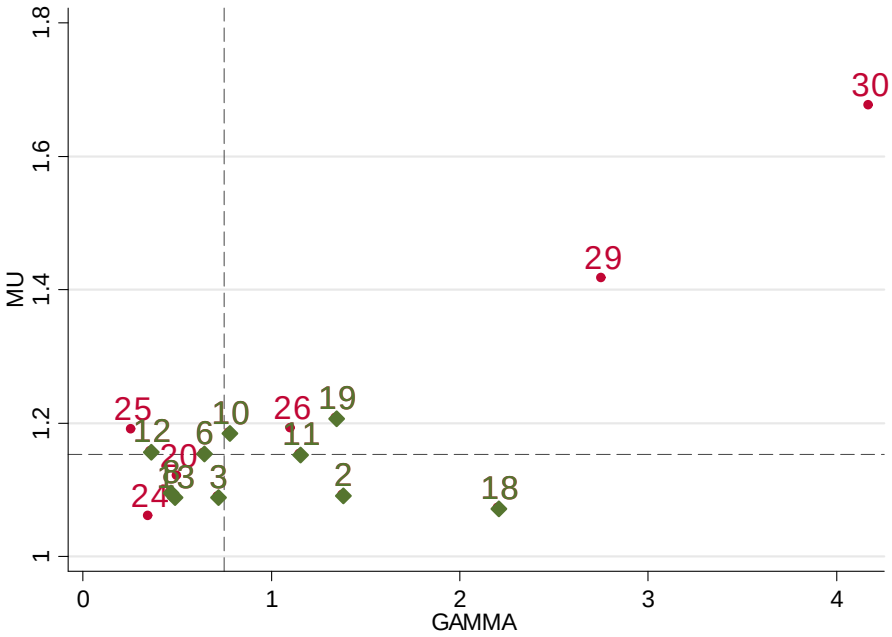
Within-regime industry differences (3)

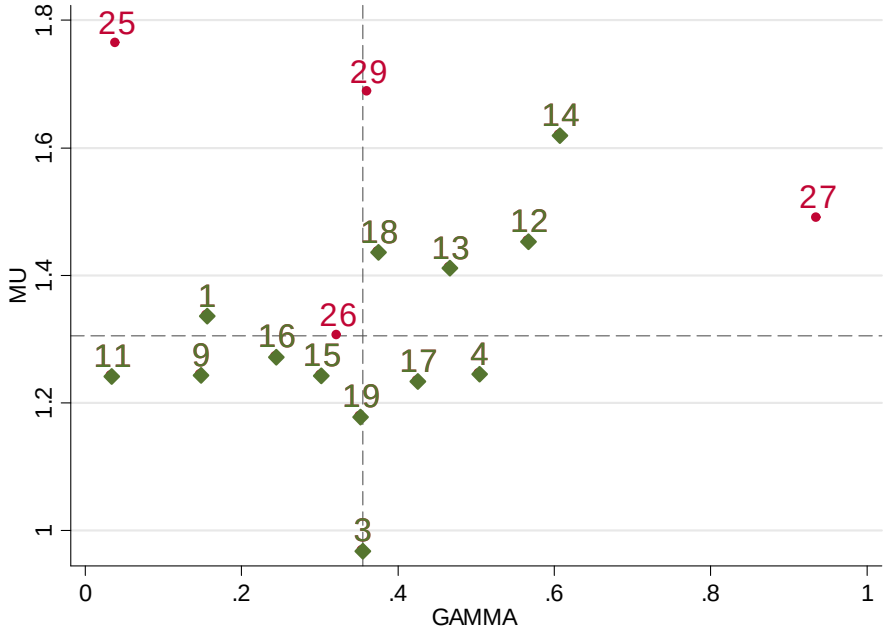
Within-regime industry differences : $R = IC\text{-}EB$

BE : 53% of industries, 51% of firms		
	$\widehat{\mu}_j$	$\widehat{\phi}_j$
Industry mean	1.183 (0.106)	0.463 (0.167)
Industry Q_1	1.090 (0.041)	0.323 (0.072)
Industry Q_2	1.153 (0.062)	0.428 (0.105)
Industry Q_3	1.190 (0.094)	0.577 (0.274)
NL : 57% of industries, 64% of firms		
	$\widehat{\mu}_j$	$\widehat{\phi}_j$
Industry mean	1.360 (0.123)	0.249 (0.125)
Industry Q_1	1.242 (0.069)	0.196 (0.084)
Industry Q_2	1.305 (0.101)	0.262 (0.113)
Industry Q_3	1.453 (0.190)	0.318 (0.175)

Within-regime industry differences (4)

R = IC-EB





BE : $\rho_{\widehat{\mu}_j,\widehat{\gamma}_j} = 0.66^{***}$

NL : $\rho_{\widehat{\mu}_j,\widehat{\gamma}_j} = 0.22$

Differences in TFP distributions :

Related literature

Related literature (1)

- Well-established result : Important role of misallocation of resources across productive units in explaining aggregate outcomes
  - Existing studies examine e.g. the extent to which specific policies, institutional factors and market imperfections impact aggregate *TFP* via generating misallocation (Restuccia and Rogerson, 2013)
  - We assess the importance of product and labor market competition in explaining *TFP* growth differences in a descriptive way

Related literature (2)

There is a vast theoretical and empirical literature on the impact of product market competition on productivity

- Theoretically, increased product market competition might *positively* affect productivity through increasing :
  - allocative efficiency $\Longrightarrow$ confirmed empirically
  - technical efficiency $\Longrightarrow$ confirmed empirically
  - dynamic efficiency $\Longrightarrow$ empirical evidence remains inconclusive

Related literature (3)

There is a large literature on the impact of unionization on productivity :

- Unions might have a *positive* impact on productivity through improving allocative and technical efficiency via :
  - reduction of staff turnover
  - improved worker motivation
  - better communication between workers and management
- Unions might have a *negative* impact on productivity through decreasing allocative and technical efficiency via :
  - strike activity and non-cooperative behavior
  - adoption of inefficient work practices
- Different channels through which unions might affect dynamic efficiency

$\Longrightarrow$ Micro evidence remains inconclusive

Related literature (4)

Labor market institutions might also influence productivity in different directions :

- On the one hand, rigid labor market institutions might hinder productivity growth through raising labor adjustment costs thereby impeding labor reallocation
- On the other hand, cooperative labor relations might lead to higher productivity growth

Differences in TFP distributions :

Descriptive evidence

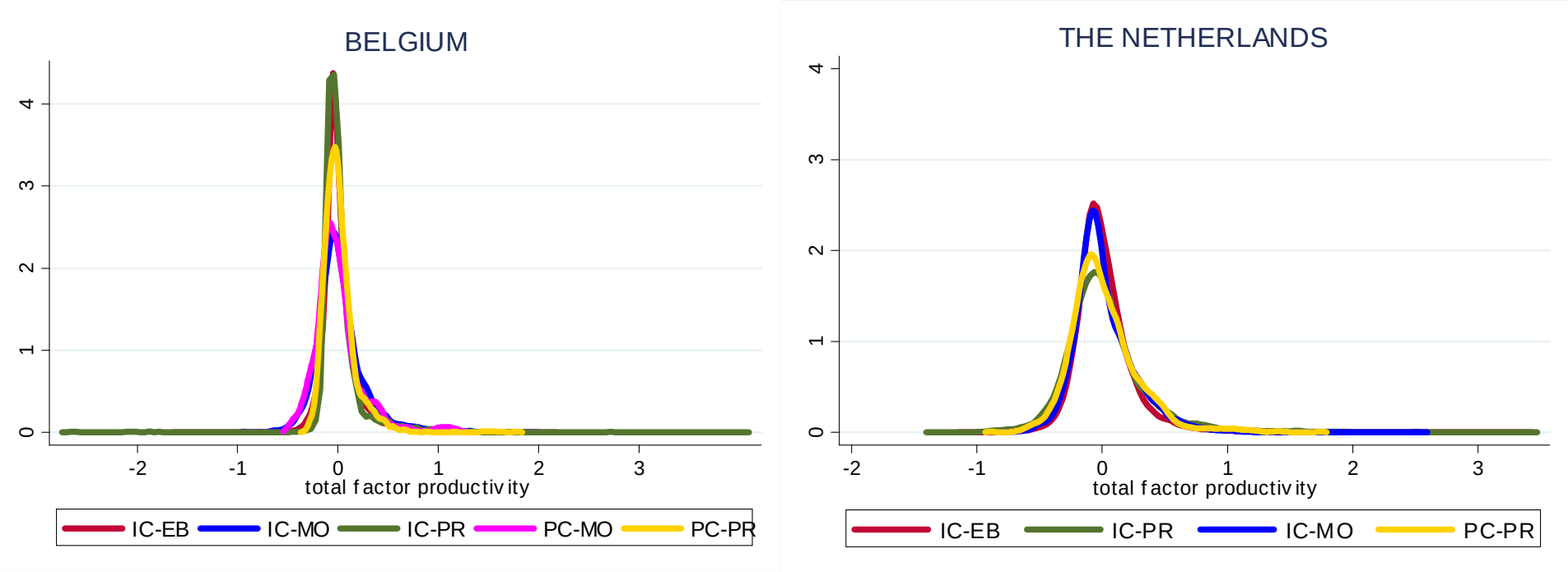
Descriptive evidence (1)

We measure *TFP* as the residual of a *SYS-GMM* estimation of the standard Cobb-Douglas production function at the industry level :

$$\begin{aligned} TFP_{it} &= q_{it} - \widehat{\mu}\left[\alpha_N\left(n_{it}-k_{it}\right)+\alpha_M\left(m_{it}-k_{it}\right)\right] \\ &\quad -\widehat{\psi}\left[\alpha_N\left(k_{it}-n_{it}\right)\right]-\widehat{\lambda}k_{it}-u_t \end{aligned} \tag{14}$$

Descriptive evidence (2)

TFP distribution, by country and regime



Cross-country comparison

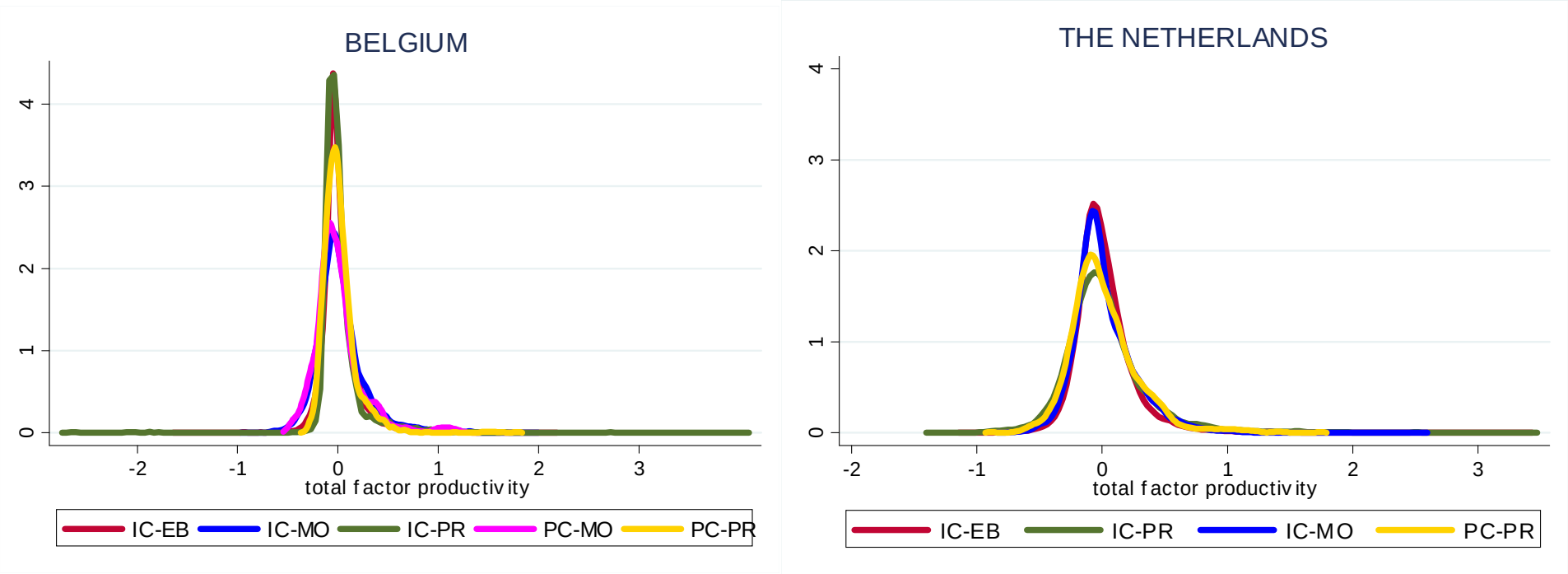
* **Mean** : [0.3-2.2] in *BE*, [1.4-2.4] in *NL*

  lower in *IC-PR* & *IC-EB* in *BE*, higher in *IC-MO* in *BE*

* **Dispersion** : higher in all regimes in *NL*, except for *IC-MO*

Descriptive evidence (3)

TFP distribution, by country and regime



Cross-regime comparison

* **IC-PR** : Rel. high mean, high dispersion which is caused by extreme outliers
* **IC-EB** : Relatively low mean, low dispersion

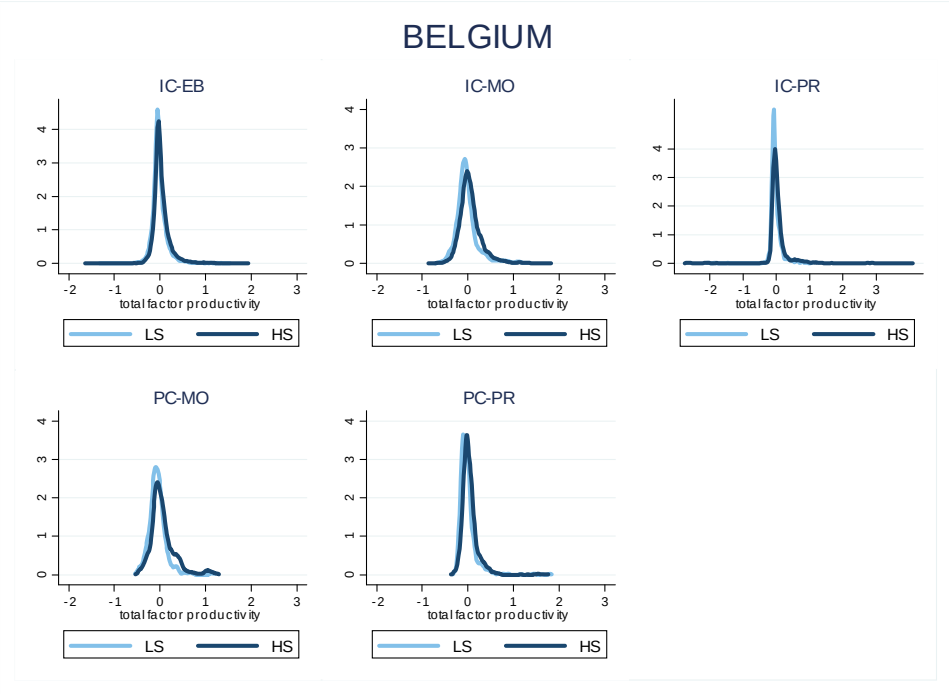
Descriptive evidence (4)

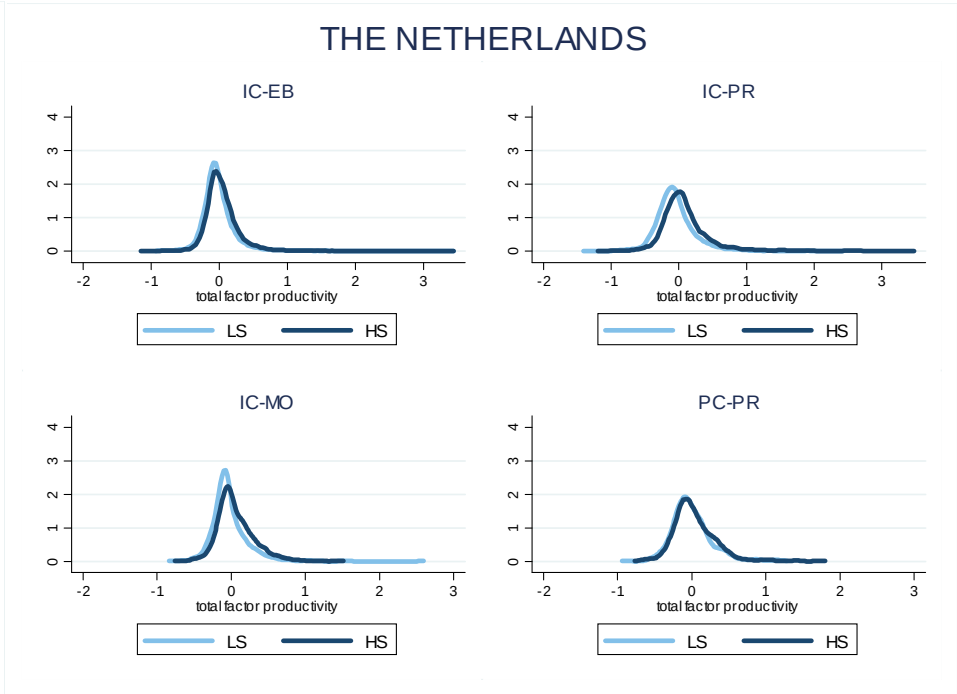
Which factors could further explain these differences in *TFP* distributions across countries and regimes?

- Skills
- Compositional variation within regimes

Descriptive evidence (5)

TFP distribution, by country, regime and firms' skill type





* **Mean** : higher in *HS* enterprises in all regimes in *BE & NL*, except for *PC-PR*

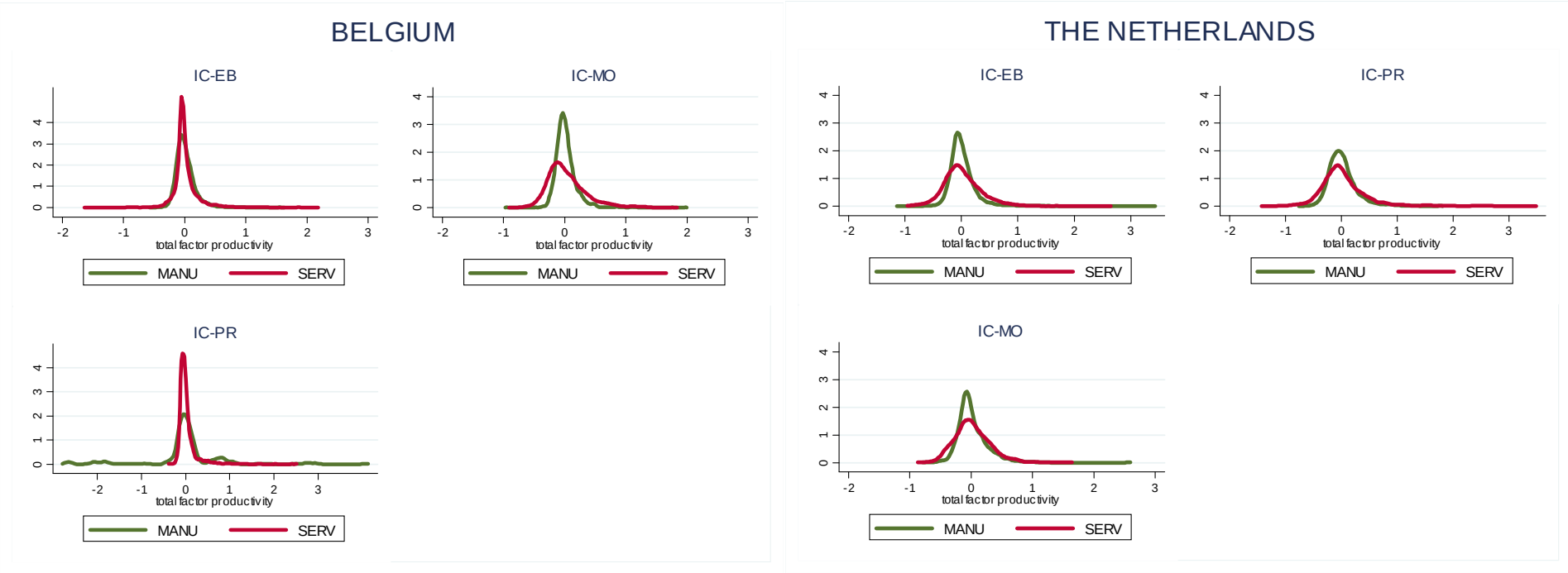
  highest skill premium in *PC-MO* in *BE* (1.6 pp.) and *IC-PR* in *NL* (2.0 pp.)

* **Dispersion** : higher in *HS* enterprises in all regimes in *NL*,

  only in *PC-MO & IC-EB* in *BE*

Descriptive evidence (6)

TFP distribution, by country, regime and manufacturing/services



* **Mean** : higher in services in all regimes in *BE & NL*

  highest service premium in *IC-PR* in *BE* (1.8 pp.) & *NL* (1.0 pp.)

* **Dispersion** : higher in services in all regimes in *BE & NL*, except for *IC-PR* in *BE*

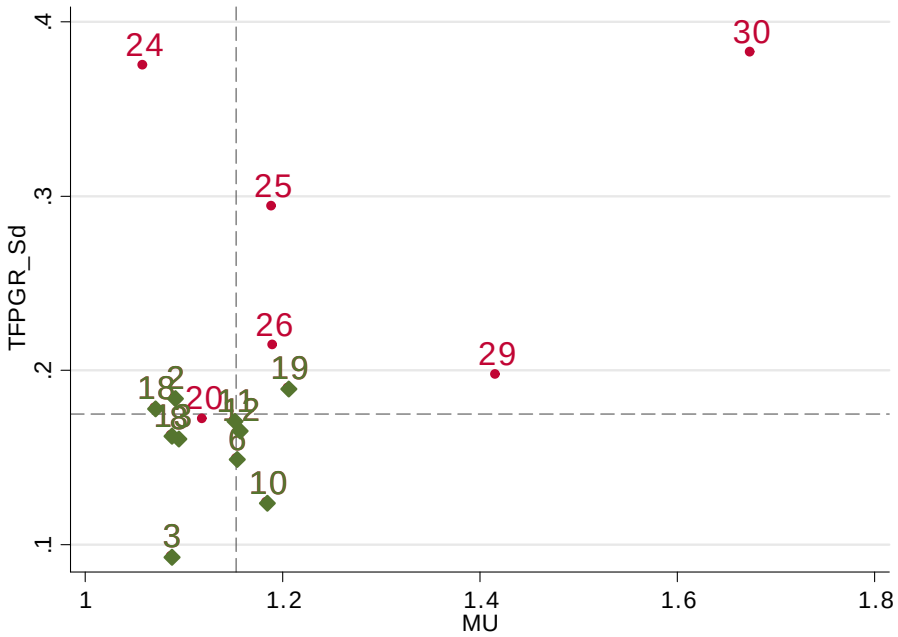
Descriptive evidence (7)

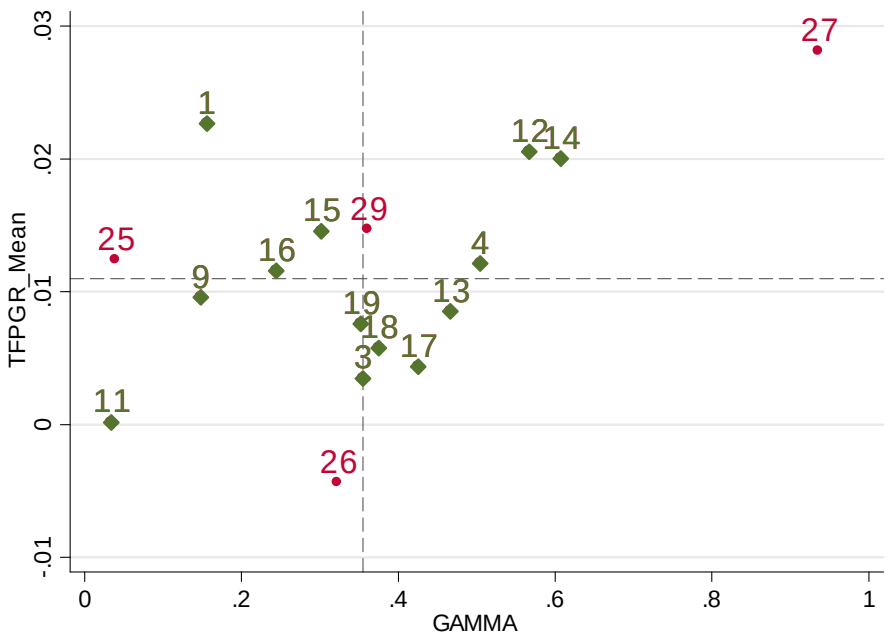
Examining the potential link between the **degree** of market imperfections and different moments of *TFP* distributions

- **IC-EB** :
  - *BE* : Negative correlation between *TFP* dispersion and $\widehat{\mu}_j$
  - *NL* : Negative correlation between average *TFP* growth rates and $\widehat{\gamma}_j$

Descriptive evidence (8)

R = IC-EB





BE : $\rho_{TFPGR_{Sd,j},\widehat{\mu}_j} = -0.22^{**}$

NL : $\rho_{TFPGR_{Mean,j},\widehat{\gamma}_j} = -0.21^{**}$

Conclusion & Extensions

Conclusion (1)

This paper examines –in a descriptive way– the joint impact of product and labor market imperfections on TFP

- **The prevalent product and labor market settings and hence the prevalent regimes are to some extent comparable in BE and NL**
  - dominant regime in both countries : *IC-EB*
  - most pronounced difference : higher prevalence of *MO* and lower prevalence of *PR* in *BE*
- **Important cross-country differences in :**
  - the composition of industries making up the regimes
  - the levels of product and labor market imperfections within *IC-EB*

Conclusion (2)

- **Cross-country cross-regime differences in TFP distributions**
  - descriptive evidence of resource misallocation across heterogeneous production units being an important source of cross-country differences in measured *TFP*
  - the prevalent *LMS* appears to be more decisive than the *PMS* in shaping regime-specific *TFP* distributions in *BE* & *NL* :

    average *TFP* growth rates are among the largest but *TFP* is more unequally distributed in *IC-PR*, the opposite holds in *IC-EB*
  - *TFP* distributional characteristics vary to some extent by the degree of imperfections in product and labor markets

- **Average TFP growth rates are higher in high-skilled enterprises in all regimes, except for PC-PR, and in services in all predominant regimes**

Extensions (1)

- Our gap methodology identifies regimes by comparing differences between the estimated average output elasticities of labor and materials and their average revenue shares
  - A more rigorous identification strategy could be based on estimating a more flexible functional form of the production function (translog) and on bootstrap hypothesis testing
- A natural extension of our production function framework is to take into account worker heterogeneity by building on the method of Hellerstein *et al.* (1999)

Extensions (2)

- Extending our analysis from a static to a dynamic framework might enable us to investigate the impact of country- and industry-level adjustment costs which are structural/permanent in nature on the prevalence of different product and labor market settings and on *TFP* performance
- Not estimating *sensu stricto* a production function for lack of firm output price information can be a cause of bias in our estimates
  - Extending our production function framework by disentangling efficiency and demand-enhancing effects