Market imperfections and total factor productivity*

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Abstract

This paper revisits the relationship between competition and total factor productivity (TFP) by examining the importance of the type and degree of product and labor market imperfections in shaping TFP distributions. Using panel data for Belgian and Dutch firms, we find that TFP distributional characteristics vary across regimes characterizing the type of competition prevailing in product and labor markets in both countries. This variation is largely driven by the type of labor market competition, and is most pronounced for the Netherlands. Differences in composition of regimes in terms of manufacturing/service industries are also important in driving variation in moments of TFP distributions.

JEL classification : C23, D24, J50, L13.
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1 Introduction

The efficient allocation of factor inputs in an industry, or an economy at large, requires the equalization of marginal products across firms in a static model of production and demand. Any deviation from this outcome represents a misallocation of resources across firms. Pioneered in Restuccia and Rogerson (2008) and Hsieh and Klenow (2009), a recent body of work has now well established the potentially important role of misallocation across productive units in explaining suboptimal aggregate outcomes, notably decreased aggregate productivity.[1] Existing studies examine, e.g., the extent to which size-dependent policies (such as labor and capital taxes with exemptions for firms below a size threshold), institutional factors (such as unemployment insurance and employment protection) and market imperfections (such as price-cost mark-ups and credit constraints) impact total factor productivity (TFP) via generating misallocation.

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[1] See Bartelsman *et al.* (2013) for an application to cross-country data and Restuccia and Rogerson (2013) and Hopenhayn (2014) for a review of recent work.

Viewed through the lens of the misallocation literature, this paper revisits the relationship between competition and TFP by examining the productivity effect of two factors that are believed to be empirically important sources of misallocation, especially in European countries. In particular, we investigate the joint impact of market power in product and labor markets on firms' TFP growth.

We use econometric production functions as a tool for testing the competitiveness of labor and product markets, for assessing their degree of imperfection and for deriving productivity estimates. This approach, to which we refer as the productivity approach, is based on the gap methodology which essentially starts from the observation that any factors that create misallocation of resources can be thought of as generating wedges in static first-order conditions of a firm's optimization problem.

The theoretical model underlying this approach embeds the efficient bargaining model and the monopsony model in standard production theory. These imperfectly competitive models of wage determination are both intuitively appealing and tractable and can be viewed as representing two polar extremes: the efficient bargaining model (one of the two canonical collective bargaining models) allocates market power to employees through costs of firing, hiring and training while the monopsony model allocates market power to employers through search frictions or heterogeneous worker preferences for job characteristics which generate upward-sloping labor supply curves to individual firms.

Many real-world labor markets are characterized by search frictions and union presence is still very important in European countries (Booth, 2014). These facts together with the productivity approach only requiring standard firm accounting information, make our methodology particularly useful to examine how the type and degree of product and labor market imperfections shape TFP distributions across a specified set of producers, thereby lending itself to a comparative analysis at the cross-national, cross-industry or cross-firm-group level.

Our empirical analysis is based on two unbalanced panels of manufacturing and service firms: 4,834 firms over the period 2003-2011 in Belgium and 5,225 firms over the period 1999-2012 in the Netherlands. We observe large cross-national variation in the wedges distorting the allocation of resources and, hence, in the prevalence of regimes characterizing the type of competition prevailing in product and labor markets. These cross-national regime differences are predominantly driven by cross-national industry differences in the type of competition prevailing in labor markets: more than 85% of manufacturing and service industries are characterized by a different labor market setting in the two countries. Exploiting this variation in the prevalence of regimes in each country, we document cross-national cross-regime differences in TFP distributions. We interpret these differences as descriptive evidence of resource misallocation being an important source of cross-national differences in measured TFP. We do not observe a country-invariant ranking of regimes in terms of TFP distributional characteristics. Rather, the interaction between product and labor market settings and country specificities is found to generate variation in TFP distributions across regimes. In particular, the prevalent labor market setting appears to be more decisive in shaping regime-specific TFP distributions in the Netherlands. As a result, TFP distributional characteristics vary much more across regimes in that country.

The plan of the article as follows. Section 2 summarizes institutional differences in the product and labor market settings in the two countries, thereby motivating the comparative nature of our study. Section 3 presents the productivity approach. Section 4 discusses the econometric implementation. Section 5 presents the firm panel data for Belgium and the Netherlands. Section 6 investigates the relationship between the type and degree of market imperfections and TFP growth. Section 7 concludes.

2 Institutional background

This section highlights some institutional characteristics of the product and labor market settings in Belgium (BE) and the Netherlands (NL) which serve as background information for our comparative study. These characteristics might shape firms' operational environment in general and, within our context, the type of competition in product and labor markets in particular (see also Konings *et al.*, 2001 and Du Caju *et al.*, 2011 for a discussion on this issue).

2.1 Product market setting

On the product market side, the Dutch political authorities have been slower to adapt competition law in par with European Union legislation. In BE, the general price regulation system was replaced by the first Competition Act similar to the European Union legislation in 1991. In NL, the old Economic Competition Act of 1956, based on the abuse principle, was only replaced by the new Competition Act, based on the prohibition principle, in 1998. At the same time, the Dutch Competition Authority (known under its Dutch acronym, NMa) started to operate.

Firm-level studies focusing on the 1990s document higher price-cost margins in both manufacturing and services in NL (Konings *et al.*, 2001, Hupkes and Maks, 2006). Disparity of price-cost margins resulted from pronounced differences in trade and competition policy that existed between both countries. Competition policy kept markets open which shaped a competitive environment in BE while the use of protective policies rather sheltered firms from import competition in NL (Van Cayseele *et al.*, 2000). Using industry-level data covering the period 1993-2007, Brouwer and Ozbugday (2012) do not find a deterrent impact of the 1998 change in the competition law on price-cost margins in Dutch manufacturing.

Varying levels of import competition between BE and NL are confirmed by data on import penetration rates provided by the OECD: trade openness in manufacturing and to a lesser extent in services is higher in BE (OECD, 2010). Using firm-level data covering the period 1996-2004, Abraham *et al.* (2009) provide evidence of pro-competitive effects resulting from trade opening in BE. In addition, differences in the intra-sectoral composition of exports between both countries might drive differences in price-cost margins, as the latter are affected by variation in the value-added content and import price competition. For example, the input price of intermediates for high-tech goods versus semi-finished goods depends on the value-added content, as reported by the European Commission (European Commission, 2013). They show that the value-added content of trading and domestic goods broken down by domestic and foreign parts is different between both countries over the period 2000-2011. In addition, a much higher revealed comparative advantage (RCA) indicator in high-tech products for NL and systematic differences in RCA indices in manufacturing and services between both countries are reported.

2.2 Labor market setting

On the labor market side, industrial relations in BE and NL share some similar wage bargaining institutional characteristics but also differ on important aspects. In both countries, there is a broadly regulated system of wage bargaining characterized by a dominance of industry-level wage bargaining, the existence of statutory minimum wages and extension mechanisms guaranteeing that most workers belonging to the private sector are covered by collective agreements. The wage bargaining system in BE is considered to be even more regulated than in NL because of state-imposed automatic wage indexation and larger government interventions. Trade union density rates are also higher (Du Caju *et al.*, 2009). In terms of employment protection, the OECD indicators show that employment protection is significantly higher and above the OECD average in BE, which is due to much stricter regulation on permanent contracts, while at the OECD average in NL (Venn, 2009; OECD, 2013). Both countries significantly eased the regulation on temporary contracts during the 1990s (Martin and Scarpetta, 2012).

In all EU member states, employees are represented in trade unions which are mostly organized on a industry-wide basis and which embody the traditional form of employee representation, and works councils which are organized at the company or establishment level. In BE, trade union representation dominates and in terms of union membership, trade unions are among the strongest in the OECD with 52% of employees in unions which is largely above the OECD average of 19% (Du Caju *et al.*, 2009, Fulton, 2013).

Collective bargaining is highly structured. There are three levels with the industry level playing the dominant role. At the centralized level, a national agreement determines a standard for the maximum hourly increase of gross labor compensation according to the expected evolution of labor costs in the neighboring countries during the first year. This so-called “wage margin” acts as a guideline for complementary negotiations at the industry and firm levels, which are held in the subsequent year (López-Novella and Sissoko, 2013). Industry-level bargaining is organized around joint committees bringing together employers' and unions' representatives at the industry level. It is the relevant bargaining level for about 98% of all firms (Druant *et al.*, 2008). Collective labor agreements might also be concluded at the firm level with large firms having a higher probability of firm-level collective bargaining (Direction Générale Statistiques et Information Economiques, 2006). This structure explains the very high proportion of employees covered by collective bargaining (96%).

The dominant form of coordination, which refers to the extent to which wage negotiations are coordinated across the different bargaining levels, is automatic wage indexation, which is an exception in the OECD. This mechanism binds wage increases to cost of living raises in order to guarantee a constant level of purchasing power for employees and those who receive benefits.[2] Another particular characteristic of the wage bargaining system is that blue-collar and white-collar workers are represented by separate unions. Pay scales for blue-collar workers depend primarily on job descriptions while pay scales for white-collar workers are defined according to seniority. Beyond collective bargaining, the wage-setting system shows individualized characteristics with incentive pay and performance reviews determining individual wage increases or promotion.

Contrary to BE, employee representation at the workplace only occurs through works councils in NL. Trade union membership is low (21%) and only slightly above the OECD average. Despite low union density, a broad majority agrees with the unions' policies. Every year, collective bargaining starts at the centralized level, where employer associations, trade unions and the government reach an agreement on the desirable development of wages which serves as an advice for actual negotiations on contracts and wages at the industry level. Modest wage increases have been central in these negotiations.[3] At both the central and industry level, the government plays the role of moderator, ensuring that agreements are based on consensus. As such, the collective bargaining system is conducive to social stability. Collective labor agreements are concluded at the company level in very large companies. The existence and widespread use of extension procedures for industry-level wage agreements, making these agreements binding for all employers and employees within the industry even if some employers or trade unions did not directly sign the agreement, explains the high rate of collective bargaining coverage despite low trade union density. Of all Dutch employees, 83% are covered by a collective contract: 69% by industry-level contracts and 14% by company contracts (Borghans and Kriechel, 2009). This wage-setting process is complemented by the prevalent use of some type of incentive pay defining the position of an employee on the pay scale.

3 Productivity approach

The productivity approach enables to derive product and labor market imperfection parameters and regression-based TFP measures from estimating firm production functions. The theoretical

[2] In particular, wages are automatically indexed according to the health price index, which is the national consumer price index excluding tobacco, motor fuels and alcoholic beverages.

[3] Since 1982, wage claims by Dutch trade unions have been mostly below the EU average (Kleinknecht *et al.*, 2006).

model underlying this approach nests two polar extremes of imperfectly competitive models of wage determination in the seminal framework of Hall (1988) for estimating price-cost mark-ups: the efficient bargaining model (one of the canonical collective bargaining models; McDonald and Solow, 1981) and the monopsony model (Manning, 2003). As such, this approach is capable of discerning whether either market power on the supply side of labor or market power on the demand side of labor is predominantly responsible for introducing allocative inefficiencies through distorting factor prices.

More specifically, the productivity approach uses econometric production functions as a tool (*i*) for testing which model of wage determination prevails and whether the product market is characterized by perfect or imperfect competition, (*ii*) for assessing the degree of market power in labor and product markets and (*iii*) for deriving regression-based TFP estimates. The statistical specification is given by:

$$q_{it} = \mu \left[\alpha_N \left(n_{it} - k_{it}\right) + \alpha_M \left(m_{it} - k_{it}\right)\right] + \psi[\alpha_N \left(k_{it} - n_{it}\right)] + \lambda k + \theta_{it} \quad (1)$$

with q_{it}, n_{it}, m_{it} and k_{it} the logarithm of output Q, labor N, material input M, and capital K in firm i at time t, respectively. Although Q_{it}, N_{it}, M_{it} and K_{it} are observed by the econometrician, θ_{it} is unobserved to the researcher. The statistical residual θ_{it} equals $\alpha_0 + \zeta_{it}$, where α_0 measures the mean efficiency level across firms and over time and ζ_{it} is the time- and firm-specific deviation from that mean. ζ_{it} can further be decomposed into ω_{it} and ϵ_{it}. ω_{it} is firm-level productivity, possibly observed (or predictable) by firms when they choose inputs at time t, representing innate technology or managerial ability at a firm, expected down-time due to machine breakdowns and strikes or expected defect rates in a manufacturing process. ϵ_{it} is an *i.i.d.* component, representing unobservables that are not observed (or predictable) by the firm before input decisions at time t, such as deviations from expected breakdown or defect in a particular year, or classical measurement error in q_{it}. $\mu = \frac{\varepsilon_M^Q}{\alpha_M}$ and $\psi = \frac{\varepsilon_M^Q}{\alpha_M} - \frac{\varepsilon_N^Q}{\alpha_N}$ are the price-cost mark-up and the joint market imperfections parameter, respectively. These parameters are identified from the gap between the output elasticities of materials and labor (ε_M^Q and ε_N^Q, respectively) and the shares of materials and labor in total revenue (α_M and α_N, respectively). λ represents the elasticity of scale parameter. Regression-based TFP measures are obtained by estimate Eq. (1) and solving for ω_{it}: $\widehat{\omega}_{it} = q_{it} - \widehat{\mu} \left[\alpha_N \left(n_{it} - k_{it}\right) + \alpha_M \left(m_{it} - k_{it}\right)\right] - \widehat{\psi}[\alpha_N \left(k_{it} - n_{it}\right)] - \widehat{\lambda} k_{it} - \widehat{\alpha_0}$.

The remainder of this section discusses how the efficient bargaining (EB) and the monopsony (MO) models are nested in the seminal framework of Hall (1988) for recovering the extent of imperfect competition in the product market.

We assume a simple Cobb-Douglas production technology with a Hicks-neutral efficiency level of firm i in period t (Θ_{it}): $Q_{it} = \Theta_{it} F(N_{it}, M_{it}, K_{it}) = \Theta_{it} N_{it}^{\varepsilon_N^Q} M_{it}^{\varepsilon_M^Q} K_{it}^{\varepsilon_K^Q}$, with $(\varepsilon_J^Q)_{it}$ $(J = N, M, K)$ is the elasticity of Q with respect to input factor J. Labor and materials are assumed to be static inputs in production, free of adjustment costs and capital a dynamic input, predetermined in the short run. Taking natural logs results in the following linear specification:

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

Let us assume that firms operate under imperfect competition in the product market, i.e. the product market setting (PMS) equals IC. We allow for three labor market settings (LMS): perfect competition or right-to-manage bargaining (PR), which is similar to the labor market setting in the original Hall (1988) model[4], efficient bargaining (EB) and monopsony (MO). We assume that material input and labor are variable input factors. Short-run profit maximization implies the following first-order condition with respect to material input:

$$\varepsilon_M^Q = \mu\alpha_M \tag{3}$$

where $\alpha_M = \frac{jM}{PQ}$ and $\mu = \frac{P}{C_Q}$ refers to the mark-up of output price P over marginal cost C_Q. Depending on the prevalent LMS, short-run profit maximization implies the following first-order condition with respect to labor (for details, we refer to Appendix A):

$$\begin{aligned}
\varepsilon_N^Q &= \mu\alpha_N \quad \text{if LMS=PR} && (4)\\
&= \mu\alpha_N - \mu\gamma(1-\alpha_N-\alpha_M) \quad \text{if LMS=EB} && (5)\\
&= \frac{\mu\alpha_N}{\beta} \quad \text{if LMS=MO} && (6)
\end{aligned}$$

where $\alpha_N = \frac{wN}{PQ}$, $\gamma = \frac{\phi}{1-\phi}$ the relative extent of rent sharing, $\beta = \frac{\varepsilon_w^N}{1+\varepsilon_w^N}$ and $\varepsilon_w^N \in \Re_+$ the wage elasticity of labor supply. From the first-order conditions with respect to material input and labor, it follows that the parameter of joint market imperfections ψ:

$$\begin{aligned}
\psi &= \frac{\varepsilon_M^Q}{\alpha_M} - \frac{\varepsilon_N^Q}{\alpha_N} && (7)\\
&= 0 \quad \text{if LMS=PR} && (8)\\
&= \mu\gamma\left[\frac{1-\alpha_N-\alpha_M}{\alpha_N}\right] > 0 \quad \text{if LMS=EB} && (9)\\
&= -\mu\frac{1}{\varepsilon_w^N} < 0 \quad \text{if LMS=MO} && (10)
\end{aligned}$$

From Eq. (7), it follows that the gap between the output elasticities of labor and materials and their revenue shares are key to identification of the product and labor market imperfection parameters. Once the relevant labor market setting is determined, the product and labor market imperfections parameters are derived from the joint market imperfections parameter (ψ): the price-cost mark-up and extent of rent-sharing parameters (μ and γ, respectively) if the efficient bargaining model prevails [see Eq. (9)] or the price-cost mark-up and labor supply elasticity parameters

[4] In both the perfectly competitive labor market model and the right-to-manage bargaining model (Nickell and Andrews, 1983), labor is unilaterally determined by the firm from profit maximization, i.e. the wage rate equals the marginal revenue of labor (see Appendix A).

(μ and ε_w^N, respectively) if the monopsony model prevails [see Eq. (10)]. On the product market side, the price-cost mark-up measures the ability of firms to charge prices above marginal costs. On the labor market side, the absolute extent of rent-sharing parameter under efficient bargaining (ϕ) measures the part of economic rents going to the workers or the degree of workers' bargaining power during worker-firm negotiations, whereas the labor supply elasticity parameter measures the degree of wage setting power that firms possess.

Assuming that the elasticity of scale, $\lambda = \varepsilon_N^Q + \varepsilon_M^Q + \varepsilon_K^Q$, is known, capital elasticity can be expressed as:

$$\varepsilon_K^Q = \lambda - \varepsilon_N^Q - \varepsilon_M^Q \tag{11}$$

Inserting Eqs. (3), (7) and (11) in Eq. (2) and rearranging terms gives Eq. (1).

4 Econometric framework

4.1 Identifying and quantifying sources of misallocation

We use econometric production functions to identifying and quantifying our sources of misallocation. To identify the type of competition prevailing in product and labor markets, we define both the labor market and the product market at the 2-digit level of industry classification. As such, we estimate the standard Cobb-Douglas production function [Eq. (1)] for each industry j. The operational definition of the labor market is motivated by the fact that BE and NL are characterized by industry-based unionism, stressing the importance of the industry-level wage setting-process and by the observation that workers often stay within the same industry rather than, e.g., within the same occupation (Bontemps *et al.*, 2001). Given the purpose of relating product and labor market imperfections to productivity, an additional reason for performing a detailed cross-national cross-industry analysis is that the productivity literature has emphasized the role of institutions as well as industry-specific characteristics as crucial determinants of productivity (see Syverson, 2011 for a discussion).

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. Following Dobbelaere *et al.* (2015), we distinguish between (nearly) perfectly competitive product markets as $H_0 : \mu_j \leq \mu_{j0}$ against imperfectly competitive product markets as $H_a : \mu_j > \mu_{j0}$, and similarly (nearly) perfectly competitive labor markets as $H_0 : |\psi_j| \leq |\psi_{j0}|$ against imperfectly competitive labor markets as $H_a : |\psi_j| > |\psi_{j0}|$. We have chosen $\mu_{j0} = 1.10$ and $|\psi_{j0}| = |0.30|$ as reasonable threshold values.[5] Our classification procedure is based on confidence intervals around estimated parameters. As it is generally accepted that market imperfections are the norm, not the exception, the PMS is

[5] Table B.1 in Appendix B motivates the "data-dependent" choice of $|0.30|$ for $|\psi_{j0}|$. It shows that when we choose a common threshold of $|0.30|$ for $|\psi_{j0}|$, the average and median values of industry-specific labor market imperfection parameters are economically meaningful for both countries.

determined by choosing IC as the null hypothesis. This can be interpreted as believing more strongly in (some degree of) imperfect competition in the product market. Likewise, to determine the relevant LMS, we choose EB/MO as the null hypothesis, which can be interpreted as believing more strongly that the marginal employee receives a real wage that differs from his/her marginal product. This procedure is summarized in Appendix B.

Considering two product market settings (PMS): perfect competition (PC) and imperfect competition (IC), and three labor market settings (LMS): perfect competition or right-to-manage bargaining (PR), efficient bargaining (EB) and monopsony (MO), we distinguish six regimes of competitiveness: $\text{R} \in \Re = \{\text{PC-PR,IC-PR,PC-EB,IC-EB,PC-MO,IC-MO}\}$, where the first part reflects the PMS and the second part reflects the LMS.

Once the regime is determined, we are able to quantify market power in product and labor markets. As shown in Section 3, the product and labor market imperfection parameters are derived from the estimated joint market imperfections parameter $\widehat{\psi}_j$.[6]

4.2 Estimation method

The most important methodological issues that emerge when estimating microeconomic production functions are endogeneity of inputs (transmission bias), endogeneity of attrition (selection bias), omitted price bias and multi-product firms bias.[7] Most of the econometric literature on estimating firm-level production functions has attempted to solve the endogeneity problem arising from the fact that firms observe productivity shocks, which are unobserved to the econometrician, and adapt their input choices accordingly. Indeed, if firms decide on their choice of inputs (n_{it}, m_{it}, k_{it}) based on the realized firm-specific productivity ω_{it}, which only they observe and if (n_{it}, m_{it}, k_{it}) are not mean-independent from the omitted productivity effect ω_{it}, i.e. $\text{E}[\zeta_{it}|n_{it}, m_{it}, k_{it}, \omega_{it}] \neq \text{E}[\zeta_{it}|\omega_{it}]$, then OLS estimation of Eq. (1) produces biased and inconsistent estimates of the production function coefficients (Marshak and Andrews, 1944). A favorable productivity shock will likely lead to increased variable input usage, which introduces an upward bias in the production function coefficients for N and M (ε_N^Q and ε_M^Q, respectively).

Focusing on this transmission bias, the recent literature on production function estimation is dominated by two econometric approaches that differ in handling endogeneity of inputs and unobserved productivity in models linear in parameters. Intuitively, both approaches differ in the way they put assumptions on the economic environment that allow econometricians to exploit lagged input decisions as instruments for current input choices. The parametric generalized method of moments (GMM) approach relies on instrumental variables. The semiparametric structural control function

[6] From a methodological perspective, our paper is related to Petrin and Sivadasan (2013) and, given the selection of countries, to Dobbelaere (2004), Benavente *et al.* (2009), Amoroso *et al.* (2015) and Dobbelaere *et al.* (2015), which are also based on the gap methodology.

[7] We refer the reader to Van Beveren (2012) and Dobbelaere *et al.* (2015, 2016) for a discussion of these issues.

approach uses firm decisions to find proxy variables for the transmitted productivity shock (ω_{it}) and exploits information in these observed variables to invert out ω_{it} from the residual ζ_{it}.

We use the GMM approach developed by Arellano and Bover (1995) and Blundell and Bond (1998) (SYS-GMM estimator). This choice is guided by the ability to allow for unobserved time-invariant firm-specific effects (α_i) and by requiring fewer assumptions regarding input demand equations.[8] The composite error term ζ_{it} represents the sum of four error components: an unobserved time-invariant firm-specific effect (α_i) and a year effect (α_t) in addition to ω_{it} and ϵ_{it}. We impose the following set of assumptions on the error components. First, we allow for potential correlation between α_i and (n_{it}, m_{it}, k_{it}). Second, consistent with our static theoretical framework, we only consider the innovation in ω_{it} between $t-1$ and t (ξ_{it}), which is uncorrelated with all input choices prior to t. Third, ϵ_{it} is *i.i.d.* over time and uncorrelated with (n_{it}, m_{it}, k_{it}) for all t. Conditional on the parameters, one can compute $\omega_{it} + \epsilon_{it}$ for all t and form sample moment conditions for estimation to consistently estimate the production function coefficients.

We apply the two-step GMM estimator which is asymptotically more efficient than the one-step GMM estimator and robust to heteroskedasticity. We use a finite-sample correction to the two-step covariance matrix developed by Windmeijer (2005). We build sets of instruments following the Holtz-Eakin *et al.* (1988)-approach which avoids the standard two-stage least squares trade-off between instrument lag depth and sample depth by including separate instruments for each time period and substituting zeros for missing observations. To avoid instrument proliferation, we only use 2- and 3-year lags of the instrumented variables as instruments in the first-differenced equation and the 1-year lag of the first-differenced instrumented variables as instruments in the original equation. In addition to the Hansen test evaluating the entire set of overidentifying moment conditions/instruments, we test the validity of subsets of instruments using difference-in-Hansen statistics.

5 Data

The productivity approach only requires standard firm balance sheet and income statement data on production values, factor inputs and factor costs to obtain estimates of product and labor market imperfection parameters and regression-based measures of TFP. This section presents the micro data in BE and NL. These country-specific microdata sets entail the advantage of having very tight data collection protocols, allowing us to conduct a reliable comparative study.

The Belgian data are sourced from the Belfirst database provided by Bureau van Dijck and the Dutch data from the Production Surveys (PS) provided by Statistics Netherlands. For both countries, our

[8] The control function approach requires both a strict monotonicity and a scalar unobservable assumption on one of the input demand equations, i.e. on either investment (Olley and Pakes, 1996) or materials (Levinsohn and Petrin, 2003), which might not fit the data well (see Dobbelaere *et al.*, 2015 for evidence on NL using a similar dataset).

estimation sample is restricted to firms having at least three consecutive observations. After some trimming on input shares in total revenue and input growth rates to eliminate outliers and anomalies, we end up with an unbalanced panel of 4,834 firms covering the period 2003-2011 in BE and 5,225 firms spanning the period 1999-2012 in NL. Table B.2 in Appendix B reports the panel structure of the estimation sample, and the number of observations and firms by industry based on technological intensity according to the OECD (2001) classification and by firm size in both countries.[9] With respect to industry composition, we observe that the Belgian sample includes less Medium-low-tech manufacturing firms (14.3% versus 19.6% in NL) but more Less-knowledge-intensive market service firms (39.2% versus 36.6% in NL). With respect to firm size, the Belgian sample includes more small firms (33.0% with $[10, 20[$ employees versus 21.8% in NL) but less medium-sized firms (11.0% with $[100, 250[$ employees versus 16.2% in NL).

Output (Q) is defined as real gross output measured by nominal sales divided by the industry-level gross output price index in both countries.[10] Labor (N) refers to the average number of employees in BE and the number of employees in September of a given year in NL. Material input is defined as intermediate consumption deflated by the industry-level intermediate consumption price index in both countries. The capital stock (K) is measured by the gross bookvalue of tangible assets deflated by the industry-level gross fixed capital formation price index for all assets in both countries. The price deflators for BE and NL are obtained from Belgostat and Statistics Netherlands respectively. The shares of labor (α_N) and material input (α_M) are constructed by dividing respectively the firm total labor cost and undeflated intermediate consumption by the firm undeflated production and by taking the average of these ratios over adjacent years.

Table 1 reports the means, standard deviations and quartile values of our main variables by country. The average growth rate of real firm output is 1.9% per year in BE and 3.5% in NL. In both countries, labor and materials have increased while capital has decreased. The material share in output is considerably higher in BE, which could reflect a different industrial production structure between both countries. The Solow residual or conventional TFP measure has been stable over the considered period in BE, and has increased at an average annual growth rate of 3.8% in NL. As expected for firm-level data, the dispersion of all these variables is considerably large. For example, conventional TFP growth is lower than -3.1% (-8.6%) for the first quartile of firms and higher than 4.1% (15.3%) for the upper quartile in BE (NL).

<Insert Table 1 about here>

[9] The OECD classification of manufacturing industries according to their technology intensity is based both on direct R&D intensity (R&D expenditures divided by production and R&D expenditures divided by value added) and R&D embodied in intermediate and investment goods (see Hatzichronoglou, 1997). For service industries, the classification is based on skill intensity and indirect R&D measures such as technology embodied in investment or investment in ICT goods.

[10] As in many firm-level datasets, we observe firm-level revenues and not prices and quantities separately. The productivity literature is dominated by two approaches to deal with this issue. One approach deflates firm-level revenues by an industry-level price index and thus estimates a revenue production function rather than an output production function. The other approach follows Klette and Griliches (1996) which amounts to adding the growth in industry output as an additional regressor. We follow the predominant approach in the literature and use the former.

6 Differences in regime-specific TFP distributions

The key point of departure in the literature on misallocation is the existence of tremendous differences in productivity across production units, even within narrowly defined industries (Syverson, 2011). In an economy with such heterogeneous production units, aggregate TFP depends not only on the TFP's of these individual production units but also on how inputs are allocated across production units. Section 6.1 reports substantial cross-national differences in the type of product and labor market competition and cross-industry differences in the degree of product and labor market imperfections. The latter two factors are believed to be empirically important sources of misallocation, especially in European countries. Viewed through the lens of the misallocation literature, Section 6.2 examines the importance of product and labor market competition in explaining TFP growth differences in a descriptive way. More specifically, to gain insight into the relevance of product and labor market settings in shaping TFP distributions, we explore whether any pattern can be observed in the moments of regime-specific productivity distributions.

6.1 Cross-national differences in regimes and within-regime industry differences in imperfections

We consider 32 comparable industries, 18 in manufacturing and 14 in services. Table B.3 in Appendix B presents the industry repartition of the estimation sample, and the number of observations and firms by industry and country. To determine the regime of competitiveness for each industry $j \in \{1, \ldots, 32\}$, we estimate the standard Cobb-Douglas production function by industry. Table B.4 in Appendix B summarizes the classification of industries in distinct regimes and Table B.5 provides details on the specific industries belonging to each regime.

We observe large cross-national variation in the wedges distorting the allocation of resources and, hence, in the prevalence of regimes characterizing the type of competition. The predominant regimes in BE are IC-EB (66% of the industries comprising 69% of the firms), IC-MO (13% of the industries comprising 9% of the firms) and PC-PR (9% of the industries comprising 11% of the firms). The predominant regimes in NL are IC-PR (44% of the industries comprising 67% of the firms), IC-MO (31% of the industries comprising 18% of the firms) and IC-EB (19% of the industries comprising 10% of the firms). The finding that industries in BE are predominantly characterized by wage determination under trade unions (i.e. EB-labor market setting) is compatible with industry-based unionism and high rates of trade union density and collective bargaining coverage. Higher labor market flexibility and less powerful unions might explain the dominant PR-labor market setting in NL.

Cross-national regime differences are driven by cross-national differences in the composition of industries making up the regimes. Indeed, comparing the prevalent regime of each industry across both countries reveals that 88.8% of manufacturing industries (16 out of 18) and 85.7% of service industries (12 out of 14) are characterized by a different regime, predominantly by a different labor market setting. This cross-national compositional variation in regimes might be driven by structural differences such as differences in the industry firm-size distribution and output-price rigidity (see Peters, 2013; Dias *et al.*, 2016).

By the same token, the degree of resource misallocation is expected to vary across industries within a particular regime in each country. Table 2 documents considerable heterogeneity in the degree of market imperfections in the most prevalent regimes, hence, confirming such varying degree of allocative efficiency.[11] Within the dominant IC-EB-regime in BE, the gap between the estimated output elasticities of labor and materials and their revenue shares $\left(\widehat{\psi}_j\right)$ is lower than 0.201 for industries in the first quartile and higher than 0.624 for industries in the third quartile. This variation results in large variation in the product and labor market imperfection parameters: $\widehat{\mu}_j$ is lower than 1.095 for the first quartile of industries and higher than 1.239 for the top quartile whereas $\widehat{\phi}_j$ is lower than 0.266 for the first quartile of industries and higher than 0.574 for the top quartile. The median values of $\widehat{\psi}_j$, $\widehat{\mu}_j$ and $\widehat{\phi}_j$ are estimated at 0.446, 1.157 and 0.422 respectively. Within the dominant IC-PR-regime in NL, $\widehat{\psi}_j$ is lower than -0.978 for the first quartile of industries and higher than -0.318 for the top quartile. Large variation in this wedge translates in substantial variation in the estimated price-cost mark-up: $\widehat{\mu}_j$ is lower than 1.130 for the first quartile of industries and higher than 1.288 for the top quartile. The median values of $\widehat{\psi}_j$ and $\widehat{\mu}_j$ are estimated at -0.812 and 1.188 respectively. A visual representation is given in Graph 1, which plots the cross-sectional association between industry-specific price-cost mark-up and joint market imperfections parameter estimates. The dashed lines denote the median values of these estimates and different regimes are represented by different symbols.

<Insert Table 2 & Graph 1 about here>

6.2 Cross-national cross-regime differences in TFP distributions

We now go from the micro features of the economy to aggregate performance and acknowledge that distortions in product and labor markets are likely to impact aggregate TFP via generating misallocation of resources. In particular, we revisit the potential relationship between our two sources of misallocation, being product and labor market imperfections, on the one hand and TFP growth on the other hand. We do so by exploiting variation in the prevalence of regimes in each country.

[11] Table 2 presents the industry mean and the industry quartile values of the SYS-GMM results. The left part reports the estimated industry-specific scale elasticity parameter, the middle part the estimated joint market imperfections parameter and the right part the relevant product and labor market imperfection parameters, i.e. the price-cost mark-up and the profit ratio within PC-PR and IC-PR, the price-cost mark-up, the profit ratio and the extent of rent sharing within IC-EB, and the price-cost mark-up, the profit ratio and the labor supply elasticity within IC-MO. The standard errors of the product and labor market imperfection parameters are computed using the Delta method (Wooldridge, 2002). Details on all industry-specific estimates of market imperfection parameters and output elasticities are available upon request.

Graph 2 presents kernel density estimates of regime-specific TFP distributions by country. Table 3 reports the moments (mean, variance, skewness and kurtosis) of the corresponding distributions. To gain insight into the relative contribution of product versus labor market settings in shaping regime-specific TFP distributions, Table 3 also displays the TFP distributional characteristics of the two product market settings (PC/IC) and the three labor market settings (PR/EB/MO). When discussing the moments of these distributions, we take the standard normal distribution as the benchmark. Within each country, regimes are ranked in decreasing order of prevalence in all tables and graphs in the remainder of this Section.

Regime-specific TFP distributions share two characteristics in both countries: the mass of the distributions is concentrated on the left (right-skewed) and the distributions have sharper peaks and heavier tails than a standard normal distribution, implying that most of the variance in TFP is due to extreme but infrequent deviations.[12]

Focusing on regime differences, average TFP growth rates vary between 1.3% (R=IC-MO) and 1.8% (R=PC-MO) in BE and between 0.5% (R=IC-EB) and 1.5% (R=IC-MO) in NL. The lowest dispersion is detected in the IC-PR-regime in both countries and the highest dispersion in the IC-EB-regime in BE and the PC-PR-regime in NL. In BE, the TFP distribution in the IC-PR-regime displays both the lowest positive skewness and positive excess kurtosis, while the TFP distribution in the PC-PR-regime the highest positive skewness and positive excess kurtosis. Compared to the dispersion, a reverse pattern is detected for both the skewness and the positive excess kurtosis in NL: the TFP distribution is less skewed to the right and is characterized by he lowest positive excess kurtosis in the PC-PR-regime, while most skewed to the right and characterized by the highest positive excess kurtosis in the IC-PR-regime. We interpret the observed cross-national cross-regime differences in TFP distributions as descriptive evidence of resource misallocation being an important source of cross-national differences in measured TFP, as emphasized in the literature.

Two main findings follow from our descriptive analysis. First, we do not observe a country-invariant ranking of regimes in terms of TFP distributional characteristics. In other words, we do not find a clear relationship between the type of competition prevailing in product and labor markets and moments of TFP that holds in both countries. Rather, the interaction between product and labor market characteristics and country specificities appears to generate variation in TFP distributions across regimes. For example, in BE, the interplay of market power on the product market side and market power on the labor demand side (IC-MO) generates a TFP distribution that is characterized by the lowest average TFP growth rate and relatively low dispersion, whereas market power on the product market side in conjunction with market power on the labor supply side (IC-EB) appears to shape such a TFP distribution in NL.

[12] In order to compare the distribution with a standard normal distribution, which has a kurtosis (k) of 3, the excess kurtosis (k^e) is defined as $k - 3$.

Second, TFP distributional characteristics are found to vary much more across regimes in NL than in BE. This is driven by much larger variation in the moments of TFP distributions across the three labor market settings in NL. For example, the average TFP growth rate in NL is only 0.5% if market power is consolidated on the labor supply side (i.e. if LMS=EB) but equals 1.5% if market power is consolidated on the labor demand side (i.e. if LMS=MO), with the PR-labor market setting lying in between.

<Insert Graph 2 and Table 3 about here>

To complement this descriptive analysis, we examined potential correlations between industry-specific moments of TFP distributions and corresponding industry-specific regimes. More specifically, we ran median regressions relating each industry-specific TFP distributional characteristic to dummies for the different product and labor market settings and the prevalent regimes in order to assess their importance in shaping industry-specific TFP distributions. For each TFP distributional characteristic (dependent variable), we estimated two specifications. In the first specification, we included 3 dummies: one for the IC-product market setting, one for the EB-labor market setting and one for the MO-labor market setting. As such, we take PMS=PC and LMS=PR as the benchmark in the product and labor markets, respectively. In the second specification, we included dummies for each of the prevalent regimes, except for R=PC-PR, which we consider to be the benchmark. Table 4 reports median regression coefficients for the two specifications using each of the 5 TFP distributional characteristics as the dependent variable.[13] Table B.6 in Appendix B reports the moments of all industry-specific TFP distributions.[14] In line with our descriptive results, the median regression estimates confirm the more pronounced role of labor market settings in shaping TFP distributions in NL. When including dummies for the prevalent labor market settings, we find that (*i*) industries characterized by efficient bargaining in the labor market appear to have a lower median value of TFP growth and (*ii*) TFP appears to be more unequally distributed in industries characterized by monopsony compared to industries characterized by the PR-labor market setting.

<Insert Table 4 about here>

Recent empirical work has provided evidence of resource misallocation being higher in services than in manufacturing (see Dias *et al.*, 2016 for references). Exploiting cross-national differences in the composition of industries making up the regimes, we examine the role of this compositional variation in explaining the observed differences in TFP distributions across countries and regimes. We decomposed the regimes to which both manufacturing and service industries belong into a manufacturing and a service part. Graph 3 presents kernel density estimates of TFP distributions

[13] Amoroso *et al.* (2015) only relate the *degree* of product and labor market power to TFP growth using Dutch firm-level panel data. They, however, impose a particular bargaining setting (efficient bargaining) on the data while our methodology allows for three labor market settings, thus letting the data determine both the *type* of competition prevailing in product and labor markets and the *degree* of product and labor market power.

[14] Within each regime, industries are ranked in increasing order of $\text{TFPGR}_{Mean,j}$. In addition to the TFP distributional characteristics used as dependent variables in the median regressions, Table B.6 also reports the 10^{th}, 25^{th}, 75^{th} and 90^{th} percentile values.

by country and by each of the prevalent regimes, split into a manufacturing and service part. Table 5 reports moments of the corresponding distributions. Let us concentrate the discussion on the first two moments.

In BE, we observe large variation in average TFP growth rates across regimes in both manufacturing and services. This variation, which is larger in services, predominantly originates from variation in average TFP growth rates across the three labor market settings. The largest average TFP growth rates are generated by LMS=PR in manufacturing whereas by LMS=MO in services. In both manufacturing and services, variation in TFP-dispersion across regimes originates from heterogeneity in dispersion across product as well as labor market settings. This variation is larger in manufacturing. The product market setting that generates the largest dispersion in manufacturing is PC whereas it is IC in services. The labor market setting that is responsible for generating inequality in TFP distributions is MO in manufacturing and EB in services.

In NL, the observed cross-regime variation in average TFP growth rates is much larger in services. These cross-regime differences are explained by variation in average TFP growth rates across product market settings in manufacturing, whereas they result from variation in average TFP growth rates across product as well as labor market settings in services. In particular, the IC-product market setting produces the largest average TFP growth rates in manufacturing, while these growth rates are generated by the PC-product market setting and, more importantly, the MO-labor market setting in services. In manufacturing, the relatively low cross-regime variation in TFP dispersion is mainly explained by variation across labor market settings with the PR-labor market setting producing the largest dispersion. In services, the cross-regime variation results from variation across both product and labor market settings with PMS=PC and LMS=MO generating the largest dispersion.

In BE, the manufacturing productivity premium amounts to 1.1 percentage points in the PC-PR-regime. In the IC-EB- and PC-MO-regimes, we observe a productivity premium in services with this premium being largest in the latter (2.2 percentage points). In NL, average TFP growth rates appear to be larger in manufacturing in the IC-PR- and IC-EB-regimes and larger in services in the IC-MO- and PC-PR-regimes. The largest manufacturing productivity premium is observed in the IC-EB-regime (1.4 percentage points) and the largest service productivity premium in the PC-PR-regime (2.6 percentage points). Except for the PC-MO-regime in BE and the dominant IC-PR-regime in NL, TFP appears to be more unequally distributed in services.

<Insert Graph 3 and Table 5 about here>

6.3 Correlations between TFP distributional characteristics and the degree of market imperfections

So far, we have focused on unravelling a potential link between the type of product and labor market imperfections and TFP distributional characteristics. Given evidence on sizeable within-regime industry heterogeneity in the degree of product and labor market imperfections (see Section 6.1), we examine in a descriptive way the potential link between the degree of market imperfections and different moments of TFP distributions. Table 6 reports correlations between TFP distributional characteristics and product and labor market imperfection parameters for all industries and for the industries within the product market settings, labor market settings and regimes that are most prevalent in both countries.[15] Two types of correlations are reported: Spearman's rank correlation coefficients and biweight midcorrelation coefficients. The latter, which is based on Wilcox (2005), gives a correlation that is less sensitive to outliers and therefore more robust.

Focusing on all industries, we observe a significantly positive robust correlation between median TFP growth rates and relative extent of rent sharing parameters ($\widehat{\gamma}_j$) in BE. Focusing on the IC-EB-regime, we find a significantly negative robust correlation between TFP dispersion and price-cost mark-up parameters ($\widehat{\mu}_j$) in BE and a significantly negative rank correlation between median TFP growth rates and $\widehat{\mu}_j$ in NL. Focusing on the IC-MO-regime, a significantly negative robust correlation is found between TFP dispersion and the relevant labor market imperfection parameters ($\widehat{\beta}_j$) in BE. In NL, we observe significantly positive rank and robust correlations between average TFP growth rates and $\widehat{\mu}_j$ and a significantly positive rank correlation between median TFP growth rates and $\widehat{\mu}_j$. In addition, a significantly positive robust correlation is detected between both the skewness and the peakedness of TFP distributions and $\widehat{\beta}_j$. Focusing on the IC-product market setting in isolation, we detect a significantly positive robust correlation between median TFP growth rates and price-cost mark-ups in BE which is found to be significantly negative but very small in NL.

<Insert Table 6 about here>

7 Conclusion

Variation in marginal products across firms within industries is a stylized fact in modern economies. This fact suggests the existence of distortions that generate misallocation of resources at the micro level. Such misallocation has been shown to contribute significantly to disparity of aggregate total factor productivity (TFP). Identifying two factors that are believed to be empirically important sources of misallocation, especially in European countries, and investigating their joint impact on TFP is at the core of our study. Viewed through the lens of the misallocation literature, this paper re-examines the potential relationship between competition and TFP by analyzing how the type and the degree of product and labor market imperfections shape TFP distributions.

We find large cross-country variation in the wedges distorting the allocation of resources and, hence, in the prevalence of regimes characterizing the type of competition. We observe cross-national cross-regime differences in TFP distributions, which we interpret as descriptive evidence of resource

[15] Evidently, the selection of PMS/LMS/regimes in each country is based on having a minimum number of industries belonging to these regimes in order to perform this descriptive exercise.

misallocation being an important source of cross-national differences in measured TFP. We do not observe a country-invariant ranking of regimes in terms of TFP distributional characteristics. Rather, the interaction between product and labor market settings and country specificities is found to generate variation in TFP distributions across regimes. In particular, the prevalent labor market setting appears to be more decisive in shaping regime-specific TFP distributions in the Netherlands. As a result, TFP distributional characteristics vary much more across regimes in that country. We also document the importance of the manufacturing-service distinction in driving variation in moments of regime-specific TFP distributions.

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Table 1: Descriptive statistics by country

BELGIUM (2003-2011)						
Variables	Mean	Sd	Q_1	Q_2	Q_3	N
Real firm output growth rate Δq_{it}	0.019	0.176	-0.062	0.018	0.100	29,944
Labor growth rate Δn_{it}	0.016	0.127	-0.038	0.000	0.064	29,944
Materials growth rate Δm_{it}	0.021	0.199	-0.073	0.019	0.113	29,944
Capital growth rate Δk_{it}	-0.041	0.229	-0.166	-0.068	0.064	29,944
$(\alpha_N)_j (\Delta n_{it} - \Delta k_{it}) + (\alpha_M)_j (\Delta m_{it} - \Delta k_{it})$	0.055	0.220	-0.070	0.067	0.188	29,944
$(\alpha_N)_j (\Delta k_{it} - \Delta n_{it})$	-0.012	0.054	-0.034	-0.012	0.011	29,944
SR_{it}	0.005	0.082	-0.031	0.005	0.041	29,944
Labor share in nominal output $(\alpha_N)_i$	0.204	0.158	0.090	0.161	0.272	34,775
Materials share in nominal output $(\alpha_M)_i$	0.703	0.187	0.603	0.746	0.844	34,775
Number of employees N_{it}	136	634	19	40	91	34,775
THE NETHERLANDS (1999-2012)						
Variables	Mean	Sd.	Q_1	Q_2	Q_3	N
Real firm output growth rate Δq_{it}	0.035	0.186	-0.053	0.026	0.113	22,904
Labor growth rate Δn_{it}	0.007	0.150	-0.042	0.000	0.051	22,904
Materials growth rate Δm_{it}	0.042	0.238	-0.067	0.030	0.140	22,904
Capital growth rate Δk_{it}	-0.027	0.371	-0.299	-0.031	0.247	22,904
$(\alpha_N)_j (\Delta n_{it} - \Delta k_{it}) + (\alpha_M)_j (\Delta m_{it} - \Delta k_{it})$	0.025	0.260	-0.172	0.029	0.227	22,904
$(\alpha_N)_j (\Delta k_{it} - \Delta n_{it})$	-0.006	0.072	-0.054	-0.007	0.041	22,904
SR_{it}	0.038	0.198	-0.086	0.030	0.153	22,904
Labor share in nominal output $(\alpha_N)_i$	0.190	0.109	0.109	0.173	0.252	28,088
Materials share in nominal output $(\alpha_M)_i$	0.536	0.200	0.408	0.548	0.683	28,088
Number of employees N_{it}	233	1431	29	61	140	28,088

Note: $SR_{it} = \Delta q_{it} - (\alpha_N)_j \Delta n_{it} - (\alpha_M)_j \Delta m_{it} - [1 - (\alpha_N)_j - (\alpha_M)_j]\Delta k_{it}$.

Table 2: Within-regime industry differences in imperfections by country

BELGIUM

Regime R=IC-EB [65.6% of industries, 68.9% of firms]	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$	$\widehat{\gamma}_j$	$\widehat{\phi}_j$
Industry mean	0.972 (0.043)	0.424 (0.280)	1.185 (0.089)	1.220 (0.087)	0.991 (0.541)	0.426 (0.195)
Industry Q_1	0.953 (0.024)	0.201 (0.203)	1.095 (0.044)	1.132 (0.054)	0.363 (0.360)	0.266 (0.077)
Industry Q_2	0.992 (0.036)	0.446 (0.241)	1.157 (0.083)	1.207 (0.081)	0.729 (0.495)	0.422 (0.126)
Industry Q_3	1.007 (0.056)	0.624 (0.288)	1.239 (0.121)	1.262 (0.123)	1.346 (0.619)	0.574 (0.254)

Regime R=IC-MO [12.5% of industries, 9.0% of firms]	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$	$\widehat{\beta}_j$	$\left(\widehat{\varepsilon}_w^N\right)_j$
Industry mean	0.973 (0.034)	-0.137 (0.333)	1.036 (0.084)	1.064 (0.084)	0.884 (0.258)	8.562 (25.67)
Industry Q_1	0.955 (0.021)	-0.183 (0.306)	0.996 (0.053)	1.043 (0.062)	0.847 (0.239)	5.539 (11.42)
Industry Q_2	0.964 (0.023)	-0.140 (0.341)	1.035 (0.068)	1.070 (0.076)	0.883 (0.265)	8.338 (21.74)
Industry Q_3	0.992 (0.046)	-0.092 (0.360)	1.077 (0.115)	1.086 (0.105)	0.920 (0.277)	11.58 (39.92)

Regime R=PC-PR [9.4% of industries, 10.5% of firms]	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$
Industry mean	0.987 (0.033)	-0.582 (0.320)	0.975 (0.078)	0.989 (0.088)
Industry Q_1	0.953 (0.019)	-0.902 (0.177)	0.913 (0.025)	0.919 (0.027)
Industry Q_2	0.976 (0.033)	-0.587 (0.325)	0.948 (0.101)	0.958 (0.112)
Industry Q_3	1.031 (0.050)	-0.257 (0.457)	1.064 (0.108)	1.090 (0.124)

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Regime R=IC-PR [43.7% of industries, 66.6% of firms]	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$
Industry mean	1.037 (0.042)	-0.697 (0.414)	1.210 (0.134)	1.168 (0.134)
Industry Q_1	1.010 (0.028)	-0.978 (0.326)	1.130 (0.058)	1.054 (0.074)
Industry Q_2	1.041 (0.036)	-0.812 (0.419)	1.188 (0.078)	1.170 (0.082)
Industry Q_3	1.072 (0.044)	-0.318 (0.509)	1.288 (0.166)	1.264 (0.141)

Regime R=IC-MO [31.2% of industries, 17.9% of firms]	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$	$\widehat{\beta}_j$	$\left(\widehat{\varepsilon}_w^N\right)_j$
Industry mean	1.023 (0.120)	-0.724 (2.771)	1.211 (0.320)	1.187 (0.324)	0.703 (0.568)	4.922 (15.86)
Industry Q_1	0.961 (0.035)	-0.749 (0.385)	1.111 (0.112)	1.081 (0.132)	0.624 (0.242)	1.660 (3.873)
Industry Q_2	0.981 (0.046)	-0.425 (0.622)	1.197 (0.148)	1.165 (0.187)	0.724 (0.314)	2.633 (6.048)
Industry Q_3	1.104 (0.076)	-0.118 (1.950)	1.318 (0.503)	1.287 (0.334)	0.899 (0.441)	8.866 (39.98)

Regime R=IC-EB [18.7% of industries, 10.1% of firms]	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$	$\widehat{\gamma}_j$	$\widehat{\phi}_j$
Industry mean	0.988 (0.043)	0.372 (0.495)	1.617 (0.212)	1.634 (0.230)	0.192 (0.220)	0.135 (0.170)
Industry Q_1	0.950 (0.033)	0.119 (0.358)	1.337 (0.100)	1.425 (0.117)	0.044 (0.163)	0.042 (0.132)
Industry Q_2	0.988 (0.043)	0.166 (0.512)	1.504 (0.1874)	1.544 (0.203)	0.081 (0.229)	0.075 (0.201)
Industry Q_3	1.002 (0.057)	0.421 (0.587)	1.763 (0.245)	1.664 (0.218)	0.238 (0.256)	0.192 (0.215)

Note: $\widehat{\lambda}_j$ denotes the industry-specific scale elasticity parameter and $\widehat{\psi}_j$ the joint market imperfections parameter. The corresponding product and labor market imperfection parameter estimates are $\widehat{\mu}_j$ (price-cost mark-up) and $\widehat{\phi}_j$ (absolute extent of rent sharing) or $\left(\widehat{\varepsilon}_w^N\right)_j$ (labor supply elasticity).

Table 3: TFP distributions by country, and by product/labor market setting and regime

	BELGIUM										THE NETHERLANDS								
TFPGR	**PC**	**IC**	**PR**	**EB**	**MO**	**IC-EB**	**IC-MO**	**PC-PR**	**PC-MO**	**IC-PR**	**PC**	**IC**	**PR**	**EB**	**MO**	**IC-PR**	**IC-MO**	**IC-EB**	**PC-PR**
Mean	0.017	0.015	0.015	0.015	0.016	0.015	0.013	0.015	0.018	0.017	0.013	0.011	0.011	0.005	0.015	0.011	0.015	0.005	0.013
Sd	0.192	0.203	0.184	0.209	0.182	0.209	0.170	0.190	0.194	0.149	0.303	0.238	0.232	0.254	0.273	0.227	0.273	0.254	0.303
Skewness	2.773	2.260	2.823	2.227	2.603	2.227	2.447	2.864	2.673	2.099	0.651	1.862	2.079	0.795	1.280	2.287	1.280	0.795	0.651
Kurtosis	18.150	17.274	20.881	16.796	17.222	16.796	19.804	21.035	15.128	11.977	4.777	16.994	20.096	6.035	8.882	22.687	8.882	6.035	4.777
p10	-0.145	-0.156	-0.154	-0.158	-0.142	-0.158	-0.154	-0.157	-0.123	-0.127	-0.301	-0.222	-0.215	-0.75	-0.254	-0.208	-0.254	-0.275	-0.301
p25	-0.077	-0.088	-0.088	-0.088	-0.073	-0.088	-0.087	-0.091	-0.066	-0.070	-0.174	-0.117	-0.114	-0.147	-0.135	-0.110	-0.135	-0.147	-0.174
p50	-0.020	-0.018	-0.015	-0.019	-0.018	-0.019	-0.011	-0.016	-0.023	-0.004	-0.020	-0.014	-0.014	-0.013	-0.016	-0.013	-0.016	-0.013	-0.020
p75	0.066	0.076	0.077	0.075	0.070	0.075	0.082	0.077	0.077	0.077	0.171	0.106	0.101	0.131	0.128	0.098	0.128	0.131	0.171
p90	0.210	0.219	0.208	0.223	0.200	0.223	0.198	0.218	0.203	0.163	0.389	0.273	0.265	0.303	0.325	0.254	0.325	0.303	0.389

Table 4: Median regression: Correlations between TFP distributional characteristics, and product/labor market settings and regimes by country

	Specification 1			**Specification 2**			
	BELGIUM						
$\widehat{\beta}(\mathbf{0.50})$	**IC**	**EB**	**MO**	**IC-PR**	**IC-EB**	**PC-MO**	**IC-MO**
$\text{TFPGR}_{Mean,j}$	0.010	-0.002	-0.004	0.010	0.008	-0.004	0.000
$\text{TFPGR}_{p50,j}$	0.023**	-0.017	-0.009	0.011	-0.006	-0.020	0.003
$\text{TFPGR}_{Sd,j}$	-0.035	0.041	0.024	-0.035	0.006	0.005	-0.011
$\text{TFPGR}_{Skew,j}$	-0.893	-0.500	-0.310	0.967	0.468	1.550	0.657
$TFPGR_{Kurt,j}$	-5.034	-3.788	-2.425	6.693	2.905	9.301	4.268
	THE NETHERLANDS						
$\widehat{\beta}(\mathbf{0.50})$	**IC**	**EB**	**MO**	**IC-PR**	**IC-EB**		**IC-MO**
$\text{TFPGR}_{Mean,j}$	0.009	-0.006	-0.004	0.009	0.003		0.005
$\text{TFPGR}_{p50,j}$	0.017	-0.029***	-0.009	0.017	-0.012		0.008
$\text{TFPGR}_{Sd,j}$	-0.025	0.066	0.100**	-0.025	0.040		0.075
$\text{TFPGR}_{Skew,j}$	0.146	-0.034	0.269	0.146	0.112		0.415
$\text{TFPGR}_{Kurt,j}$	1.449	-1.333	-0.508	1.449	0.116		0.941

Note: ***Significant at 1%, **Significant at 5%, *Significant at 10%.

Table 5: TFP distributions by country, product/labor market setting, regime & manufacturing/services

	BELGIUM										THE NETHERLANDS								
	MANUFACTURING										MANUFACTURING								
TFPGR	**PC**	**IC**	**PR**	**EB**	**MO**	**IC-EB**	**IC-MO**	**PC-PR**	**PC-MO**	**IC-PR**	**PC**	**IC**	**PR**	**EB**	**MO**	**IC-PR**	**IC-MO**	**IC-EB**	**PC-PR**
Mean	0.013	0.013	0.017	0.012	0.011	0.012	0.013	0.017	0.003	0.017	-0.000	0.013	0.014	0.010	0.011	0.015	0.011	0.010	0.000
Sd	0.200	0.165	0.176	0.164	0.190	0.164	0.170	0.182	0.245	0.149	0.247	0.241	0.246	0.209	0.240	0.246	0.240	0.209	0.247
Skewness	2.806	2.351	3.404	2.320	2.200	2.320	2.447	3.537	1.777	2.099	0.560	2.139	2.450	0.762	0.958	2.576	0.958	0.762	0.560
Kurtosis	18.813	17.165	26.189	16.111	15.031	16.111	19.804	27.097	8.441	11.977	4.772	21.283	24.559	7.232	6.778	25.851	6.778	7.232	4.772
p10	-0.162	-0.147	-0.141	-0.145	-0.169	-0.145	-0.154	-0.144	-0.242	-0.127	-0.277	-0.227	-0.228	-0.220	-0.241	-0.225	-0.241	-0.220	-0.277
p25	-0.098	-0.085	-0.083	-0.086	-0.099	-0.086	-0.087	-0.086	-0.132	-0.070	-0.158	-0.120	-0.120	-0.118	-0.133	-0.118	-0.133	-0.118	-0.158
p50	-0.018	-0.013	-0.013	-0.015	-0.016	-0.015	-0.011	-0.015	-0.037	-0.004	-0.022	-0.010	-0.011	-0.005	-0.013	-0.011	-0.013	-0.005	-0.022
p75	0.075	0.079	0.074	0.078	0.083	0.078	0.082	0.071	0.085	0.077	0.130	0.115	0.111	0.121	0.129	0.111	0.129	0.121	0.130
p90	0.219	0.192	0.187	0.193	0.218	0.193	0.198	0.199	0.297	0.163	0.320	0.275	0.272	0.268	0.303	0.268	0.303	0.268	0.320
	SERVICES										SERVICES								
TFPGR	**PC**	**IC**	**PR**	**EB**	**MO**	**IC-EB**		**PC-PR**	**PC-MO**		**PC**	**IC**	**PR**	**EB**	**MO**	**IC-PR**	**IC-MO**	**IC-EB**	**PC-PR**
Mean	0.021	0.017	0.006	0.017	0.025	0.017		0.006	0.025		0.026	0.009	0.009	-0.004	0.022	0.008	0.022	-0.004	0.026
Sd	0.180	0.229	0.226	0.229	0.165	0.229		0.226	0.165		0.349	0.235	0.216	0.320	0.324	0.203	0.324	0.320	0.349
Skewness	2.700	2.124	0.996	2.124	3.831	2.124		0.996	3.831		0.594	1.489	1.439	0.782	1.409	1.609	1.409	0.782	0.594
Kurtosis	16.301	15.222	5.789	15.522	23.671	15.522		5.789	23.676		4.140	11.040	10.914	4.430	8.752	12.384	8.752	4.430	4.140
p10	-0.100	-0.168	-0.230	-0.168	-0.080	-0.168		-0.230	-0.080		-0.339	-0.216	-0.200	-0.365	-0.293	-0.189	-0.293	-0.365	-0.339
p25	-0.061	-0.089	-0.140	-0.089	-0.054	-0.089		-0.140	-0.054		-0.188	-0.113	-0.108	-0.212	-0.139	-0.105	-0.139	-0.212	-0.188
p50	-0.021	-0.020	-0.027	-0.020	-0.020	-0.020		-0.027	-0.020		-0.019	-0.018	-0.016	-0.041	-0.019	-0.016	-0.019	-0.041	-0.019
p75	0.053	0.073	0.112	0.073	0.037	0.073		0.112	0.037		0.213	0.093	0.090	0.161	0.127	0.086	0.127	0.161	0.213
p90	0.198	0.245	0.310	0.245	0.170	0.245		0.310	0.170		0.479	0.267	0.253	0.391	0.406	0.237	0.406	0.391	0.479

Table 6: Correlations between industry-specific TFP distributional characteristics and estimates of product and labor market imperfections by country

	$TFPGR_{Mean,j}$	$TFPGR_{p50,j}$	$TFPGR_{Sd,j}$	$TFPGR_{Skew,j}$	$TFPGR_{Kurt,j}$
BELGIUM					
All industries					
$\widehat{\psi}_j$	-0.074 [0.190]	0.017 [0.252]	0.090 [-0.310]	-0.006 [-0.104]	0.100 [-0.004]
$\widehat{\mu}_j$	0.079 [0.314]	0.054 [0.289]	0.077 [-0.328]	0.031 [-0.052]	0.026 [0.077]
$\widehat{\gamma}_j$	-0.085 [0.209]	0.083 [0.308*]	0.000 [-0.372]	-0.023 [-0.016]	0.051 [0.050]
$\widehat{\beta}_j$	-0.092 [0.137]	0.023 [0.148]	0.068 [-0.308]	-0.020 [-0.078]	0.089 [-0.029]
PMS=IC					
$\widehat{\psi}_j$	-0.240 [0.207]	-0.227 [0.266]	0.215 [-0.347]	-0.025 [-0.072]	0.069 [-0.057]
$\widehat{\mu}_j$	0.006 [0.329]	-0.178 [0.301*]	0.193 [-0.366**]	0.017 [-0.006]	-0.056 [0.039]
LMS=MO					
$\widehat{\psi}_j$	0.750** [0.467]	0.500 [0.445]	-0.821** [-0.448]	0.357 [-0.207]	0.286 [-0.086]
$\widehat{\mu}_j$	0.321 [0.627]	0.393 [0.605]	-0.500 [-0.520]	0.393 [-0.111]	0.464 [0.044]
$\widehat{\beta}_j$	0.607 [0.432]	0.393 [0.397]	-0.857*** [-0.462*]	0.321 [-0.095]	0.250 [-0.068]
LMS=EB≡R=IC-EB					
$\widehat{\psi}_j$	-0.300 [0.132]	-0.132 [0.224]	0.221 [-0.308]	-0.061 [-0.041]	0.087 [-0.023]
$\widehat{\mu}_j$	-0.012 [0.252]	-0.082 [0.227]	0.204 [-0.310**]	-0.058 [0.005]	-0.169 [0.051]
$\widehat{\gamma}_j$	-0.348 [0.152]	-0.006 [0.291]	0.069 [-0.369]	-0.134 [0.035]	-0.075 [0.022]
R=IC-MO					
$\widehat{\psi}_j$	0.200 [0.452]	0.400 [0.366]	-0.800 [-0.459**]	-0.200 [-0.210]	-0.200 [-0.210]
$\widehat{\mu}_j$	-0.400 [0.593]	-0.800 [0.543]	-0.400 [-0.548]	0.400 [-0.035]	0.400 [0.002]
$\widehat{\beta}_j$	-0.400 [0.396]	-0.200 [0.337]	-1.000 [-0.441*]	-0.400 [-0.098]	-0.400 [-0.128]
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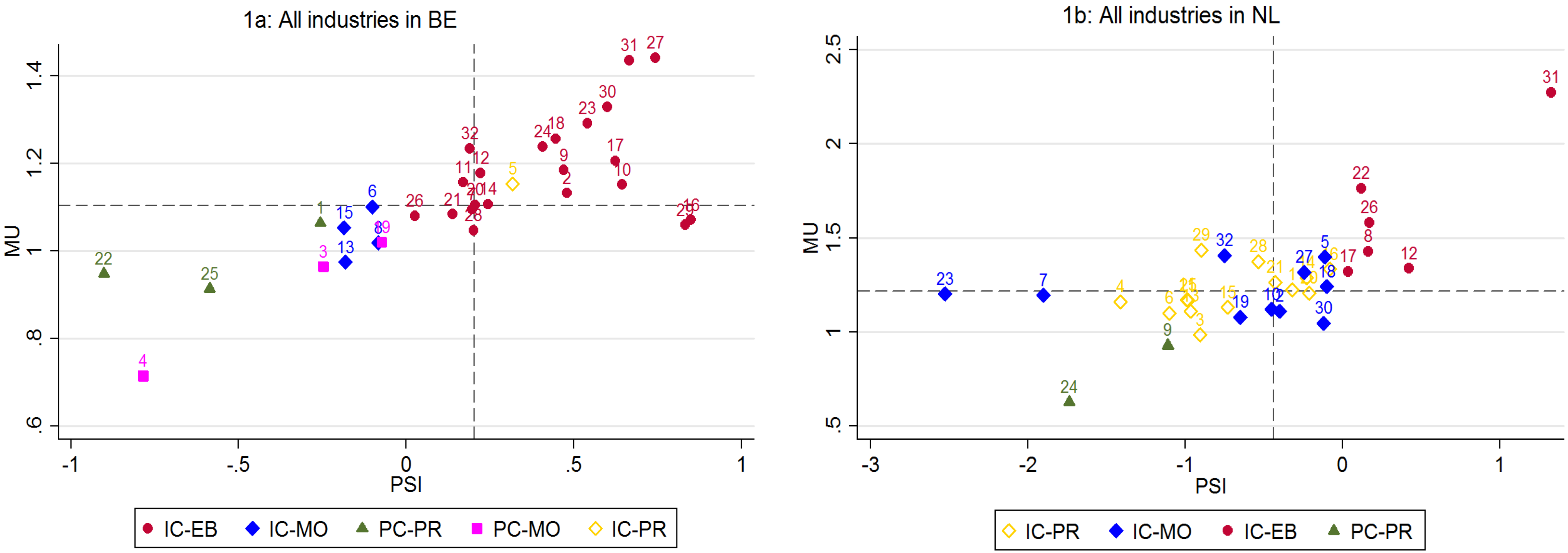
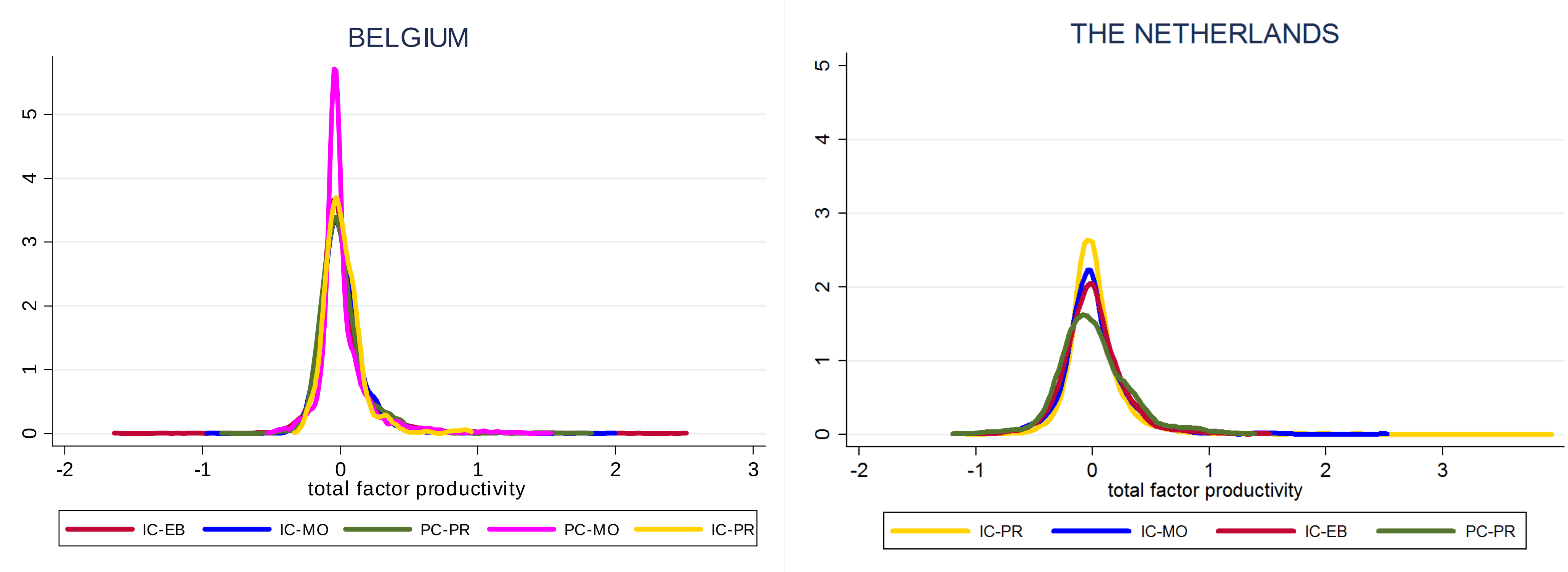
	$TFPGR_{Mean,j}$	$TFPGR_{p50,j}$	$TFPGR_{Sd,j}$	$TFPGR_{Skew,j}$	$TFPGR_{Kurt,j}$
All industries					
$\widehat{\psi}_j$	-0.129 [0.312]	-0.068 [0.137]	-0.083 [0.038]	0.195 [0.073]	0.272 [0.127]
$\widehat{\mu}_j$	0.086 [0.271]	0.088 [-0.018]	0.189 [0.146]	-0.016 [0.156]	-0.099 [0.126]
$\widehat{\gamma}_j$	-0.077 [0.357]	-0.038 [0.064]	-0.013 [0.186]	0.214 [0.140]	0.266 [0.132]
$\widehat{\beta}_j$	-0.106 [0.335]	-0.056 [0.156]	-0.050 [0.032]	0.197 [0.120]	0.256 [0.203]
PMS=IC					
$\widehat{\psi}_j$	-0.158 [0.315]	-0.150 [0.132*]	-0.012 [0.057]	0.156 [0.074]	0.236 [0.126]
$\widehat{\mu}_j$	0.108 [0.279]	0.033 [-0.028**]	0.284 [0.160]	-0.051 [0.221]	-0.151 [0.129]
LMS=MO≡R=IC-MO					
$\widehat{\psi}_j$	0.067 [0.297]	0.164 [0.124]	-0.515 [0.051]	0.551*[0.083]	0.612* [0.143]
$\widehat{\mu}_j$	0.576* [0.244**]	0.709** [-0.129]	0.139 [0.127]	-0.079 [0.279]	0.006 [0.215]
$\widehat{\beta}_j$	0.079 [0.327]	0.248 [0.124]	-0.454 [0.056]	0.479 [0.140**]	0.539* [0.225**]
LMS=EB≡R=IC-EB					
$\widehat{\psi}_j$	0.543 [0.238]	-0.600 [0.117]	0.486 [-0.130]	0.543 [0.076]	0.371 [0.211]
$\widehat{\mu}_j$	-0.314 [0.184]	-0.771* [0.052]	0.657 [0.040]	0.200 [0.124]	-0.143 [0.128]
$\widehat{\gamma}_j$	0.543 [0.276]	-0.600 [0.078]	0.486 [0.038]	0.543 [0.113]	0.371 [0.193]

Notes: Rank correlation is reported. A robust correlation is reported in square brackets.
***Significant at 1%, **Significant at 5%, *Significant at 10%.

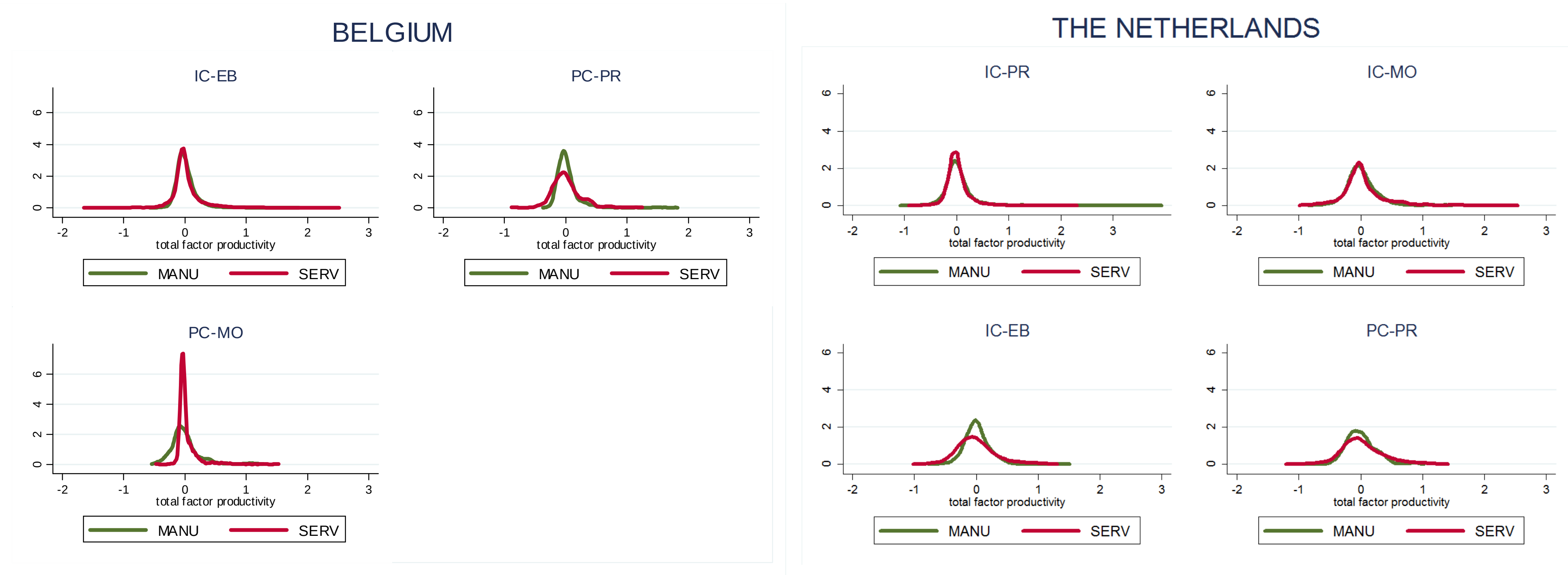
Graph 1: Within-regime industry differences in imperfections by country



Graph 2: Distribution of total factor productivity, by country and regime



Graph 3: Distribution of total factor productivity, by country, regime and manufacturing/services



Theoretical appendix A

In this Appendix, we derive the first-order condition with respect to labor under each labor market setting (perfect competition or right-to-manage bargaining (PR), efficient bargaining (EB) and monopsony (MO)). To simplify notation, we do not use firm and time indices.

A.1 Output elasticity of labor under PR

In a *perfectly competitive labor market* model, a firm takes the exogenously-determined market wage w as given. Assuming that material input and labor are static inputs in production, free of adjustment costs, the short-run profit function of a representative firm that operates under imperfect competition in the product market is given by: $\pi = R - wN - jM$, with R total revenue, N labor, M material input, and w and j the prices of labor and material input, respectively. Short-run profit maximization with respect to labor implies: $\varepsilon_N^Q = \mu\alpha_N$ [Eq. (4) in the main text].

In the *right-to-manage bargaining model*, labor is also unilaterally determined by the firm from short-run profit maximization, which implies the same static first-order condition with respect to labor as in the perfectly competitive labor market model.

A.2 Output elasticity of labor under EB

The *efficient bargaining model* assumes that the risk-neutral workers and risk-neutral firm negotiate simultaneously over wages and employment in order to maximize the joint surplus of their economic activity. The generalized Nash product is written as:

$$\Omega_{EB} = \left\{Nw + \left(\overline{N} - N\right)\overline{w} - \overline{N}\overline{w}\right\}^{\phi} \left\{R - wN - jM\right\}^{1-\phi} \tag{A.1}$$

with $\overline{N}$ the competitive employment level $(0 < N \leq \overline{N})$, $\overline{w}$ the worker's alternative market wage in the event of a breakdown in bargaining and ϕ the degree of workers' bargaining power during work-firm negotiations or the absolute extent of rent sharing.

Maximization of Eq. (A.1) with respect to the wage rate gives the following first-order condition:

$$w = \overline{w} + \gamma \left[\frac{R - wN - jM}{N}\right] \tag{A.2}$$

with $\gamma = \frac{\phi}{1-\phi}$ the relative extent of rent sharing.

Maximization of Eq. (A.1) with respect to labor gives the following first-order condition:

$$w = R_N + \phi \left[\frac{R - R_N N - jM}{N}\right] \tag{A.3}$$

with R_N the marginal revenue of labor.

Solving simultaneously the first-order conditions with respect to the wage rate and labor leads to the following expression for the contract curve:

$$R_N = \overline{w} \tag{A.4}$$

Eq. (A.4) shows that under risk neutrality, the firm's decision about employment equals the one of a (non-bargaining) neoclassical firm that maximizes its short-run profit at the alternative wage. Put differently, the firm hires workers until the marginal revenue of labor is equal to the wage a worker would receive if fired, i.e. the employment level does not depend on the bargained wage.

Let us denote the marginal revenue by R_Q and the marginal product of labor by Q_N. Given that $\mu = \frac{P}{R_Q}$ in equilibrium (where P is the output price), the marginal revenue of labor can be expressed as follows: $R_N = R_Q \times Q_N = R_Q \times \varepsilon_N^Q \times \frac{Q}{N} = \frac{PQ_N}{\mu}$. Using this expression together with Eq. (A.4), the elasticity of output with respect to labor can be written as:

$$\varepsilon_N^Q = \mu\overline{\alpha}_N \tag{A.4}$$

with $\overline{\alpha}_N = \frac{\overline{w}N}{PQ}$ the labor share evaluated at the reservation wage. Given that we can rewrite Eq. (A.2) as $\alpha_N = \overline{\alpha}_N + \gamma(1 - \alpha_N - \alpha_M)$, we obtain the following expression for the output elasticity with respect to labor:

$$\varepsilon_N^Q = \mu\alpha_N - \mu\gamma(1 - \alpha_N - \alpha_M) \tag{A.5}$$

Eq. (A.5) is equivalent to Eq. (5) in the main text.

A.3 Output elasticity of labor under MO

So far, we have assumed that there is a potentially infinite supply of employees wanting a job in the firm. A small wage cut by the employer will result in the immediate resignation of all existing workers. However, the *monopsony model* postulates that there are a number of reasons why labor supply might be less than perfectly elastic, creating rents to jobs. Paramount among these are the absence of perfect information on alternative possible jobs, moving costs and heterogeneous worker preferences for job characteristics on the supply side, and efficiency wages with diseconomies of scale in monitoring and entry costs on the part of competing firms on the demand side. All these factors give employers non-negligible market power over their workers.

Let us consider a firm that operates under imperfect competition in the product market and faces a labor supply $N(w)$, which is an increasing function of the wage w. Both $N(w)$ and the inverse of this relationship $w(N)$ are referred to as the labor supply curve of this monopsonist firm. The firm's objective is to maximize its short-run profit function, taking the labor supply curve as given:

$$\max_{N,\,M} \pi = R - w(N)\,N - jM \tag{A.6}$$

Maximization with respect to labor gives the following first-order condition:

$$w = \beta R_N \tag{A.7}$$

where $\beta = \frac{\varepsilon_w^N}{1+\varepsilon_w^N}$ and $\varepsilon_w^N \in \Re_+$ represents the wage elasticity of the labor supply. Rewriting Eq. (A.7) and using that $R_N = \frac{PQ_N}{\mu}$ gives the following expression for the elasticity of output with respect to labor:

$$\varepsilon_N^Q = \mu\alpha_N \left(1 + \frac{1}{\varepsilon_w^N}\right) \tag{A.8}$$

Eq. (A.8) is equivalent to Eq. (6) in the main text.

Statistical appendix B

Classification procedure

Classification procedure:	Statistical significance level	Null hypothesis not rejected
Hypothesis test for product market setting (PMS): H_0: $\mu_j - 1 > 0.10$ against H_a: $\mu_j - 1 \leq 0.10$	5%	PMS=IC
Hypothesis test for EB-labor market setting (LMS): H_0: $\psi_j > 0.30$ against H_a: $\psi_j \leq 0.30$	5%	LMS=EB
Hypothesis test for MO-labor market setting (LMS): H_0: $\psi_j < -0.30$ against H_a: $\psi_j \geq -0.30$	5%	LMS=MO

Table B.1: Underpinnings of common threshold of $|0.30|$ for ψ_j by country

BELGIUM				
	Mean	Q_1	Q_2	Q_3
$(\alpha_N)_j$	0.204	0.090	0.161	0.272
$(\alpha_M)_j$	0.703	0.603	0.746	0.844
$(\alpha_K)_j$	0.093	0.037	0.067	0.115
$\left(\widehat{\varepsilon}_N^Q\right)_j$	0.229	0.137	0.213	0.310
$\left(\widehat{\varepsilon}_M^Q\right)_j$	0.712	0.650	0.732	0.807
$\left(\widehat{\varepsilon}_K^Q\right)_j$	0.028	0.008	0.022	0.033
$\widehat{\gamma}_j$	0.650	0.677	0.735	0.742
$\widehat{\phi}_j$	0.394	0.404	0.424	0.426
$\widehat{\beta}_j$	0.771	0.782	0.766	0.761
$\left(\widehat{\varepsilon}_w^N\right)_j$	3.376	3.593	3.271	3.187
THE NETHERLANDS				
	Mean	Q_1	Q_2	Q_3
$(\alpha_N)_j$	0.190	0.109	0.173	0.252
$(\alpha_M)_j$	0.536	0.408	0.548	0.683
$(\alpha_K)_j$	0.273	0.180	0.265	0.351
$\left(\widehat{\varepsilon}_N^Q\right)_j$	0.402	0.290	0.384	0.482
$\left(\widehat{\varepsilon}_M^Q\right)_j$	0.558	0.478	0.568	0.659
$\left(\widehat{\varepsilon}_K^Q\right)_j$	0.060	0.020	0.057	0.093
$\widehat{\gamma}_j$	0.201	0.155	0.189	0.223
$\widehat{\phi}_j$	0.167	0.134	0.159	0.182
$\widehat{\beta}_j$	0.776	0.796	0.776	0.763
$\left(\widehat{\varepsilon}_w^N\right)_j$	3.470	3.905	3.455	3.216

Notes: This table shows that when we choose a common threshold of $|0.30|$ for $|\psi_{j0}|$, the average values of industry-specific labor market imperfection parameters are economically meaningful for both countries. E.g. the average value for $\widehat{\gamma}_j$ in BE is computed as: $\widehat{\gamma}_j = 0.30\frac{(\alpha_M)_j}{\left(\widehat{\varepsilon}_M^Q\right)_j}\frac{(\alpha_N)_j}{(\alpha_K)_j} = 0.650$, implying that the average value of $\widehat{\phi}_j$ equals 0.394.

Table B.2: Estimation sample by country: Panel structure, industry and firm size distribution

	BELGIUM				THE NETHERLANDS			
	# obs.	%	# firms	%	# obs.	%	# firms	%
# OF PARTICIPATIONS$^{a)}$								
3	1,071	3.08	357	7.39	3,378	12.03	1,126	21.55
4	1,300	3.74	325	6.72	4,422	15.74	1,105	21.15
5	1,955	5.62	391	8.09	4,466	15.90	892	17.07
6	2,448	7.04	408	8.44	4,060	14.45	676	12.94
7	4,067	11.70	581	12.02	3,780	13.46	540	10.33
8	8,112	23.33	1,014	20.98	3,176	11.31	397	7.60
9	15,822	45.50	1,758	36.37	2,151	7.66	239	4.57
10					1,450	5.16	145	2.78
11					748	2.66	68	1.30
12					300	1.07	25	0.48
13					143	0.51	11	0.21
14					14	0.05	1	0.02
INDUSTRY BY TECHNOLOGICAL INTENSITY								
High-tech manufacturing (HTM)	634	1.82	82	1.70	493	1.76	79	1.51
Medium-high-tech manufacturing (MHTM)	3,632	10.44	479	9.91	3,506	12.48	559	10.70
Medium-low-tech manufacturing (MLTM)	5,223	15.02	692	14.32	5,859	20.86	1,026	19.64
Low-tech manufacturing (LTM)	6,929	19.93	928	19.20	5,609	19.97	978	18.72
High-tech knowledge-intensive services (HTKIS)	1,861	5.35	284	5.8	889	3.17	222	4.25
Knowledge-intensive market services (KIMS)	2,743	7.89	426	8.81	1,575	5.61	405	7.75
Other knowledge-intensive services (OKIS)	366	1.05	49	1.01	487	1.73	96	1.84
Less knowledge-intensive market services (LKIMS)	13,387	38.50	1,894	39.18	9,670	34.43	1,860	36.60
FIRM SIZE								
10-19	9,194	26.44	1,596	33.02	3,844	13.69	1,138	21.78
20-49	11,202	32.21	1,579	32.66	8,368	29.86	1,655	31.67
50-99	6,424	18.47	776	16.05	6,286	22.38	1,002	19.18
100-249	4,800	13.80	533	11.03	5,609	19.97	849	16.25
250-500	1,743	5.01	187	3.87	1,976	7.04	294	5.63
500-999	857	2.46	99	2.05	1,080	3.85	159	3.04
1000+	555	1.60	64	1.32	907	3.23	128	2.45
Total	34,775	100.0	4,834	100.0	28,088	100.0	5,225	100.0

Note: a) Median number of observations per firm: 8 [BE] and 5 [NL].

Table B.3: Detailed industry repartition by country

				BELGIUM				THE NETHERLANDS			
Ind. j	Name	NACE Rev. 2	$\text{Ind}_{tech}^{a)}$	# obs.	%	# firms	%	# obs.	%	# firms	%
1	Food	10-12	LTM	3,179	9.14	417	8.63	2,702	9.62	446	8.54
2	Textile, wearing apparel & leather (products)	13-15	LTM	1,209	3.48	172	3.56	428	1.52	83	1.59
3	Wood (products)	16	LTM	502	1.44	67	1.39	522	1.86	92	1.76
4	Paper (products)	17	LTM	543	1.56	68	1.41	593	2.11	97	.86
5	Printing and reproduction of recorded media	18	LTM	713	2.05	99	2.05	749	2.67	143	2.74
6	Chemicals	19-20	MHTM	1,571	4.52	196	4.05	974	3.47	148	2.83
7	Pharmaceutical products & preparations	21	HTM	273	0.79	36	0.74	92	0.33	14	0.27
8	Rubber and plastic products	22	MLTM	1,020	2.93	129	2.67	1,141	4.06	170	3.25
9	Other non-metallic mineral products	23	MLTM	1,199	3.45	160	3.31	669	2.38	113	2.16
10	Basic metals	24	MLTM	622	1.79	78	1.61	328	1.17	53	1.01
11	Fabricated metal products	25	MLTM	2,113	6.08	287	5.94	2,350	8.37	424	8.11
12	Computer, electronic and optical products	26	HTM	314	0.90	40	0.83	385	1.37	63	1.21
13	Electrical equipment	27	MHTM	403	1.16	55	1.14	371	1.32	62	1.19
14	Machinery and equipment, n.e.c.	28	MHTM	1,121	3.22	155	3.21	1,510	5.38	234	4.8
15	Motor vehicles & other transport equipment	29-30	MHTM	442	1.27	57	1.18	581	2.07	98	1.88
16	Furniture	31	LTM	600	1.73	78	1.61	557	1.98	104	199
17	Other manufacturing, n.e.c.	32	LTM	338	0.97	51	1.06	332	1.18	60	1.15
18	Repair and installation of machinery and equipment	33	MLTM	256	0.74	36	0.74	1,183	4.21	238	4.56
19	Wholesale, retail trade & repair of motor vehicles	45	LKIMS	2,274	6.54	324	6.70	568	2.02	147	2.81
20	Wholesale	46	LKIMS	6,053	17.41	837	7.31	5,365	19.10	981	18.78
21	Retail	47	LKIMS	3,203	9.21	462	9.56	2,880	10.25	535	10.24
22	Publishing activities	58	OKIS	357	1.03	48	0.99	462	1.64	88	1.68
23	Programming and broadcasting & telecommunications	59-61	HTKIS	462	1.33	66	1.37	117	0.42	29	0.56
24	Computer programming & information service activities	62-63	HTKIS	1,345	3.87	209	4.32	694	2.47	170	3.25
25	Legal and accounting activities	69	KIMS	265	0.76	41	0.85	175	0.62	48	0.92
26	Head offices & management consultancy activities	70	KIMS	775	2.23	131	2.71	193	0.69	54	1.03
27	Research & development	71-72	KIMS	704	2.02	106	2.19	574	2.04	144	2.76
28	Adverstising, market research & & other professional activities	73-75	KIMS	656	1.89	99	2.05	538	1.92	137	2.62
29	Rental & leasing activities	77	LKIMS	577	1.66	83	1.72	338	1.20	74	1.4
30	Employment activities	78-79	KIMS	403	1.16	58	1.20	224	0.80	60	1.15
31	Buildings & landscape activities	80-81	LKIMS	516	1.48	76	1.57	387	1.38	91	1.74
32	Other business related activities	82	LKIMS	767	2.21	113	2.34	106	0.38	25	0.48
Total				34,775	100.0	4,834	100.0	28,088	100.0	5,225	100.0

Note: a) In case 2 industries with different technological intensity (ind_{tech}) belong to the same ind. j, the industry with the highest coverage determines ind_{tech}. E.g.: Ind. $j = 27$ is composed of NACE Rev. $2 = 71$ ($\text{ind}_{tech} = KIMS$) and NACE Rev. $2 = 72$ ($\text{ind}_{tech} = HTKIS$). Since the coverage of the former dominates, 91% (84%) in BE (NL), Ind. $j = 27$ is considered as $KIMS$.

Table B.4: Cross-country variation in regimes of competitiveness

# ind. prop. of ind. (%) prop. of firms (%)	LABOR MARKET SETTING							
PRODUCT MARKET SETTING	**PR**		**EB**		**MO**			
	BE	NL	BE	NL	BE	NL	BE	NL
PC	3	2	0	0	3	0	6	2
	9.4	6.2	0	0	9.4	0	18.7	6.2
	10.5	5.4	0	0	9.5	0	20.0	5.4
IC	1	14	21	6	4	10	26	30
	3.1	43.7	65.6	18.7	12.5	31.2	81.2	93.7
	2.0	66.6	68.9	10.1	9.0	17.9	80.0	94.6
	4	16	21	6	7	10	32	32
	12.5	50.0	65.6	18.7	21.9	31.2	100	100
	12.5	72.0	68.9	10.1	18.5	17.9	100	100

Table B.5: Industry-regime match

		Regime R	
Ind. j	Name	BE	NL
1	Food	PC-PR	IC-PR
2	Textile, wearing apparel & leather (products)	IC-EB	IC-MO
3	Wood (products)	PC-MO	IC-PR
4	Paper (products)	PC-MO	IC-PR
5	Printing and reproduction of recorded media	IC-PR	IC-MO
6	Chemicals	IC-MO	IC-PR
7	Pharmaceutical products & preparations	IC-EB	IC-MO
8	Rubber and plastic products	IC-MO	IC-EB
9	Other non-metallic mineral products	IC-EB	PC-PR
10	Basic metals	IC-EB	IC-MO
11	Fabricated metal products	IC-EB	IC-PR
12	Computer, electronic and optical products	IC-EB	IC-EB
13	Electrical equipment	IC-MO	IC-PR
14	Machinery and equipment, n.e.c.	IC-EB	IC-PR
15	Motor vehicles & other transport equipment	IC-MO	IC-PR
16	Furniture	IC-EB	IC-PR
17	Other manufacturing, n.e.c.	IC-EB	IC-EB
18	Repair and installation of machinery and equipment	IC-EB	IC-MO
19	Wholesale, retail trade & repair of motor vehicles	PC-MO	IC-MO
20	Wholesale	IC-EB	IC-PR
21	Retail	IC-EB	IC-PR
22	Publishing activities	PC-PR	IC-EB
23	Programming and broadcasting & telecommunications	IC-EB	IC-MO
24	Computer programming & information service activities	IC-EB	PC-PR
25	Legal and accounting activities	PC-PR	IC-PR
26	Head offices & management consultancy activities	IC-EB	IC-EB
27	Research & development	IC-EB	IC-MO
28	Adverstising, market research & other professional act.	IC-EB	IC-PR
29	Rental & leasing activities	IC-EB	IC-PR
30	Employment activities	IC-EB	IC-MO
31	Buildings & landscape activities	IC-EB	IC-EB
32	Other business related activities	IC-EB	IC-MO

Table B.6: Industry-specific TFP distributions by country

BELGIUM										
Sample	**TFPGR**	Mean	Sd	Skewness	Kurtosis	p10	p25	p50	p75	p90
R=IC-EB										
Ind. j	7	-0.003	0.161	0.513	3.692	-0.177	-0.114	-0.032	0.088	0.230
	30	-0.003	0.392	0.052	4.989	-0.407	-0.216	-0.004	0.216	0.424
	17	-0.002	0.189	1.502	6.924	-0.192	-0.128	-0.030	0.080	0.231
	27	0.001	0.198	0.656	3.932	-0.225	-0.137	-0.033	0.138	0.264
	23	0.001	0.329	3.503	20.286	-0.259	-0.162	-0.054	0.085	0.212
	28	0.002	0.231	1.353	6.943	-0.247	-0.155	-0.037	0.125	0.265
	16	0.006	0.178	3.371	31.429	-0.183	-0.095	0.000	0.087	0.185
	9	0.006	0.124	1.601	10.316	-0.118	-0.069	-0.012	0.064	0.146
	10	0.009	0.171	1.318	5.818	-0.161	-0.107	-0.025	0.096	0.225
	11	0.014	0.165	1.977	10.522	-0.143	-0.088	-0.021	0.078	0.206
	14	0.014	0.156	1.600	8.869	-0.143	-0.086	-0.010	0.089	0.194
	21	0.016	0.145	4.584	31.963	-0.082	-0.049	-0.009	0.038	0.114
	29	0.016	0.375	0.775	7.880	-0.350	-0.206	-0.021	0.228	0.465
	20	0.017	0.185	3.818	27.717	-0.119	-0.081	-0.026	0.045	0.174
	24	0.018	0.220	1.404	6.436	-0.203	-0.118	-0.023	0.097	0.322
	2	0.020	0.178	3.958	30.496	-0.120	-0.075	-0.013	0.060	0.180
	12	0.020	0.196	1.793	8.189	-0.162	-0.099	-0.007	0.095	0.201
	18	0.023	0.174	2.265	12.197	-0.144	-0.082	-0.008	0.084	0.223
	31	0.024	0.304	2.362	12.235	-0.250	-0.153	-0.039	0.126	0.329
	26	0.026	0.344	0.861	4.464	-0.371	-0.192	-0.024	0.206	0.460
	32	0.055	0.308	0.939	3.991	-291	-0.171	0.007	0.211	0.485
R=IC-MO										
Ind. j	15	0.003	0.210	1.548	7.415	-0.211	-0.123	-0.017	0.083	0.227
	8	0.007	0.118	0.721	4.122	-0.130	-0.073	-0.006	0.076	0.164
	6	0.018	0.173	3.246	29.161	-0.138	-0.076	-0.013	0.074	0.208
	13	0.021	0.215	1.789	9.552	-0.211	-0.127	-0.005	0.116	0.271
R=PC-PR										
Ind. j	22	0.005	0.184	0.452	3.919	-0.190	-0.119	-0.037	0.102	0.305
	25	0.008	0.274	1.132	5.284	-0.275	-0.190	-0.012	0.119	0.357
	1	0.017	0.182	3.537	27.097	−0.144	-0.086	-0.015	0.071	0.199
R=PC-MO										
Ind. j	3	0.002	0.189	2.682	14.585	-0.150	-0.104	-0.038	0.051	0.187
	4	0.004	0.288	1.410	6.063	-0.298	-0.191	-0.035	0.112	0.377
	19	0.025	0.165	3.831	23.676	-0.080	-0.054	-0.020	0.037	0.170
R=IC-PR										
Ind. j	5	0.017	0.149	2.099	11.977	-0.127	-0.070	-0.004	0.077	0.163

Table B.6 (ctd): Industry-specific TFP distributions by country

THE NETHERLANDS										
Sample	**TFPGR**	Mean	Sd	Skewness	Kurtosis	p10	p25	p50	p75	p90
R=IC-PR										
Ind. j	3	-0.002	0.193	0.707	6.220	-0.211	-0.104	-0.005	0.087	0.194
	16	0.001	0.203	0.369	9.604	-0.197	-0.099	0.008	0.092	0.208
	4	0.005	0.176	0.685	4.850	-0.192	-0.114	-0.016	0.092	0.253
	21	0.006	0.192	0.981	6.49	-0.218	-0.105	-0.004	0.093	0.227
	20	0.007	0.188	2.693	21.478	-0.156	-0.099	-0.023	0.070	0.204
	15	0.007	0.178	0.179	3.714	-0.218	-0.105	0.003	0.107	0.236
	13	0.008	0.221	0.143	4.68	-0.218	-0.133	-0.014	0.139	0.282
	1	0.009	0.248	2.117	17.380	-0.234	-0.129	-0.027	0.113	0.276
	28	0.010	0.275	0.750	4.093	-0.277	-0.172	-0.040	0.132	0.391
	14	0.012	0.202	0.461	4.701	-0.215	-0.105	-0.002	0.113	0.245
	25	0.015	0.299	0.126	2.920	-0.344	-0.196	0.004	0.221	0.432
	6	0.023	0.261	1.467	9.976	-0.269	-0.139	-0.005	0.148	0.325
	29	0.025	0.304	-0.168	3.186	-0.349	-0.180	0.026	0..233	0.403
	1	0.029	0.301	3.656	32.203	-0.230	-0.116	-0.012	0.108	0.292
R=IC-MO										
Ind. j	7	-0.018	0.324	0.551	3.112	-0.419	-0.323	-0.014	0.186	0.285
	30	-0.011	0.347	1.094	5.713	-0.360	-0.220	-0.063	0.125	0.425
	2	0.003	0245	0.293	3.487	-0.271	-0.154	-0.009	0.128	0.332
	10	0.003	0.181	0.739	4.861	-0.196	-0.103	-0.017	0.090	0.236
	23	0.004	0.378	0.536	3.340	-0.432	-0.231	-0.022	0.158	0.587
	18	0.005	0.252	0.987	7.85	-0.262	-0.144	-0.014	0.142	0.293
	27	0.017	0.322	0.975	9.281	-0.353	-0.159	-0.006	0.185	0.398
	5	0.032	0.226	1.589	7.183	-0188	-0.110	-0.012	0.116	0.325
	19	0.037	0.273	3.238	26.85	-0.154	-0.098	-0.022	0.041	0.295
	32	0.055	0.451	0.734	4.055	-0.566	-0.175	0.017	0.260	0.655
R=IC-EB										
Ind. j	22	-0.010	0.287	0.819	4.740	-0.345	-0.196	-0.034	0.148	0.334
	17	-0001	0.212	0.095	3.413	-0.262	-0.137	-0.002	0.128	0.289
	31	0.000	0.333	0.672	3.450	-0.373	-0237	-0.044	0.177	0.479
	26	0.003	0.369	0.828	4.887	-0.361	-0.199	-0.047	0.168	0.406
	8	0.010	0.192	0.423	5.288	-0.191	-0.101	-0.005	0.102	0.242
	12	0.019	0.249	1.509	9.896	-0.243	-0.159	-0.010	0.171	0.323
R=PC-PR										
Ind. j	9	0.000	0.247	0.560	4.772	-0.277	-0.158	-0.022	0.130	0.320
	24	0.026	0.349	0.594	4.140	-0.339	-0.188	-0.019	0.213	0.479

Note: Within each regime, industries are ranked according to $\text{TFPGR}_{Mean,j}$.