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by Sabien Dobbelaere and Mark Vancauteren

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

Sabien DOBBELAERE† Mark VANCAUTEREN‡

Abstract

This paper revisits the relationship between competition and total factor productivity by analyzing how the type and the degree of product and labor market imperfections affect different moments of total factor productivity distributions. Following the methodology developed in Dobbelaere and Mairesse (2013), we use an unbalanced panel of 5,285 firms over the period 2003-2011 in Belgium and 9,653 firms over the period 1999-2008 in the Netherlands to first classify 30 comparable manufacturing and service industries in 6 distinct regimes that differ in the type of competition prevailing in product and labor markets. In both countries, the dominant regime is one of imperfect competition in the product market and efficient bargaining in the labor market. We find important cross-country differences in the composition of industries making up the regimes and cross-country variation in the levels of product and labor market imperfection parameters within the dominant regime. We then provide clear descriptive evidence of total factor productivity distributional characteristics varying by the type of competition predominating in product and labor markets and to some extent by the degree of product and labor market imperfections. In both countries, average total factor productivity growth rates are found to be higher in high-skilled enterprises in all regimes, except for the regime characterized by perfect competition in both markets.

JEL classification : C23, D24, J50, L13.
Keywords : Rent sharing, monopsony, price-cost mark-ups, human capital, total factor productivity, panel data.

1 Introduction

The two landmarks of institutional reforms over the past twenty years –the Single Market Program and the Lisbon Strategy– were based on the premise that costs, prices and mark-ups would fall and that more

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†VU University Amsterdam, Tinbergen Institute and IZA. Corresponding author: *sabien.dobbelaere@vu.nl*.
‡Hasselt University, Statistics Netherlands.

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 economic phenomena in general and productivity growth in particular across countries and industries.[1] As there are several theoretical routes through which institutions affect productivity, guidance ultimately must come from the data. Yet, empirical studies are scarce, mainly focus on an aggregate cross-country or at most a cross-industry analysis and provide inconclusive findings. 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. This paper aims at examining the joint effect of market imperfections in the output and the labor market on firms' total factor productivity (TFP) growth.

More specifically, combining firm, industry and country-level perspectives for two small EU countries, we first identify and quantify two factors that are believed to be empirically important sources of misallocation. In particular, we first determine the type and the degree of competition in product and labor markets in manufacturing and service industries using firm-level data in Belgium and the Netherlands. Do we observe large cross-country variation in the wedges distorting the allocation of resources and 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 regulatory policies and the industrial relations system in the two countries under consideration? Do we uncover important cross-country differences in the *composition of industries* making up the regimes or do manufacturing and service industries in both countries belong to the same regime? Is there considerable heterogeneity in terms of allocative efficiency across industries within regimes, i.e. do we observe large heterogeneity in the *degree* of industry-specific product and labor market imperfections within regimes? These are the main questions that we address in the first part. In a subsequent, more descriptive part, we exploit variation in the prevalence of regimes in each country to reconsider the potential relationship between the type and the degree of our two sources of misallocation –being product and labor market imperfections– on the one hand and firm-level TFP growth on the other hand. 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*? These are the pertinent questions that we investigate in the second part.

From a policy perspective, our study contributes to an understanding of the institutional context of TFP growth. While several studies have examined the role of regulatory practices across EU countries, no attempt has been made so far to assess the intention of the Single Market Program and the Lisbon Strategy within a microeconometric framework. By consistently analyzing the indirect impact of these major reforms on TFP growth through product and labor market imperfections in two EU countries, our purpose is to investigate whether increasing flexibility is conducive to TFP growth. Within Europe 2020 –the successor of the Lisbon strategy– European leaders have earmarked human capital as a key priority for action and investment.[2] By paying special attention to the role of a firm's skill type in affecting the potential competition-productivity

[1] Recent studies on this overarching theme, investigating the impact of policies and practices affecting the regulation of product, labor and capital markets and intellectual property rights systems on productivity growth, include Buchele and Christiansen (1999), Scarpetta and Tressel (2004), Storm and Naastepad (2007) and Bas and Causa (2013).

[2] Indeed, Europe 2020 has set ambitious objectives on education, innovation, employment, social inclusion and climate/energy to be reached by 2020. One main target is that at least 40% of 30-34 year olds should have a tertiary degree by 2020.

relationship at the firm level, we examine a novel indirect channel through which human capital might influence firm-level TFP growth.

In the first part of this paper, we rely on two extensions of a microeconomic version of Hall's (1988) framework for estimating price-cost margins that take into account two polar extremes of types of imperfections in the labor market. Instead of imposing a particular labor market setting on the data –a common practice in empirical studies estimating labor market imperfections– we follow the methodology developed in Dobbelaere and Mairesse (2013) and use econometric production functions as a tool for testing the competitiveness of product and labor markets and evaluating their degree of imperfection. We distinguish six regimes of competitiveness corresponding to two product market settings (perfect competition (PC) and imperfect competition (IC)) and three labor market settings (perfect competition or right-to-manage bargaining (PR), efficient bargaining (EB) and monopsony (MO)). Consistent with our modified production function framework, we measure TFP as the residual of a system generalized method of moments estimation of industry-specific standard Cobb-Douglas production functions in the second part and evaluate how TFP distributional characteristics vary across countries and regimes, taking into account skill heterogeneity.

Our empirical analysis is based on two unbalanced panels of manufacturing and service firms: 5,285 firms over the period 2003-2011 in Belgium and 9,653 firms over the period 1999-2008 in the Netherlands. The Belgian-Dutch comparison is motivated by differences in institutions, industrial relations and productivity performance between the two countries, making our comparative study particularly interesting and the availability of highly comparable microdata sets, allowing us to conduct a reliable comparative study.

From a methodological perspective, our study implements a classification procedure which is based on the one developed in Dobbelaere and Mairesse (2013). Our analysis is to some extent related to Petrin and Sivadasan (2013) and –given the selection of countries– to Dobbelaere (2004), Benavente *et al.* (2009), Amoroso *et al.* (2013) and Dobbelaere *et al.* (2014). These studies are also based on the gap methodology which essentially starts from the observation that any factors that create misallocation can be thought of as generating wedges in the first-order conditions of firm optimization problems. Using a sample of manufacturing plants in Chile, Petrin and Sivadasan (2013) estimate the gaps between an input's marginal product and its cost to infer the value of lost output arising from allocative efficiency at the manufacturing level. Using a sample of manufacturing firms in Belgium, Dobbelaere (2004) imposes efficient bargaining on the data and estimates a Solow residual equation to analyze industry differences in estimated average price-cost mark-up and rent-sharing parameters. Using a sample of manufacturing firms in Belgium, Chile and France, Benavente *et al.* (2009) also use the Solow residual normalization to retrieve estimates of average price-cost mark-up and rent-sharing parameters at the manufacturing level. Using a sample of manufacturing firms in the Netherlands, Amoroso *et al.* (2013) follow Dobbelaere (2004) by examining industry differences in price-cost and wage mark-ups and evaluating their impact on TFP growth. Using a sample of manufacturing firms in France, Japan and the Netherlands, Dobbelaere *et al.* (2014) apply two distinct classification procedures to investigate differences in revealed product and labor market settings at the industry level and to check the sensitivity of these settings to the choice of estimator.

This paper makes contact with two strands of the literature. The first is the econometric literature on estimating simultaneously market imperfections in product and labor markets. Second, this paper is related to the recent literature on the impact of misallocation of resources. Our contribution is threefold. First, whilst the aforementioned studies have only investigated industry differences in manufacturing, we focus on both manufacturing and services. The manufacturing-services distinction is particularly useful in deepening our understanding of the productivity slowdown in European countries –compared to the US– over the last decade.[3] Second, we revisit the relationship between competition and TFP growth by analyzing how the type and the degree of two important sources of misallocation –i.e. product and labor market imperfections– affect TFP distributional characteristics. To the best of our knowledge, this kind of analysis has not yet been performed.[4] Third, given that part of 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), we perform a detailed cross-country industry comparison within a microeconometric framework.

Our main findings are summarized as follows. First, the prevalent product and labor market settings and hence the prevalent regimes are to some extent comparable in Belgium and the Netherlands. In both countries, (*i*) the proportion of industries that is characterized by imperfect competition in the product market amounts to more than 90% and (*ii*) the most prevalent labor market setting is efficient bargaining. As such, the dominant regime is one of imperfect competition in the product market and efficient bargaining in the labor market in both countries (IC-EB). The most pronounced difference that we observe is a higher prevalence of monopsony and a lower prevalence of perfect competition or right-to-manage bargaining in Belgium compared to the Netherlands. Second, our analysis reveals important cross-country differences in the composition of industries making up the regimes and cross-country variation in the levels of product and labor market imperfection parameters within the dominant IC-EB-regime. Within the latter regime, the median price-cost mark-up is estimated to be significantly higher in the Netherlands (1.305 compared to 1.153 in Belgium) whilst the median absolute extent of rent sharing is estimated to be significantly higher in Belgium (0.428 compared to 0.262 in the Netherlands). Third, we provide clear descriptive evidence of TFP distributions varying by two important sources of resource misallocation, i.e. the type of competition prevailing in product and labor markets. The prevalent labor market setting appears to be more decisive than the product market setting in shaping regime-specific TFP distributions. In both countries, average TFP growth rates are among the largest but TFP is more unequally distributed in the regime characterized by imperfect competition in the product market and perfect competition or right-to-manage bargaining in the labor market (IC-PR) whilst the opposite holds in the regime typified by imperfect competition in the product market and efficient bargaining in the labor market (IC-EB). In addition, our descriptive analysis demonstrates that TFP distributional characteristics vary to some extent by the degree of imperfections in product and labor markets, i.e. the levels of product and labor market power. Finally, in all regimes

[3] Indeed, Van Ark *et al.* (2008) show that this productivity slowdown is largely caused by a more sluggish productivity growth in (mostly intermediate) service industries. They claim that the latter trend is mainly due to a lack of competitiveness and flexibility in the labor and product markets in European service industries. The same argument is put forward by Desmet and Parente (2010). Despite the fact that the EU launched a series of policies – notably the "Single Market" and "Services Directive" –to promote competition and bolster efficiency in European service industries since the mid 1990s, Badinger (2007) provides evidence of a slight increase of price-cost mark-ups in most European service industries since the early 1990s. This calls for a detailed industry analysis, not only within a country but also across countries.

[4] The only study that relates the *degree* of product and labor market power to TFP growth using firm-level data is Amoroso *et al.* (2013). However, they impose a particular bargaining setting –i.e. efficient bargaining– on the data while our methodology allows for three labor market settings, thus letting the data determine the extent of resource misallocation and the *type* of competition prevailing in product and labor markets and they only focus on the Netherlands.

both countries, we find that average TFP growth rates are higher in high-skilled enterprises, except for the regime characterized by perfect competition in both markets (PC-PR). In all predominant regimes in both countries, average TFP growth rates are found to be higher in services compared to their counterparts in manufacturing.

We proceed as follows. Section 2 highlights differences in economic performance and in institutional characteristics in the two countries, thereby motivating the comparative nature of our study. Section 3 briefly discusses the theoretical framework. Section 4 presents the firm panel data for Belgium and the Netherlands. Section 5 discusses the estimation method and the econometric implementation of our procedure to classify industries in distinct regimes characterizing the type of competition prevailing in product and labor markets. Section 6 reports the results of the classification procedure, investigating how industries in both countries differ in the type and the degree of product and labor market imperfections. Section 7 explores –by means of descriptive analysis– the relationship between the type and the degree of market imperfections and TFP growth, taking into account skill heterogeneity. Section 8 concludes.

2 Economic performance and institutions: A comparison

This section provides an overview of average productivity growth rates and its components, labor input compositions, competition policy, innovation and labor market developments and related institutional settings between Belgium (BE) and the Netherlands (NL), motivating the comparative nature of our study. This increases our understanding of differences in economic performance between both countries, and in particular, how productivity growth evolves through product and labor market imperfections in both countries.

2.1 Productivity

Let us start our comparison at the meso level using aggregate data for BE and NL, and focusing on the productivity decomposition method.[5] Using EUKLEMS data for the period 1995-2008, the empirical decomposition of real output growth or productivity growth shows that the importance of output growth and the contribution of each factor input vary notably by country and industry. Focusing on real output gains, the largest output growth rates are found in service industries such as, whole- and retail sales, transportation, storage and communications, and finance and business activities. Cross-country differences in average productivity growth rates are apparent. The most pronounced difference appears in the chemical industry with a growth rate of 7.5% in BE compared to a growth rate of 3% in NL.

Focusing on the contribution of input factors, the growth in intermediate inputs is the most important source of output growth. To a lesser extent are IT and non-IT capital, and high- and medium-skilled labor growth. For example, for manufacturing, the output growth of 3.2% in BE (2.0% in) in NL) can be decomposed

[5] We decompose output growth into the contributions of ICT and non-ICT capital, purchases of intermediate goods and services, labor growth (measured as total hours worked) further broken down by skill type and TFP growth. The latter equals the Solow residual (SR) and measures the change of output that can be explained by all other factors that are not explicitly subsumed in the production process. According to that methodology, TFP measurement is based on perfect competition and constant returns to scale. Average TFP growth rates are calculated on the basis of the total period TFP growth contributions to output growth.

into 2.6% (1.5% in NL) accounted by the growth in intermediate inputs, 0.3% by IT capital (0.02% in NL), 0.2% by non-IT capital (0.1% in NL), -0.1% by labor (also in NL) and 0.2% by TFP (0.5% in NL). The contribution of TFP is widespread with positive and negative growth rates across industries. The small or negative TFP growth rate contributions of BE and NL are due to the fact that there has been a catching-up effect with the US of the EU countries explaining the structural slowdown in productivity performances (Ederveen *et al.*, 2005; Kegels *et al.*, 2008). For most of the industries, we observe that output growth is caused by decreases in low-skilled labor. In a study based on annual EUKLEMS data of three small European countries: Austria, Belgium and the Netherlands, Kegels *et al.* (2008) show that the average annual output growth rate (measured in value-added GDP) has increased over the period 1970-2005. However, the growth performance was noticeably lower from 1995-2005 than from 1970-1995. Looking at sources of productivity growth, the authors argue that this slowdown in productivity growth has been primarily caused by more labor-intensive growth (hours worked) caused by lower levels of unemployment and higher participation rates. We also observe some distinct patterns across countries and industries. In particular, the contribution of IT capital to output growth in the service industries is generally higher than non-IT capital in BE whilst the opposite is true in NL. The data also reveal that the contribution of medium-skilled labor volume growth remains positive throughout each of the manufacturing and service industries in BE whilst it fell for the most important manufacturing industries in NL. Focusing on a cross-industry comparison, it is apparent that TFP growth is not only widespread with positive and negative growth rates but also different across most of the industries in BE and NL.[6] For example, average TFP grew on average by 0.18% in the Dutch finance and business industry while it fell by 3.47% in BE. One of the objectives of this study is exactly to exploit empirically the firm-level heterogeneity in the data in order to evaluate TFP differences and to assess the role of competition and skills in shaping these differences. For that purpose, it is important to discover institutional differences in terms of competition policy and industrial relations between both countries, which we discuss in the subsequent sections.

2.2 Product market setting

To what extent do price-cost margins prevail within industries in BE and NL? While theory has put forward several competition drivers including market structure, international trade, regulatory reforms, competition policy regimes (Tirole, 1988), this section focuses on cross-country heterogeneity.

Using EUKLEMS data for manufacturing and services covering the period 1995-2008 and comparing price-cost margins (PCM) for BE and NL with an aggregate of the EU15 countries, we observe that price-cost margins in manufacturing are considerably above the EU average in both countries whilst the opposite holds for services.[7] The data also reveal that price-cost margins in manufacturing increased over the period in NL

[6] The TFP indices for respectively Belgian and Dutch industries with the latter being reported in parentheses are the following: total (manufacturing and services) -1.43 (-0.47), food, beverage, tobacco -0.94 (0.31), chemicals -0.75 (1.14), metals 2.62 (-0.002), construction -0.86 (-0.81), wholesale and retail -5.40 (-3.05), transportation, storage and communication -10.14 (0.18), finance and business -3.47 (0.19).

[7] Price-cost margin is defined as the difference between revenue and variable cost over revenue (Schmalensee, 1989). The variable cost is the sum of the costs of variable inputs, that is, labor and materials. While this measure has a computation advantage, it assumes constant returns to scale.

and were higher than in BE. Price-cost margins in services remained stable in both countries until 2004, after which they dropped sharply in BE but rose slightly in NL.

Can these discrepancies be explained by institutional factors? Taking a longer historical perspective, Creusen *et al.* (2006) also show that the overall level of imperfect competition in the output market –measured by the price-cost-margin and relative profits measure– decreased over the period 1993-2001 in NL, induced by regulatory reforms aimed at fostering competitive behavior but partly offset by a strong increase in market demand. Konings et *al.* (2001) document that price-cost margins were higher in NL in the period before competition legislation was amended (1994-1996) and similarly find that Dutch firms behave less competitively than Belgian firms (NL is referred to as a "cartel paradise"). Dikker Hupkes and Maks (2006) report that price-cost margins were lower in Belgian services than in Dutch services over the period 1995-1999.

Besides the more effective regulatory system, the stronger pro-competitive impact of imports in BE and differences in the intra-sectoral composition of exports between both countries might explain part of the consistently lower price-cost margins in BE compared to NL. Covering the period 1996-2004, Abraham *et al.* (2009) provide evidence of the pro-competitive effects resulting from trade opening in BE. As discussed by Van Cayseele *et al.* (2000), pronounced differences in trade and competition policy existed between both countries: competition policy kept markets open which shaped a competitive environment in BE whilst the use of protective policies rather sheltered firms from import competition in NL. In addition, Dutch exports consist of finished, high-tech goods flowing through a few global multinational enterprises with Dutch origin whilst Belgian exports consist of semi-finished goods and components oriented towards competitive world markets. These differences in the composition of export goods 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 the high-tech goods versus semi-finished goods depends on the value-added content, as reported by the European Commission (EC, 2013). They show that the value-added content broken down by domestic and foreign parts of trading and domestic goods are to a certain extent different between both countries over the period 2000-2011. The study also confirms a much higher revealed comparative advantage (RCA) indicator for the NL in high-tech products and reports systematic differences in the RCA indices in manufacturing and services between both countries. 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 in higher in BE compared to NL.

As mentioned before, competition can be influenced by numerous factors. While existing firm-level studies appear to find the Belgian product market to be more competitive than the Dutch counterpart, Belgian regulations proved to be less market oriented than in NL according to the OECD indicators of product market restrictive regulations (see Hupkes and Maks, 2006), Wölfl *et al.*, 2010). Clearly, the friendliness of the product related regulatory environment differs substantially between both countries: NL ranks 9^{th} whilst BE 17^{th} out of the 21 countries. A closer examination reveals that differences are especially apparent for barriers to entrepreneurship which include licenses and permit systems and other administrative burdens. Price-cost mark-ups are also determined by the prevailing price stickiness meaning that prices changes, as a result of changes in demand and supply, may take time due to the presence of nominal rigidities. The concept of sticky prices has been examined by the ECB using firm-level data in the Euro area. By looking at possible determinants of price changes in BE, Aucremanne and Druant (2005) find that labor and other factor costs seem to be the main driver for price increases while competitive behavior is the predominant factor for price decreases in BE. For NL, Hoeberichts and Stokman (2010) point to fixed and variable price-cost margins as the main price determinants whilst costs linked to wages and competitor prices seem to be less important drivers of prices. These additional factors highlight why product market competition, being characterized by imperfect competition in both countries, is to a certain degree also asymmetric.

2.3 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). Both countries significantly eased the regulation on temporary contracts during the 1990s but less so during the later years (Martin and Scarpetta, 2012). This subsection provides some details on the institutional characteristics affecting wage formation in both countries.

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 a 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 relates 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.[8] Another particular characteristic of the wage bargaining system is that blue-

[8] In particular, wages are automatically indexed according to the health price index, which is the national consumer price

collar and white-collar workers are represented by separate unions. Pay scales for blue-collar workers depend primarily on the job description 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 interviews 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 the low union density, a broad majority agrees with the unions' policies. Every year, collective bargaining starts at a 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 negotations.[9] At both the central and industry level, the government plays the role of a moderator, ensuring that agreements are based on consensus. As such, the collective bargaining system is conducive to social stability. In very large companies, collective labor agreements are concluded at the company level. 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 the 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 centralized wage-setting process is complemented by the prevalent use of some kind of incentive pay determining the position of an employee on the pay scale.

These institutional and organizational differences between BE and NL 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).

3 Theoretical framework

This section extends the framework of Hall (1988) for estimating price-cost margins and scale economies. To this end, we follow Dobbelaere and Mairesse (2013) by considering three labor market settings: perfect competition or right-to-manage bargaining (Nickell and Andrews, 1983), efficient bargaining (McDonald and Solow, 1981) and monopsony (Manning, 2003). The canonical rent-sharing models and the monopsony model can be viewed as polar extremes and are both intuitively appealing and tractable (Booth, 2014). This section contains the main ingredients of the theoretical framework. For technical details, we refer to Dobbelaere and Mairesse (2013).

We start from a production function $Q_{it} = \Theta_{it}F(N_{it}, M_{it}, K_{it})$, where i is a firm index, t a time index, N is labor, M is material input and K is capital. $\Theta_{it} = Ae^{\eta_i+u_t+\upsilon_{it}}$, with η_i an unobserved firm-specific effect, u_t a year-specific intercept and υ_{it} a random component, is an index of technical change or "true" total factor productivity. Denoting the logarithm of Q_{it}, N_{it}, M_{it}, K_{it} and Θ_{it} by q_{it}, n_{it}, m_{it}, k_{it} and θ_{it} respectively,

index excluding tobacco, motor fuels and alcoholic beverages.

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

the logarithmic specification of the production function gives:

$$q_{it} = (\varepsilon_N^Q)_{it} n_{it} + (\varepsilon_M^Q)_{it} m_{it} + (\varepsilon_K^Q)_{it} k_{it} + \theta_{it} \tag{1}$$

where $(\varepsilon_J^Q)_{it}$ $(J = N,\ M,\ K)$ is the elasticity of output with respect to input factor J.

Firms operate under imperfect competition in the product market (IC). We allow for three labor market settings (LMS): perfect competition or right-to-manage bargaining (PR)[10], efficient bargaining (EB) and monopsony (MO). We assume that material input and labor are variable factors. Short-run profit maximization implies the following first-order condition with respect to material input:

$$(\varepsilon_M^Q)_{it} = \mu_{it}\,(\alpha_M)_{it} \tag{2}$$

where $(\alpha_M)_{it} = \frac{j_{it} M_{it}}{P_{it} Q_{it}}$ is the share of material costs in total revenue and $\mu_{it} = \frac{P_{it}}{(C_Q)_{it}}$ refers to the mark-up of output price P_{it} over marginal cost $(C_Q)_{it}$. Depending on the prevalent LMS, short-run profit maximization implies the following first-order condition with respect to labor:

$$\begin{aligned}
(\varepsilon_N^Q)_{it} &= \mu_{it}\,(\alpha_N)_{it} \qquad \text{if } LMS = PR & (3)\\
&= \mu_{it}\,(\alpha_N)_{it} - \mu_{it}\gamma_{it}\,[1 - (\alpha_N)_{it} - (\alpha_M)_{it}] \qquad \text{if } LMS = EB & (4)\\
&= \frac{\mu_{it}\,(\alpha_N)_{it}}{\beta_{it}} \qquad \text{if } LMS = MO & (5)
\end{aligned}$$

where $(\alpha_N)_{it} = \frac{w_{it} N_{it}}{P_{it} Q_{it}}$ is the share of labor costs in total revenue. $\gamma_{it} = \frac{\phi_{it}}{1-\phi_{it}}$ represents 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. From the first-order conditions with respect to material input and labor, it follows that the parameter of joint market imperfections (ψ_{it}):

$$\begin{aligned}
\psi_{it} &= \frac{(\varepsilon_M^Q)_{it}}{(\alpha_M)_{it}} - \frac{(\varepsilon_N^Q)_{it}}{(\alpha_N)_{it}} & (6)\\
&= 0 \qquad \text{if } LMS = PR & (7)\\
&= \mu_{it}\gamma_{it}\left[\frac{1 - (\alpha_N)_{it} - (\alpha_M)_{it}}{(\alpha_N)_{it}}\right] > 0 \qquad \text{if } LMS = EB & (8)\\
&= -\mu_{it}\frac{1}{(\varepsilon_w^N)_{it}} < 0 \qquad \text{if } LMS = MO & (9)
\end{aligned}$$

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:

$$(\varepsilon_K^Q)_{it} = \lambda_{it} - (\varepsilon_N^Q)_{it} - (\varepsilon_M^Q)_{it} \tag{10}$$

Inserting Eqs. (2), (6) and (10) in Eq. (1) and rearranging terms gives:

$$q_{it} = \mu_{it}\,[(\alpha_N)_{it}\,(n_{it} - k_{it}) + (\alpha_M)_{it}\,(m_{it} - k_{it})] + \psi_{it}(\alpha_N)_{it}\,(k_{it} - n_{it}) + \lambda_{it} k_{it} + \theta_{it} \tag{11}$$

[10] Our framework does not allow to disentangle perfect competition in the labor market from right-to-manage bargaining. In both settings, labor is unilaterally determined by the firm from profit maximization, i.e. the wage rate equals the marginal revenue of labor.

4 Data description

Our modified production function framework, which allows us to estimate product and labor market imperfection parameters, only requires data on production values, factor inputs and factor costs, which we present in Section 4.1. To evaluate whether TFP distributional characteristics vary by a firm's skill type, we also collect data on the skill composition of the workforce (see Section 4.2).

4.1 Production function variables

The data for estimating product and labor market imperfection parameters and retrieving TFP growth rates are sourced from the Belfirst database provided by Bureau van Dijck for BE and from the Production Surveys (PS) provided by Statistics Netherlands for NL. For each country, our 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 5,285 firms covering the period 2003-2011 in BE and 9,653 firms over the period 1999-2008 in NL. Table B.1 in Appendix B gives the panel structure of the estimation sample by country.

Output (Q) is defined as real gross output measured by nominal sales divided by the industry-level gross output price index in both countries.[11] 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 in BE and proxied by depreciation of fixed assets deflated by the industry-level gross fixed capital formation price index for all assets in NL. 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.

4.2 Skill heterogeneity

Measuring "skill heterogeneity" is complex because labor market characteristics are constantly evolving due to a changing working population as employees become, on average, better educated and remain longer active in the labor market (Borghans *et al.*, 2001; Kok and ter Weel, 2014). At the same time, the demand for labor also changes as a result of technological progress which changes the work composition between physical and human capital (see Acemoglu and Autor, 2011 for a survey). While there is a large number of studies

[11] 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. Theoretically, this approach relies on the assumption that the market power of firms originates from product differentiation. Intuitively, in the case of product differentiation, the demand for an individual firm's products is a function of its relative price within the industry. Relative price differences can then be expressed in terms of relative output growth differences in the industry. We follow the predominant approach in the literature and use the former.

focusing on labor skills, evidence suggests that the level of education, technological intensity, wage levels, occupation and experience tend to be valid characteristics that define skills (Doms *et al.*, 1997).

To ascertain comparability of human capital variables across both countries, our approach of defining skill heterogeneity is based on the concept of knowledge workers (see Horwitz *et al.*, 2003 for a literature review on this categorization) where we rely on classifying jobs into low- to high-paid level classifications according to certain threshold values based on the entire wage distribution (see Groot *et al.*, 2014 for an application of this approach on regional labor market effects). Specifically, the so called skill-biased technical change hypothesis is often used to explain the returns to education and the increased wage differentials between skilled and unskilled labor (e.g., Krueger, 1993, Autor *et al.*, 1998; Entorf and Kramarz, 1995, Borghans and ter Weel, 2007).

The data on which the skill composition of the workforce is based are sourced from the National Social Security Office (RSZ) for BE and from the Social Statistics Database (SSB) and the Labor Force Study (EBB) for NL. In order to validate our skill heterogeneity measure based on income percentile groups, we performed two exercises using the Dutch data which are reported in Section A.1 in Appendix A.[12] The first validation exercise consists in examining the correlation between individual wages and the level of education –which is at the core of the skill-biased technological change hypothesis– controlling for age groups and industry dummies. On the basis of this first validation exercise, we decided to classify employees as having a high-paid job if their wage is in the 81^{st} percentile or higher of all registered jobs by age category and NACE 2-digit industry, a high-medium-paid job if their wage falls between the 56^{th} and 80^{th} percentile, a low-medium-paid job if their wage falls between the 31^{th} and 55^{th} percentile and a low-paid job if their wage is at or below the 30^{th} wage percentile. The second validation exercise consists in comparing our measure of the share of high-skilled employees with the measure of the share of high-skilled employees that is derived from the education type of employees as used in Bartelsman *et al.* (2014). This second validation exercise shows that both measures of the share of high-skilled employment shares are very close for the total matched sample and for manufacturing. The discrepancy between both measures appears to be larger for services.

Based on our comparable measure of skill heterogeneity in BE and NL, we define a firm to be high-skilled if its employment share of high-skilled (i.e. high-paid) employees is equal to or exceeds the median value of the share of high-skilled employees in firm size class s of industry j (NACE 2-digit classification) in year t, whereas it is defined to be low-skilled if its employment share of high-skilled employees is lower than the aforementioned median value.[13,14] To examine firm-level persistence in the skill types of firms, we looked

[12] We were not able to conduct a comparable analysis on the basis of the Belgian data since the RSZ provided the skill composition of the workforce at the level of the *firm*.

[13] We consider 7 firm size classes: size class = 1 if the number of employees $(L) < 19$, size class = 2 if $L \in [20, 50[$, size class = 3 if $L \in [50, 100[$, size class = 4 if $L \in [100, 250[$, size class = 5 if $L \in [250, 500[$, size class = 6 if $L \in [500, 1000[$ and size class = 7 if $L \geq 1000$.

[14] Previous studies defined the skill composition of the workforce on the basis of the white- versus blue-collar (or non-manual versus manual) distinction (see e.g. Dumont *et al.* (2012) using Belgian data). As a measurement check for BE, we compared our measure of the share of high-skilled employees (denoted by $Sh_{HS\_w,it}$) with the measure of the share of non-manual employees (denoted by $Sh_{NM,it}$). The correlation amounts to 0.27 for the total estimation sample, 0.38 for manufacturing and 0.33 for services. If we define the skill type of enterprises based on the median value of the share of non-manual employees at the firm size-industry level and compare the firms' skill types with our definition, we find that the match in terms of firms' skill types

at one-year transition probability rates from period t to period $(t+1)$ of skill types across states over the considered periods in both countries. The states are defined as high-skilled and low-skilled. We find strong persistence in skill types as we observe the highest values on the diagonal for each state: 85.4% (81.9%) of the high-skilled firms and 78.4% (81.2%) of the low-skilled firms remain in their initial state in BE (NL).

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 2.0% per year in BE and 2.9% in NL. In BE, labor and materials have increased at an average annual growth rate of 1.7% and 2.2% respectively, whilst capital has decreased at an average annual growth rate of 4.0%. In NL, labor, materials and capital have increased at an average annual growth rate of 1.1%, 3.8% and 2.1% respectively. The material share in output is considerable higher in BE, which could reflect a different industrial production structure between both countries. The Solow residual or the conventional measure of TFP has been stable over the considered period in BE, and has increased at an average annual growth rate of 1.5% in NL. As discussed in Section 2.1., similar patterns are confirmed using EUKLEMS data. As expected for firm-level data, the dispersion of all these variables is considerably large. For example, conventional TFP growth is lower than -3.2% (-7.9%) for the first quartile of firms and higher than 4.4% (10.5%) for the upper quartile in BE (NL). The share of high-skilled employees is lower than 2.9% (6.5) for the first quartile of firms and higher than 30.0% (12.9%) for the upper quartile in BE (NL). The median share of high-skilled, medium-skilled and low-skilled employees equals 14.8% (12.9%), 51.2% (50.0%) and 22.7% (31.8%) respectively in BE (NL).

<Insert Table 1 about here>

5 Econometric framework

5.1 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, not only for estimating factor elasticities and total factor productivity as has been common practice in the econometric literature on estimating microeconomic production functions.

Since our study aims at (i) comparing regime differences in terms of the type of competition prevailing in product and labor markets across BE and NL and (ii) evaluating whether TFP distributional characteristics differ across regimes and firms' skill types, we estimate *average* parameters:

$$q_{it} = \mu \left[\alpha_N \left(n_{it} - k_{it}\right) + \alpha_M \left(m_{it} - k_{it}\right)\right] + \psi\alpha_N \left(k_{it} - n_{it}\right) + \lambda k_{it} + u_t + \zeta_{it} \tag{12}$$

with $\zeta_{it} = \omega_{it} + \epsilon_{it}$. Of the error components, ω_{it} represents unobserved productivity to the econometrician but possible observed by the firm at t when input decisions are made (transmitted productivity shock), while ϵ_{it} captures all other sources of error or productivity that is not observed by the firm before making input choices at t. u_t is a year-specific intercept. Our method of retrieving product and labor market imperfection

amounts to 48%, suggesting that the non-manual versus manual distinction only gives a partial view on the skill composition of employees. Detailed results not reported but available upon request.

parameters from the gap between the estimated *average* output elasticities of labor and materials and their *average* revenue shares allows to wash out firm-level differences in adjustment costs which are temporary in nature, i.e. related to the business cycle.

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 (IV). The semiparametric structural control function (CF) approach uses observed variables and economic theory to invert out productivity nonparametrically and hence to obtain an observable expression for productivity.[15]

We rely on a general approach to estimating error components models designed for panels with few time periods and many individuals, covariates that are not strictly exogenous, unobserved heterogeneity, heteroskedasticity and autocorrelation within individuals, developed by Arellano and Bover (1995) and Blundell and Bond (1998) (*SYS-GMM* estimator). This approach extends the standard *(first-differenced) GMM* estimator of Arellano and Bond (1991) –which eliminates unobserved firm-specific effects by taking first differences– by relying on a richer set of orthogonal conditions.[16] The error components are an unobserved fixed effect (η_i), a possibly autoregressive productivity shock ($\omega_{it} = \rho\omega_{it-1} + \xi_{it}$ with $|\rho| < 1$) and serially uncorrelated measurement errors (ϵ_{it}), with $\xi_{it}, \epsilon_{it} \sim i.i.d.$ Consistent with our static theoretical framework, we estimate the restricted version of the Blundell-Bond model and only consider idiosyncratic productivity shocks (imposing $\rho = 0$). We apply the two-step GMM estimator which is asymptotically more efficient than the one-step GMM estimator and which is robust to whatever patterns of heteroskedasticity and cross-correlation. We use a finite-sample correction to the two-step covariance matrix developed by Windmeijer (2005). The validity of GMM crucially hinges on the assumption that the instruments are exogenous. We report both the Sargan and Hansen test statistics for the joint validity of the overidentifying restrictions.[17] 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. However, the *SYS-GMM* estimator might generate moment conditions prolifically with the instrument count quadratic in the time dimension of the panel. 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 restrictions/instruments, we provide difference-in-Hansen statistics to test the validity of subsets of

[15] Eberhardt and Helmers (2010) survey the most popular parametric and semiparametric estimators dealing with the transmission bias for Cobb-Douglas production functions.

[16] The Arellano-Bover/Blundell-Bond estimator assumes that the first differences of the instrumental variables are uncorrelated with the fixed effects, which allows the introduction of more instruments which might improve efficiency dramatically.

[17] We opt to report both the Sargan and the Hansen statistics after the two-step estimations since the Sargan tests do not depend on an estimate of the optimal weighting matrix and are hence not so vulnerable to instrument proliferation. On the other hand, they require homoskedastic errors for consistency which is not likely to be the case. As documented by Andersen and Sørensen (1996) and Bowsher (2002), instrument proliferation might weaken the Hansen test of instrument validity to the point where it generates implausibly good p-values (see Roodman, 2009 for a discussion).

instruments.[18]

For illustrative purposes, we restrict heterogeneity of the production technology across firms by breaking the estimation sample into seven industries according to the OECD classification: High-technology manufacturing (HTM), Medium-high-technology manufacturing ($MHTM$), Medium-low-technology manufacturing ($MLTM$), Low-technology manufacturing (LTM), High-technology knowledge-intensive services ($HTKIS$), Knowledge-intensive market services ($KIMS$) and Less-knowledge-intensive market services ($LKIMS$).[19] Table B.2 in Appendix B provides details on the industry breakdown of manufacturing and services depending on their technological intensity.[20] Table B.3 in Appendix B present the *SYS-GMM* estimates of production function coefficients, scale elasticity and product and labor market imperfection parameters at the industry level (7-industry classification). Interesting cross-country and cross-industry differences show up. Focusing on the product market side, all industries in both countries are characterized by imperfect competition in the product market, except for $LKIMS$ in NL. Focusing on the labor market side, manufacturing and service industries with a (relatively) high level of technological intensity are typified by efficient bargaining whilst manufacturing and service industries with a low level of technological intensity are characterized by monopsony in BE. The latter does not hold in NL: irrespective of the level of technological intensity, all manufacturing industries are typified by efficient bargaining whereas the level of technological intensity matters for the labor market setting in service industries. Similar to BE, the prevalent labor market setting is efficient bargaining in $HTKIS$ and monopsony in $LKIMS$. Contrary to BE, the prevalent labor market setting is perfect competition or right-to-manage bargaining in $KIMS$. In Belgian manufacturing industries, the degree of product and labor market imperfections does not vary according to the level of technological intensity. The estimated price-cost mark-up lies in the [1.112-1.189]-range and the absolute extent of rent sharing lies in the [0.424-0.505]-range for the manufacturing industries typified by IC-EB. In the Belgian service industries, price-cost mark-up estimates increase with the level of technological intensity, ranging between 1.079 ($LKIMS$) and 1.214 ($HTKIS$). In both manufacturing and service industries in NL, the degree of market imperfections varies with the level of technological intensity, i.e. price-cost mark-ups are estimated to be higher in high-technology industries compared to the low-technology counterparts. The estimated price-cost mark-ups lie in the [1.364-1.498]-range for the manufacturing industries and the [0.929-1.269]-range for the service industries. Likewise, the estimated absolute extent of rent sharing is significantly higher in high-technology manufacturing than in the manufacturing industries with a lower level of technological intensity. The apparent positive relationship between price-cost mark-ups and the level of technological intensity in the service industries in BE and in both the manufacturing and service industries in NL is consistent with e.g. Cassiman and Vanormelingen (2013) who provide evidence of innovation affecting price-cost mark-ups through demand shifts and factor input costs.

[18] Besides the simultaneity bias, other methodological issues emerge when estimating microeconomic production functions, most notably omitted price bias, selection bias/endogeneity of attrition and measurement error. To deal with these methodological issues, several estimators have been proposed (see Dobbelaere *et al.*, 2014 for a discussion).

[19] 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.

[20] The most pronounced difference is the much larger proportion of firms in $LKIMS$ in BE due to the much larger representation of enterprises in the Belgian retail and wholesale industries.

To sum up, we find that (i) price-cost mark-ups are estimated to be significantly higher in all Dutch manufacturing and service industries[21] and (ii) absolute extent of rent-parameters are estimated to be significantly higher in comparable IC-EB-industries in Belgian manufacturing. As discussed in Section 2, a larger exposure to international competition in BE and differences in the intra-sectoral composition of exports between BE and NL might explain the former whilst the Dutch trade unions' focus on wage moderation might explain the latter. We find no evidence against constant returns to scale in all industries in both countries.

A crucial assumption of the validity of GMM is that the instruments are exogenous. The Sargan and Hansen statistics test the joint validity of the moment conditions (identifying restrictions). Both tests indicate that the null of exogeneity is rejected in 3 out of 7 industries in BE and in 5 out of 7 industries in NL, thus rendering our instrumentation strategy in these industries invalid. As the Hansen test evaluates the entire set of overidentifying restrictions/instruments, it is particularly important to test the validity of subsets of instruments (levels and differenced) via the difference-in-Hansen tests. For BE, the difference-in-Hansen tests suggest that the 1-year lagged first-differenced inputs as instruments in the levels equation may be to blame (exogeneity rejected) in $MLTM$ and $LKIMS$ while the use of the 2-year lags of the inputs as instruments in the first-differenced equation does not prove informative for LTM. For NL, the validity of the 1-year lagged first-differenced inputs as instruments in the levels equation is rejected in $MHTM$ and $MLTM$ while the exogeneity of the 2-year lags of the inputs as instruments in the first-differenced equation is rejected in $KIMS$ and $LKIMS$.[22]

While the Hansen test is usually considered as a test of instrument validity, it can also be thought of as a test of structural specification (Baum, 2006; Roodman, 2009). As our 7 samples of manufacturing and service industries contain heterogeneous firms from different industries, imposing common slopes for the industries could move components of variation into the error term and make them correlated with the instruments. If input choice is correlated with unobserved firm-level production technology differences, this unaccounted heterogeneity might further introduce a bias in the production function coefficients, and hence in our parameters of product and labor market imperfections. Following the tradition in the empirical industrial organization literature, the remainder of our analysis is, therefore, based on a more disaggregated industry classification.

5.2 Classification procedure

In each country, we consider 30 comparable industries, 19 in manufacturing and 11 in services, making up our estimation sample.[23] This decomposition is detailed enough for our purpose and ensures that each industry contains a sufficient number of observations. Table B.4 in Appendix B presents the industry repartition of the estimation sample and the number of firms and the number of observations by industry and country. For each industry $j \in \{1, \ldots, 30\}$, we estimate a standard Cobb-Douglas production function [Eq. (12)] using the SYS-GMM estimator.

[21] In $LKIMS$, the estimated price-cost mark-ups are, however, not statistically significantly different in both countries.

[22] For the latter, the use of 3-year lags of the inputs as instruments in the first-differenced equation does not prove informative either.

[23] Since we had to define comparable industries based on NACE Rev. 2-codes for BE while NACE Rev. 1.1-codes for NL, we could only select 30 common industries. In both countries, these 30 common industries account for about 92% of the total sample.

Eq. (6) shows that the gap between the estimated output elasticities of labor and materials and their revenue shares are key to empirical identification of the product and labor market imperfection parameters. Intuitively, in a perfectly competitive labor market or in a right-to-manage bargaining setting, the marginal employee receives a wage that equals his/her marginal revenue. As such, the only source of discrepancy between the estimated output elasticity of labor and the share of labor costs in revenue is the price-cost mark-up, just like in the materials market, yielding the value zero of the joint market imperfections parameter. In an efficient bargaining (monopsony) setting, the marginal employee gets a wage that exceeds (is less than) his/her marginal revenue, yielding the positive (negative) value of the joint market imperfections parameter.

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. Given the comparative nature of our study, we obviously need to select sensible threshold values, μ_{j0} and ψ_{j0}, that are the same across countries and industries. We have chosen $\mu_{j0} = 1.10$ and $|\psi_{j0}| = |0.20|$ as reasonable threshold values for our comparison. The "data-dependent" choice of $|0.20|$ for $|\psi_{j0}|$ is motivated by the fact that the average and median values of industry-specific labor market imperfection parameters that we obtain are economically meaningful for both countries, as shown in Table B.6 in Appendix B. The estimated industry-specific joint market imperfections parameter $\left(\widehat{\psi}_j\right)$ determines the regime characterizing the type of competition prevailing in the product and the labor market. *A priori*, 6 distinct regimes are possible: (*1*) perfect competition in the product market (PC) and perfect competition or right-to-manage bargaining in the labor market (PR), (*2*) imperfect competition in the product market (IC) and perfect competition or right-to-manage bargaining in the labor market (PR), (*3*) perfect competition in the product market (PC) and efficient bargaining in the labor market (EB), (*4*) imperfect competition in the product market (IC) and efficient bargaining in the labor market (EB), (*5*) perfect competition in the product market (PC) and monopsony in the labor market (MO) and (*6*) imperfect competition in the product market (IC) and monopsony in the labor market (MO). We denote the 6 possible regimes by $R \in \Re = \{PC\text{-}PR, IC\text{-}PR, PC\text{-}EB, IC\text{-}EB, PC\text{-}MO, IC\text{-}MO\}$.

Our classification procedure is based on confidence intervals around estimated parameters. It is generally accepted that market imperfections are the norm, not the exception. Therefore, 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. Likewise, 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. As such, our classification procedure is summarized as follows:

Classification procedure:	Statistical significance level	Null hypothesis not rejected
Hypothesis test for product market setting (PMS): H_{10}: $\mu_j - 1 > 0.10$ against H_{1a}: $\mu_j - 1 \leq 0.10$	5%	$PMS = PC$
Hypothesis test for EB-labor market setting (LMS): H_{10}: $\psi_j > 0.20$ against H_{1a}: $\psi_j \leq 0.20$	5%	$LMS = EB$
Hypothesis test for MO-labor market setting (LMS): H_{10}: $\psi_j < -0.20$ against H_{1a}: $\psi_j \geq -0.20$	5%	$LMS = MO$

6 Differences in regimes and market imperfections

6.1 Prevalent regimes

Table 2 summarizes the resulting industry classification. Table B.5 in Appendix B provides details on the specific industries belonging to each regime. Focusing on the product market side, 90% of the industries comprising 89% of the firms are typified by imperfect competition in BE whilst this holds for 93% of the industries comprising 97% of the firms in NL. The three PC-industries in BE belong to manufacturing whilst the two PC-industries in NL belong to services. On the labor market side, 53% of the industries comprising 51% of the firms are characterized by efficient bargaining, 33% of the industries comprising 22% of the firms by monopsony and 13% of the industries comprising 27% of the firms by perfect competition or right-to-manage bargaining in BE. In NL, 57% of the industries comprising 64% of the firms are characterized by efficient bargaining, 27% of the industries comprising 24% of the firms by perfect competition or right-to-manage bargaining and 17% of the industries comprising 12% of the firms by monopsony.

Taken together, the three predominant regimes in BE are IC-EB, IC-MO and IC-PR:

- IC-EB-regime: 53% of the industries comprising 51% of the firms,
- IC-MO-regime : 27% of the industries comprising 19% of the firms and
- IC-PR-regime: 10% of the industries comprising 18% of the firms.

In NL, the three predominant regimes are IC-EB, IC-PR and IC-MO:

- IC-EB-regime: 57% of the industries comprising 64% of the firms,
- IC-PR-regime: 20% of the industries comprising 21% of the firms and
- IC-MO-regime: 17% of the industries comprising 12% of the firms.

<Insert Table 2 about here>

Summing up, the prevalent product and labor market settings and hence the prevalent regimes are to some extent comparable in BE and NL. In both countries, (i) the proportion of industries that is characterized by imperfect competition in the product market amount to more than 90% and (ii) the most prevalent labor market setting is efficient bargaining. As such, the dominant regime is one of imperfect competition in the product market and efficient bargaining in the labor market in both countries. The most pronounced difference that we observe is a higher prevalence of monopsony and a lower prevalence of perfect competition or right-to-manage bargaining in BE compared to NL.

How sensitive are the revealed product and labor market settings and regimes to the choice of estimator? As a robustness check, we estimate our modified production function framework using three other estimators that are widely adopted in the literature: (i) the *ordinary least squares (OLS)* estimator, (ii) the *within-group fixed-effects (FE)* estimator and (iii) the *Wooldridge-Levinsohn-Petrin (W-LP)* estimator[24]. More specifically, we take our preferred estimator (*SYS-GMM*) as the benchmark and compare systematically each of these three other estimators (*OLS*, *FE* and *W-LP*) to this benchmark. Table 3 summarizes this sensitivity check by reporting the proportion of industries belonging to the same product market setting/labor market setting/regime according to each pair of estimators. As the four implemented methodologies are based on different statistical and economic assumptions, we expect *a priori* to find shifts in $PMS/LMS/$*regime* across estimators, which we confirm. From Table 3, it follows that for both countries, the lowest match in terms of PMS results from comparing the *SYS-GMM* and *FE* estimators whilst the highest match is obtained by comparing the *SYS-GMM* and *W-LP* estimators. The proportion of industries belonging to the same PMS lies in the [57%-90%]-range for BE and the [70%-93%]-range for NL. The match in terms of LMS across estimators is driven by the matched EB-industries. We observe the lowest match in terms of LMS by comparing the *SYS-GMM* and *W-LP* estimators in both countries whilst the highest match by comparing the *SYS-GMM* and *OLS* estimators in BE and by comparing the *SYS-GMM* and *FE* estimators in NL. The proportion of industries belonging to the same LMS lies in the [43%-67%]-range for BE and the [37%-47%]-range for NL. The lowest match in terms of *regime* (requiring a match in terms of PMS as well as LMS) results from comparing the *SYS-GMM* and *W-LP* estimators for BE and the *SYS-GMM* and *FE* estimators for NL. For both countries, the highest match in terms of *regime* is obtained by comparing the *SYS-GMM* and *OLS* estimators. The proportion of industries belonging to the same *regime* lies in the [20%-53%]-range for BE and the [33%-67%]-range for NL.

<Insert Table 3 about here>

6.2 Within-regime industry differences

The main finding of the previous section is that BE and NL are characterized by the same predominant regimes, which can be interpreted in two ways. *First*, our methodology does not allow to capture country-level institutional differences in terms of regulatory policy and the industrial relations system, which are structural in nature. *Second*, minor cross-country regime differences mask important cross-country differences in the composition of industries making up the regimes. To investigate the latter interpretation, we compare the relevant regime of each industry $j \in \{1, \ldots, 30\}$ across both countries (see Table B.5 in Appendix B). Confirming within-regime industry heterogeneity across both countries, we observe that 68% (13 out of 19) of the industries in manufacturing and 55% (6 out of 11) industries in services are characterized by a different regime. The six common IC-EB-industries in manufacturing are wearing apparel and leather products, basic metals, fabricated metal products, machinery and equipment n.e.c., furniture and other manufacturing n.e.c.

[24] Wooldridge (2009) modifies the Levinsohn and Petrin (2003)-approach by writing the moment restrictions used by Levinsohn-Petrin in terms of two equations with the same dependent variable but different instrument sets and applying generalized method of moments. The main advantages of this one-step approach compared to the two-step estimation procedure implemented by Ackerberg *et al.* (2006) –who propose a hybrid of the Olley and Pakes (1996) and Levinsohn and Petrin (2003) approaches– are (i) obtaining robust standard errors in the standard GMM framework, (ii) generating more efficient estimates by using the cross-equation correlation and an optimal weighting matrix accounting for serial correlation and heteroskedasticity and (iii) allowing for straightforward testing of overidentification restrictions. As usually done, we perform the *W-LP* estimator by approximating the unobserved productivity shock by a third-order polynomial in material costs and capital.

In four out of these six IC-EB-industries, the price-cost mark-up is estimated to be larger in NL whilst in three out of these six IC-EB-industries, the extent of rent sharing is estimated to be larger in BE. In services, wholesale is typified by IC-PR, telecommunications by IC-MO and publishing activities, other computer and related activities, and architectural and engineering activities by IC-EB in both countries. In the common IC-PR-industry in services, price-cost mark-ups are not significantly different in both countries. In the common IC-MO-industry in services, both the price-cost mark-up and the labor supply elasticity are estimated to be larger in BE. In the three common IC-EB-industries in services, the price-cost mark-up is estimated to be larger in NL whilst the opposite holds for the extent of rent sharing. As referred to in Section 2, several studies –including OECD studies– report the degree of product and labor market regulation at the country level. Our finding that the vast majority of manufacturing and service industries is mostly characterized by different labor market settings in the two countries, however, calls for an approach to construct such a regulation index at the country-industry level rather than at the country level.

Confirming the aforementioned within-regime industry heterogeneity, Table B.8 in Appendix B provides details on the compositional variation of the predominant regimes across both countries. In the IC-EB-regime, we observe a higher prevalence of manufacturing industries, with the dominance of manufacturing industries being higher in NL. None of the IC-EB-industries are low-technology industries in either manufacturing or services in NL. In addition, in NL, there is a significantly larger proportion of IC-EB-industries in high-technology services. In the IC-MO-regime, we only observe a higher prevalence of manufacturing industries in NL. None of the IC-MO-industries are either in low- or high-technology manufacturing in BE whilst the opposite holds in NL, i.e. all of them belong to these two types of manufacturing industries. None of the IC-MO-industries belong to low-technolology services in NL. In the IC-PR-regime, we only discern a higher prevalence of manufacturing industries in BE. None of the IC-PR-industries are in low-technology manufacturing in BE whereas none of them are in high-technology manufacturing in NL. None of the IC-PR-industries belong to high-technology services in both countries.

So far, we have concentrated on the *identification of the type* of competition prevailing in product and labor markets. As resource allocative efficiency is likely to vary across countries and across industries, we now focus on the *quantification* of market power in product and labor markets. This enables us to evaluate to which degree actual product and labor markets deviate from their perfectly competitive or economically efficient counterparts. From Section 3, it is clear that once the regime is determined, the product and labor market imperfection parameters are derived from the estimated joint market imperfections parameter $\widehat{\psi}_j$. Table 4 presents the industry mean and the industry quartile values of the SYS-GMM results within each of the predominant regimes in BE and NL. The left part of Table 4 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[25] within 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

[25] The profit ratio, defined as $\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$, shows that the source of profit lies either in imperfect competition or decreasing returns to scale.

standard errors (σ) of $\widehat{\mu}_j$, $\widehat{\gamma}_j$, $\widehat{\phi}_j$, $\widehat{\beta}_j$ and $\left(\widehat{\varepsilon}_w^N\right)_j$ are computed using the Delta method (Wooldridge, 2002).[26] All industry-specific estimates are presented in Table B.9 in Appendix B. In addition to the parameters reported in Table 4, Table B.9 also reports the computed factor shares and the output elasticity estimates.[27] In Table B.9, industries within the *PC-PR*- and *IC-PR*-regimes are ranked according to $\widehat{\mu}_j$. Within the *IC-EB*-regime, we rank industries in increasing order of $\widehat{\gamma}_j$. Within the *PC-MO*- and *IC-MO*-regimes, industries are ranked according to $\widehat{\beta}_j$. Graph B.1 in Appendix B shows the relationship between the product market competition parameter ($\widehat{\mu}_j$) and the joint market imperfections parameter ($\widehat{\psi}_j$) for all industries using different symbols for the different regimes.

Let us focus the discussion on the primary parameters within the predominant regimes in *BE* and *NL* respectively. The predominant regimes in *BE* are *IC-EB* (53% of industries/51% of firms), *IC-MO* (27% of industries/19% of firms) and *IC-PR* (17% of industries/12% of firms).

- Within regime $R = IC\text{-}EB$ in *BE*, $\widehat{\lambda}_j$ is lower than 0.925 for industries in the first quartile and higher than 0.993 for industries in the third quartile. $\widehat{\psi}_j$ is lower than 0.240 for industries in the first quartile and higher than 0.707 for industries in the third quartile. The corresponding $\widehat{\mu}_j$ is lower than 1.090 for the first quartile of industries and higher than 1.190 for the top quartile. The corresponding $\widehat{\phi}_j$ is lower than 0.323 for the first quartile of industries and higher than 0.577 for the top quartile. The median values of $\widehat{\lambda}_j$, $\widehat{\psi}_j$, $\widehat{\mu}_j$ and $\widehat{\phi}_j$ are estimated at 0.977, 0.434, 1.153 and 0.428 respectively.

- Within regime $R = IC\text{-}MO$ in *BE*, $\widehat{\lambda}_j$ is lower than 0.952 for industries in the first quartile and higher than 1.025 for industries in the third quartile. $\widehat{\psi}_j$ is lower than -0.176 for industries in the first quartile and higher than -0.072 for industries in the third quartile. The corresponding $\widehat{\mu}_j$ is lower than 1.016 for the first quartile of industries and higher than 1.090 for the top quartile. The corresponding $\left(\widehat{\varepsilon}_w^N\right)_j$ is estimated to be lower than 6.309 for industries in the first quartile and higher than 15.803 for industries in the upper quartile. The median values of $\widehat{\lambda}_j$, $\widehat{\psi}_j$, $\widehat{\mu}_j$ and $\left(\widehat{\varepsilon}_w^N\right)_j$ are estimated at 0.978, -0.094, 1.033 and 11.585 respectively.

- Within regime $R = IC\text{-}PR$ in *BE*, $\widehat{\lambda}_j$ is lower than 0.985 for industries in the first quartile and higher than 1.228 for industries in the third quartile. $\widehat{\mu}_j$ is lower than 1.105 for industries in the first quartile and higher than 1.219 for industries in the upper quartile. The median values of $\widehat{\lambda}_j$ and $\widehat{\mu}_j$ are estimated at 1.014 and 1.178 respectively.

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[26] Dropping subscript j, $\widehat{\mu}$, $\widehat{\gamma}$, $\widehat{\phi}$, $\widehat{\beta}$ and $\widehat{\varepsilon}_w^N$ are derived as follows: $\widehat{\mu} = \frac{\widehat{\varepsilon}_M^Q}{\alpha_M}$, $\widehat{\gamma} = \frac{\widehat{\varepsilon}_N^Q - \left(\widehat{\varepsilon}_M^Q \frac{\alpha_N}{\alpha_M}\right)}{\frac{\widehat{\varepsilon}_M^Q}{\alpha_M}(\alpha_N + \alpha_M - 1)}$, $\widehat{\phi} = \frac{\widehat{\gamma}}{1+\widehat{\gamma}}$, $\widehat{\beta} = \frac{\alpha_N}{\alpha_M}\frac{\widehat{\varepsilon}_M^Q}{\widehat{\varepsilon}_N^Q}$ and $\widehat{\varepsilon}_w^N = \frac{\widehat{\beta}}{1-\widehat{\beta}}$. Their respective standard errors are computed as:

$$(\sigma_{\widehat{\mu}})^2 = \frac{1}{(\alpha_M)^2}\left(\sigma_{\widehat{\varepsilon}_M^Q}\right)^2, \quad (\sigma_{\widehat{\gamma}})^2 = \left(\frac{\alpha_M}{\alpha_N+\alpha_M-1}\right)^2 \frac{\left(\widehat{\varepsilon}_M^Q\right)^2\left(\sigma_{\widehat{\varepsilon}_N^Q}\right)^2 - 2\widehat{\varepsilon}_N^Q\widehat{\varepsilon}_M^Q\left(\sigma_{\widehat{\varepsilon}_N^Q,\widehat{\varepsilon}_M^Q}\right) + \left(\widehat{\varepsilon}_N^Q\right)^2\left(\sigma_{\widehat{\varepsilon}_N^Q}\right)^2}{\left(\widehat{\varepsilon}_M^Q\right)^4}, \quad \left(\sigma_{\widehat{\phi}}\right)^2 = \frac{(\sigma_{\widehat{\gamma}})^2}{(1+\widehat{\gamma})^4},$$

$$\left(\sigma_{\widehat{\beta}}\right)^2 = \left(\frac{\alpha_N}{\alpha_M}\right)^2 \frac{\left(\widehat{\varepsilon}_M^Q\right)^2\left(\sigma_{\widehat{\varepsilon}_N^Q}\right)^2 - 2\widehat{\varepsilon}_N^Q\widehat{\varepsilon}_M^Q\left(\sigma_{\widehat{\varepsilon}_N^Q,\widehat{\varepsilon}_M^Q}\right) + \left(\widehat{\varepsilon}_N^Q\right)^2\left(\sigma_{\widehat{\varepsilon}_M^Q}\right)^2}{\left(\widehat{\varepsilon}_N^Q\right)^4} \text{ and } \left(\sigma_{\widehat{\varepsilon}_w^N}\right)^2 = \frac{\left(\sigma_{\widehat{\beta}}\right)^2}{(1-\widehat{\beta})^4}.$$

[27] For reasons of completeness, Table B.9 also provides detailed information on the *SYS-GMM* estimates of the industries which are classified in the non-predominant regimes in both countries, i.e. the *PC-PR*- and *PC-MO*-regimes in *BE* and the *PC-PR*-regime in *NL*.

The predominant regimes in NL are *IC-EB* (57% of industries/64% of firms), *IC-PR* (20% of industries/21% of firms) and *IC-MO* (17% of industries/12% of firms).

- Within $R =$ *IC-EB* in NL, $\widehat{\lambda}_j$ is lower than 0.965 for industries in the first quartile and higher than 1.004 for industries in the third quartile. $\widehat{\psi}_j$ is lower than 0.282 for industries in the first quartile and higher than 0.573 for industries in the third quartile. The corresponding $\widehat{\mu}_j$ is lower than 1.242 for the first quartile of industries and higher than 1.453 for the top quartile. The corresponding $\widehat{\phi}_j$ is estimated to be lower than 0.196 for industries in the first quartile and higher than 0.318 for industries in the upper quartile. The median values of $\widehat{\lambda}_j$, $\widehat{\psi}_j$, $\widehat{\mu}_j$ and $\widehat{\phi}_j$ are estimated at 0.977, 0.453, 1.305 and 0.262 respectively.

- Within regime $R =$ *IC-PR* in NL, $\widehat{\lambda}_j$ is lower than 0.997 for industries in the first quartile and higher than 1.099 for industries in the third quartile. $\widehat{\mu}$ is lower than 1.020 for industries in the first quartile and higher than 1.264 for industries in the upper quartile. The median values of $\widehat{\lambda}_j$ and $\widehat{\mu}_j$ are estimated at 1.087 and 1.166 respectively.

- Within $R =$ *IC-MO* in NL, $\widehat{\lambda}_j$ is lower than 0.982 for industries in the first quartile and higher than 1.023 for industries in the third quartile. $\widehat{\psi}_j$ is lower than -0.415 for industries in the first quartile and higher than -0.085 for industries in the third quartile. The corresponding $\widehat{\mu}_j$ is lower than 1.021 for the first quartile of industries and higher than 1.253 for the top quartile. The corresponding $\left(\widehat{\varepsilon}_w^N\right)_j$ is estimated to be lower than 2.662 for industries in the first quartile and higher than 12.030 for industries in the upper quartile. The median values of $\widehat{\lambda}_j$, $\widehat{\psi}_j$, $\widehat{\mu}_j$ and $\left(\widehat{\varepsilon}_w^N\right)_j$ are estimated at 1.009, -0.145, 1.105 and 9.413 respectively.

<Insert Table 4 about here>

Given that we have provided evidence of compositional variation in regimes across countries, we expect *a priori* to observe differences in median market imperfection parameters across countries within a particular regime. We confirm this expectation within the dominant regime. Indeed, within the *IC-EB*-regime, the median price-cost mark-up is estimated to be significantly higher in NL (1.305 compared to 1.153 in BE) whilst the median absolute extent of rent sharing is estimated to be significantly higher in BE (0.428 compared to 0.262 in NL). As noted above, the level of price-cost mark-ups depends on the degree of tradeability of an industry's output, and hence asymmetric exposure to international competition might be an important determinant of price-cost mark-up heterogeneity across countries and industries. The higher trade opennes in BE and the composition of Belgian exports might explain the lower price-cost mark-up estimates in BE whilst the lower extent of rent-sharing estimates in NL might be explained by the trade unions' voluntary acceptance of modest wage increases. However, we do not detect any statistically significant cross-country differences in the median product and labor market imperfection parameters within the other two predominant regimes.

Existing empirical studies –relying on either the same or a simplified version of our theoretical model– have found that product and labor market imperfections are likely to go hand in hand by documenting a positive correlation between the estimated price-cost mark-up and the estimated extent of rent sharing in the cross-section dimension (see Dobbelaere, 2004; Boulhol *et al.*, 2011 and Dobbelaere and Mairesse, 2013).

Corroborative evidence is provided by several OECD studies indicating that (*i*) there is a positive correlation between product market regulation and industry wage mark-ups (OECD, 2001) and (*ii*) product and labor market deregulations are correlated across countries (e.g. Brandt *et al.*, 2005). Supporting evidence is also given by Ebell and Haefke (2006) who argue that the strong decline in coverage and unionization in the UK and the US might have been a direct consequence of product market reforms of the early 1980s and by Boulhol (2009) who develops a theoretical model formalizing the idea that trade and capital market liberalization put pressure on labor market institutions leading to deregulation. Do we observe any relationship between product and labor imperfections in the two countries under consideration? To get a first insight, Table B.7 in Appendix B reports correlations between product and labor market imperfection parameters for all industries and for two out the three predominant regimes (IC-EB and IC-MO) in both countries. Two types of correlations between $\widehat{\mu}_j$ and $\widehat{\gamma}_j$ / $\widehat{\mu}_j$ and $\widehat{\beta}_j$ 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. Considering all industries, we observe a significant and strong correlation (of more than 0.60) between either $\widehat{\mu}_j$ and $\widehat{\gamma}_j$ or $\widehat{\mu}_j$ and $\widehat{\beta}_j$ in BE. This holds for both types of correlation coefficients. Within the dominant IC-EB-regime in BE, we find a significant robust correlation of about 0.66 between $\widehat{\mu}_j$ and $\widehat{\gamma}_j$, which we do not confirm within the IC-MO-regime. Considering all industries, we observe a significant rank (robust) correlation of 0.63 (0.18) between $\widehat{\mu}_j$ and $\widehat{\gamma}_j$ and a significant rank (robust) correlation of 0.57 (0.22) between $\widehat{\mu}_j$ and $\widehat{\beta}_j$ in NL. However, none of the correlation coefficients are significant within the predominant IC-EB- and IC-MO- regimes.[28] A visual representation is given in Graph 1 for BE and Graph 2 for NL. The first two panels in each graph focus on all industries, whereas the last two panels focus on the IC-EB- and IC-MO- regimes respectively. The dashed lines denote the median values of the product and labor market imperfection parameters. Manufacturing industries are indicated in green, service industries in red.

<Insert Graphs 1-2 about here>

During the second half of 2008, the Belgian economy was hit in earnest by the international crisis. We examined the sensitivity of the type and the degree of market imperfections to excluding the financial crisis years 2009-2011 from the estimation sample in BE. Selecting only firms having at least three consecutive observations as in the original estimation sample, we end up with 4,310 firms covering the period 2003-2008 (i.e. 81% (60%) of the original estimation sample in terms of firms (observations)). Compared to the original classification (see Table 2), we observe a slight decrease in the proportion of PC-PR- and PC-MO-industries which translates into a slight increase in the proportion of IC-PR- and IC-MO-industries. Consistent with the original classification, the predominant regimes are IC-EB (53% of industries), IC-PR (30% of industries) and IC-PR (13% of industries). Considering all industries, the median price-cost mark-up is estimated at

[28] Another measure that is often used as a proxy for market power is the PCM (see supra). We checked how the average industry-specific PCM_j –which we computed from the raw data– correlates with (*i*) the average industry-specific price-cost mark-ups imposing the PR-labor market setting on the data as in Hall (2006) ($\mu_{only,j}$) and (*ii*) our average industry-specific price-cost mark-up (μ_j). We find a significantly positive robust correlation between PCM_j and $\mu_{only,j}$ in all industries and in the IC-EB- and IC-MO-regimes which is about 0.40 for BE and about 0.30 for NL. In addition, we observe a significantly positive robust correlation between PCM_j and μ_j of about 0.20 in the IC-EB- and IC-MO-regimes. In contrast, the latter correlation appears to be significantly negative for NL.

1.100 (compared to 1.098 in the original estimation sample). In the IC-EB-regime, the median price-cost mark-up and absolute extent of rent sharing are estimated at 1.163 and 0.462 respectively (compared to 1.153 and 0.428 in the original estimation sample). In the IC-MO-regime, the median price-cost mark-up and labor supply elasticity are estimated at 1.059 and 2.813 respectively (compared to 1.033 and 11.585 in the original estimation sample). In the IC-PR-regime, the median price-cost mark-up is estimated at 1.140 (compared to 1.178 in the original estimation sample). This sensitivity check reveals that neither the type nor the degree of market imperfections is significantly affected by excluding the financial crisis years 2009-2011 from the Belgian estimation sample (except for the large decrease in the labor supply elasticity estimate in the IC-MO-regime).[29]

7 Differences in TFP distributions

7.1 Related literature

Economists have devoted much research to identifying the sources of large and persistent productivity growth differences across firms, industries and countries (Syverson, 2011). Starting from the perspective that in an economy with heterogeneous production units, aggregate TFP depends not only on the TFP's of individual production units but also on how inputs are allocated across these production units, a new theoretical and empirical literature has emerged over the past decade. This literature has now well established the 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 (such as unemployment insurance and employment protection, trade barriers) and market imperfections (such as heterogeneity in price-cost mark-ups, credit constraints) impact aggregate TFP via generating misallocation (see Restuccia and Rogerson, 2013 for references).

In the previous section, we have documented heterogeneity in resource allocative efficiency across countries and industries and we have identified and quantified industry-specific measures of product and labor market competition which are thought to be empirically important sources of this documented misallocation. This section attempts to assess the importance of product and labor market competition in explaining TFP growth differences in a descriptive way. More specifically, to gain insight into the importance 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. In addition, to investigate the potential role of skills and the compositional variation within regimes in affecting regime-specific TFP distributions, we also distinguish between (i) high- and low-skilled firms within each of the prevalent regimes and (ii) manufacturing and service firms within each of the predominant regimes in both countries.

There is a vast theoretical and empirical literature on the impact of product market competition on productivity. Theoretically, there are several channels through which increased product market competition might positively affect productivity: (i) through within-firm reallocation of inputs and between-firm reallocation; forcing the least productive firms to exit (selection effect, see e.g. Syverson, 2007) and reallocating market

[29] Detailed results are not reported but available upon request.

shares towards the most productive firms (reallocation effect) (both effects are referred to as allocative efficiency, see e.g. Melitz, 2003)[30], (*ii*) through optimizing the use of production factors (productive or technical efficiency, see e.g. Green and Mayes, 1991); predominantly through reducing agency costs and increasing managerial and workers' effort and (*iii*) through incentivizing firms to innovate and moving towards the technological frontier (dynamic efficiency, see Hashmi, 2013 for references). Empirically, studies focusing on the first channel generally find a negative relationship between the degree of product market competition and price-cost mark-ups, confirming the theoretical predictions (see e.g. Jacquemin and Sapir, 1991; Allen *et al.*, 1998; Griffith and Harrison, 2004; Boulhol *et al.*, 2011). Empirical studies using frontier production techniques confirming the theoretical predictions of the second channel include e.g. Green and Mayes, 1991; Bradley *et al.*, 2001; Lien and Peng, 2001; Driessen *et al.*, 2006; Yuen and Zhang, 2009. Empirical evidence on the third channel remains inconclusive (see Hashmi and Van Biesenbroeck, 2010 for a discussion).[31]

Likewise, there is a large literature on the impact of labor market conditions/institutions in general and unionization in particular on productivity. The latter literature identifies two channels through which unions might have a positive impact on productivity (Freeman and Medoff, 1984). The first channel –which is called the monopoly union effect– is through firms' response to increased labor costs by increasing the capital intensity and employing better-quality labor. The second channel –which is called the union voice/institutional response effect– is through (*i*) the 'shock' effect that unions might cause, inducing managers to change production methods and to adopt more efficient personnel policies (Slichter *et al.*, 1960), (*ii*) a reduction of staff turnover (Freeman, 1976; Addison and Barnett, 1982), (*iii*) improved worker morale and motivation (Leibenstein, 1966) and (*iv*) better communication between workers and management (Dworkin and Ahlburg, 1985). The productivity gain resulting from the first channel is socially harmful because it is caused by inefficient allocation of resources while the productivity gain from the second channel is socially desirable because it is induced by improved allocative and technical efficiency (Freeman and Medoff, 1979; DeFina, 1983). Negative productivity effects might arise from strike activity and non-cooperative behavior (Caves, 1980; Flaherty, 1987) and the adoption of inefficient work practices (Pencavel, 1977); thereby decreasing allocative and technical efficiency. There are several channels through which unions might have an impact on innovation activities, affecting dynamic efficiency (see Menezes-Filho and Van Reenen, 2003 and Lingens, 2007 for a discussion). Empirically, micro evidence on the impact of unions on productivity as well as on innovation is inconclusive (see Doucouliagos and Laroche, 2003, 2012 for surveys).[32] Inspired by the seminal papers of Bruno and Sachs (1985) and Calmfors and Driffel (1988), a vast empirical literature has examined the impact of the level of centralization of wage bargaining on economic performance but has not established a robust relationship (see Flanagan, 1999 and Aidt and Tzannatos, 2005 for surveys).[33]

Labor market institutions might also influence productivity in different directions. On the one hand, rigid la-

[30] The general presumption is that intensified competition among firms alleviates the distortions associated with monopoly power, thereby generating higher TFP. Several studies, however, challenge the latter presumption (see e.g. Vickers, 1995, Epifani and Gancia, 2011 and De Loeker *et al.*, 2012).

[31] We refer to Polder and Veldhuizen (2012) for evidence for the NL.

[32] In a model of strategic R&D with union bargaining, Ulph and Ulph (1994) show that the impact of unions on innovation depends on the bargaining scope (i.e. wages (right-to-manage bargaining) versus wages and employment (efficient bargaining)), which is empirically confirmed by Menezes-Filho *et al.* (1998).

[33] Lingens (2007) theoretically shows that the growth effect of unionization depends on the level of centralization of wage bargaining.

bor market institutions (such as employment protection regulation, search frictions in job-to-job transitions) might hinder productivity growth through raising labor adjustment costs thereby impeding labor reallocation (Autor *et al.*, 2007; Martin and Scarpetta, 2012; Fajgelbaum, 2013).[34,35] On the other hand, such cooperative labor relations might lead to higher productivity growth. Protection against dismissal might improve productivity as secure workers will be more willing to cooperate with management in the development of the production process and in disclosing (tacit) knowledge for the firm (Lorenz, 1992, 1999; Gächter and Falk, 2002). By promoting job stability, high employment protection might also encourage workers to invest in education in training as it reduces the uncertainty with the future pay-offs of such human capital investments (Agell, 1999; Acharya *et al.*, 2013).[36]

7.2 Descriptive evidence

Consistent with our modified production function framework, we measure TFP as the residual of a *SYS-GMM* estimation of the standard Cobb-Douglas production function at the industry level [Eq. (12)]. More specifically, we estimate a production function for each of the 30 manufacturing and service industries in BE and NL and calculate TFP as $TFP_{it} = q_{it} - \widehat{\mu}\left[\alpha_N\left(n_{it} - k_{it}\right) + \alpha_M\left(m_{it} - k_{it}\right)\right] - \widehat{\psi}_M\left[\alpha_N\left(k_{it} - n_{it}\right)\right] - \widehat{\lambda}k_{it} - u_t$. Graph 3 presents the kernel density estimates of the TFP distributions by country and by each of the prevalent regime. The upper part of Table 5 reports the moments –mean, variance, skewness and kurtosis– of the corresponding distributions. Within each country, regimes are ranked in decreasing order of prevalence in all tables and graphs in this section.

Interesting cross-country and cross-regime differences show up. Focusing on cross-country differences, average TFP growth rates vary between 0.3% ($R = PC\text{-}MO$) and 2.2% ($R = IC\text{-}MO$) in BE and between 1.4% ($R = PC\text{-}PR$) and 2.4% ($R = IC\text{-}PR$) in NL. Average TFP growth rates are lower in the $IC\text{-}PR$- and $IC\text{-}EB$-regimes in BE, whilst the opposite is true in the $IC\text{-}MO$-regime. No significant differences in TFP growth rates are detected in the $PC\text{-}PR$-regime. Except for the $IC\text{-}MO$-regime, TFP is more dispersed in all regimes in NL, suggesting more inequality in the TFP distributions in these Dutch regimes. The mass of the TFP distributions is concentrated on the left in in all regimes in both countries (right-skewed). The positive skewness is lower in the $IC\text{-}PR$- and $IC\text{-}EB$-regimes in BE, whilst the opposite holds in the $PC\text{-}PR$- and $IC\text{-}MO$-regimes. TFP distributions consistently have sharper peaks and heavier tails than a standard normal distribution in all regimes in both countries, implying that most of the variance in TFP is due to extreme but infrequent deviations.[37]. Except for the $IC\text{-}EB$-regime, this positive excess kurtosis is significantly higher in all regimes in BE.

Focusing on regime differences, we observe the lowest average TFP growth rate in $PC\text{-}MO$-regime in BE

[34] Recent cross-country evidence and studies of policy reforms relating firm-level adjustment to institutional characteristics of the labor market include Caballero *et al.* (2004), Kugler (2007) and Haltiwanger *et al.* (2008).

[35] In a search model with two sided heterogeneity and on-the-job search, Cai *et al.* (2014) study the desirability of centralized (versus decentralized) bargaining agreements by assessing the trade-off between the reduced allocative role of wages and the internalization of the business-stealing externality induced by centralized wage bargaining.

[36] Dustmann and Schonberg (2009) show that unions positively affect on-the-job training by imposing wage floors that lead to wage compression.

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

and in the regime characterized by perfect competition in both markets (R = PC-PR) in NL. The highest average TFP growth rate is recorded in the IC-MO-regime in BE and the IC-PR-regime in NL. The lowest dispersion is detected in the PC-PR-regime (IC-MO-regime) in BE (NL) and the highest dispersion in the IC-PR-regime in both countries. Irrespective of the product market setting, TFP appears to be more unequally distributed in regimes characterized by perfect competition or right-to-manage bargaining in NL. Compared to the dispersion, a reverse pattern is detected for the skewness in BE: the TFP distribution in the IC-PR-regime displays the lowest positive skewness, whilst the TFP distribution in the PC-PR-regime the highest positive skewness. In NL, the TFP distribution is less skewed to the right in the IC-MO-regime and most skewed to the right in the IC-EB-regime. The lowest positive excess kurtosis is detected in the IC-MO-regime (PC-PR-regime) and the highest positive excess kurtosis in the IC-PR-regime (IC-EB-regime) in BE (NL).

Summing up, we discern cross-country cross-regime differences in TFP distributions which might be interpreted as descriptive evidence of resource misallocation across heterogeneous production units being an important source of cross-country differences in measured TFP as emphasized in the literature (see supra). However, our descriptive analysis does not reveal a clear relationship between the type of product and labor market imperfections and TFP distributional characteristics. In other words, we do not observe a unified ranking of regimes in terms of TFP distributional characteristics in both countries. We do find that TFP distributions in the IC-PR- and IC-EB-regimes share similar characteristics in both countries. More specifically, TFP distributions in the IC-PR-regime are characterized by (*i*) a (relatively) high mean, (*ii*) the highest dispersion which (*iii*) is caused by (extreme) outliers. TFP growth rates are on average relatively low and at the same time less dispersed in the IC-EB-regime. The latter finding suggests that unionization seems to impact TFP negatively compared to non-unionized regimes. The lower TFP dispersion in the unionized regime is somehow compatible with the microeconomic evidence of highly centralized wage bargaining settings being more conducive to wage compression compared to decentralized wage bargaining settings (see Hartog *et al.*, 2002; Cardoso and Portugal, 2005; Card and de la Rica, 2006).

<Insert Graph 3 and Table 5 about here>

Which factors could further explain these differences in TFP distributions across countries and regimes? Given the data at hand, we examine (*i*) the role of skills and (*ii*) the compositional variation within regimes in shaping TFP distributions. Focusing on skill heterogeneity, the middle part of Table 5 reports the TFP distributional characteristics selecting only the high-skilled firms whilst the lower part only selects the low-skilled firms. The corresponding TFP differences are visualized in Graph 4. Looking at the first two moments of the TFP distributions, we confirm that average TFP growth rates are significantly higher in high-skilled enterprises in all regimes, except for the PC-PR-regime in both countries. This result is consistent with the finding of significantly positive effects of human capital on productivity (see Lebedinski and Vandenberghe, 2014 for evidence for BE and Bartelsman *et al.*, 2014 for evidence for NL). Focusing on cross-country differences, average TFP growth rates vary between 0.8% (R = PC-MO) and 2.1% (R = IC-MO) in high-skilled firms in BE and between 1.0% (R = PC-PR) and 2.7% (R = IC-PR) in NL. In low-skilled firms, the respective growth rates vary between -0.8% (R = PC-MO) and 2.1% (R = PC-PR) in BE and between 0.7% (R = IC-PR) and 1.5% (R = IC-MO) in NL. The gap in average TFP growth rates between high- and low-skilled enterprises is most pronounced in the PC-MO-regime in BE and the IC-PR-regime in NL. The respective premia amount to 1.6 and 2.0 percentage points. TFP is more dispersed in high-skilled enterprises in all regimes in NL whilst this only holds for the PC-MO- and IC-EB-regimes in BE. Focusing on a cross-country cross-regime comparison, interesting differences shows up. In both types of firms, average TFP growth rates are high and TFP is less unequally distributed in the regime characterized by perfect competition in both markets (R = PC-PR) compared to the other prevalent regimes in BE whereas the opposite pattern holds in NL. Focusing on the regimes typified by imperfect competition in both markets, TFP distributions are characterized by a relatively low mean and a relatively low dispersion in the IC-EB-regime in BE and by a relatively high mean but a relatively low dispersion in the IC-MO-regime in NL. This is true for both the high- and low-skilled enterprises.

<Insert Graph 4 about here>

In Section 6.2, we already pointed to large within-regime industry heterogeneity across both countries. Inspired by the compositional variation within the predominant regimes –IC-EB, IC-MO and IC-PR– across both countries (seeTable B.8 in Appendix B), we decomposed each of these predominant regimes into a manufacturing and a services part to examine the role of this compositional variation in shaping TFP distributions.[38] Graph 5 presents the kernel density estimates of the TFP distributions by country and by each of the prevalent regime, split into a manufacturing and services part. Table 6 reports the moments of the corresponding distributions. Focusing on cross-country differences, average TFP growth rates are the lowest in the IC-EB-regime in both manufacturing and services in both countries. In manufacturing, the highest average TFP growth rate is found in the IC-MO-regime (IC-PR-regime) in BE (NL). TFP distributions are less dispersed in the IC-EB-regime and most widely dispersed in the IC-PR-regime in manufacturing in both countries. In services, the highest average TFP growth rate is recorded in the IC-PR-regime in both countries. TFP is less unequally distributed in the R = IC-MO-regime and most unequally distributed in the IC-PR-regime in services in both countries. In all regimes in both countries, average TFP growth rates are higher in services with this productivity premium being the highest in the IC-PR-regime. The latter amounts to 1.8 and 1.0 percentage points in BE and NL respectively. In all regimes in both countries, TFP distributions in services are more dispersed than their counterparts in manufacturing, except for the IC-PR-regime in BE.

<Insert Graph 5 and Table 6 about here>

So far, we have focused on uncovering a potential link between the *type* of product and labor market imperfections and TFP distributional characteristics. Section 6.2 has provided evidence of sizeable within-regime industry heterogeneity in the *degree* of product and labor market imperfections. Examining in a descriptive way the potential link between the degree of market imperfections and different moment of TFP distributions, Table 7 reports correlations between TFP distributional characteristics and product and labor market imperfection parameters for all industries in both countries and for industries belonging to the IC-EB- or IC-MO-industries in BE, and the IC-EB-, IC-PR-, or IC-MO-industries in NL.[39] Selecting only the

[38] For both countries, we obviously selected only the regimes to which both manufacturing and service industries belong, which are precisely the predominant regimes.

[39] The selection of regimes in each country is based on having a minimum number of industries belonging to these regimes in order to perform this descriptive exercise.

statistically significant correlations, a visual representation is given in Graph 6 for BE and Graph 7 for NL where manufacturing industries are indicated in green and service industries in red. The dashed lines denote the median values of the relevant TFP distributional characteristics and the product/labor market imperfection parameters. Graphs B.2 and B.3 in Appendix B show the relationship between TFP distributional characteristics ($TFPGR_{Mean,j}$, $TFPGR_{p50,j}$, $TFPGR_{Sd,j}$, $TFPGR_{Skew,j}$ and $TFPGR_{Kurt,j}$) and the product market competition parameter ($\widehat{\mu}_j$) for all industries in BE and NL respectively, using different symbols for the different regimes. Table B.10 in Appendix B reports the moments of all industry-specific TFP distributions in a particular regime.[40] The corresponding TFP differences are visualized in Graph B.4 for BE and Graph B.5 for NL in Appendix B.

Focusing on all industries, we observe a small significantly positive robust correlation between average TFP growth rates and relative extent of rent sharing parameters in BE. In NL, we find a small significantly positive robust correlation between median TFP growth rates and both labor market imperfection parameters, i.e. either $\widehat{\gamma}_j$ or $\widehat{\beta}_j$ whilst a significantly negative rank and robust correlation is detected between TFP dispersion and both labor market imperfection parameters. Focusing on the *IC*-*EB*-regime, we find a significantly negative robust correlation between TFP dispersion and price-cost mark-up parameters in BE. In NL, we observe a large significantly positive rank correlation between average TFP growth rates and price-cost mark-up parameters whilst a significantly negative robust correlation between average TFP growth rates and relative extent of rent sharing parameters. The latter suggests that the negative impact of unionization on TFP seems to depend on the bargaining strength of unions. Focusing on the *IC*-*MO*-regime, a large significantly negative rank correlation is found between median TFP growth rates and the relevant product and labor market imperfection parameters ($\widehat{\mu}_j$ and $\widehat{\beta}_j$) whereas a significantly negative robust correlation is detected between TFP dispersion and $\widehat{\beta}_j$ in BE. The latter also holds in NL, although the correlation is much smaller. In addition, we observe a large significantly negative rank and robust correlation between TFP dispersion and price-cost mark-up parameters and a large significantly positive rank and robust correlation between the peakedness of TFP distributions and $\widehat{\beta}_j$ in NL. Focusing on the *IC*-*PR*-regime in NL, a significantly negative robust and rank correlation is found between TFP dispersion and price-cost mark-up parameters.

<Insert Graphs 6 & 7 and Table 7 about here>

Summing up, this section illustrates considerable heterogeneity in TFP across the two countries, between different regimes, between enterprises that differ in terms of skill type within a regime and between different industries within a regime. Hence, we provide clear descriptive evidence of TFP distributions varying by the *type* of competition prevailing in product and labor markets. The prevalent labor market setting appears to be more decisive than the product market setting in shaping regime-specific TFP distributions. In both countries, average TFP growth rates are among the largest but TFP is more unequally distributed in the regime characterized by imperfect competition in the product market and perfect competition or right-to-manage bargaining in the labor market whilst the opposite holds in the regime typified by imperfect competition in the product market and efficient bargaining in the labor market. In addition, our descriptive analysis

[40] For reasons of completeness, Table B.10 also reports the TFP distributional characteristics for industries which are classified in the *IC*-*PR*-, *PC*-*MO*- or *PC*-*PR*-regimes in BE and the *PC*-*PR*-regime in NL. Within each regime, industries are ranked in increasing order of $TFPGR_{Mean,j}$.

demonstrates that TFP distributional characteristics vary to some extent by the *degree* of imperfections in product and labor markets, i.e. the levels of product and labor market power.

8 Conclusion

Since the initiation of the Single Market Program, regulatory policies aimed at fostering market openness and competition have been implemented and at the same time efforts in linking labor market policies to industrial relations have been intensified across EU countries in order to stimulate productivity. While some empirical studies have confirmed the effectiveness of these pro-competitive effects by providing evidence of stronger product market competition and less rigid labor market policies having boosted productivity performances, an evaluation of the *joint* impact of product and labor market imperfections on productivity is non-existent. Contributing to the econometric literature on product and labor market imperfections and to the recent literature on misallocation of resources, this paper re-examines the potential relationship between competition and total factor productivity (TFP) by analyzing how the type and the degree of product and labor market imperfections shape TFP distributions.

Following the methodology developed in Dobbelaere and Mairesse (2013), we use econometric production functions as a tool for testing the type of competition prevailing in product and labor markets and for assessing their degree of imperfection. Our empirical analysis is based on two unbalanced panels of manufacturing and service firms: 5,285 firms over the period 2003-2011 in Belgium and 9,653 firms over the period 1999-2008 in the Netherlands. It consists of two parts. In the first part, we apply a procedure to classify 30 comparable manufacturing and service industries in distinct regimes characterizing the type of competition prevailing in product and labor markets and to investigate within-regime industry heterogeneity in the degree of product and labor market imperfections. In the second part, we revisit the potential relationship between –product and labor market– competition and TFP growth in a descriptive way by exploring whether any pattern can be observed in the moments of regime-specific TFP distributions.

Our main findings are summarized as follows. First, the prevalent product and labor market settings and hence the prevalent regimes are to some extent comparable in Belgium and the Netherlands. In both countries, (i) the proportion of industries that is characterized by imperfect competition in the product market amount to more than 90% and (ii) the most prevalent labor market setting is efficient bargaining. As such, the dominant regime in both countries is one of imperfect competition in the product market and efficient bargaining in the labor market (IC-EB). The most pronounced difference that we observe is a higher prevalence of monopsony and a lower prevalence of perfect competition or right-to-manage bargaining in Belgium compared to the Netherlands. Second, our analysis reveals important cross-country differences in the composition of industries making up the regimes and cross-country variation in the levels of product and labor market imperfection parameters within the dominant IC-EB-regime. Within the latter regime, the median price-cost mark-up is estimated to be significantly higher in the Netherlands (1.305 compared to 1.153 in Belgium) whilst the median absolute extent of rent sharing is estimated to be significantly higher in Belgium (0.428 compared to 0.262 in the Netherlands). Third, we discern cross-country cross-regime differences in TFP distributions which might be interpreted as descriptive evidence of resource misallocation across heterogeneous production units being an important source of cross-country differences in measured

TFP. Our descriptive analysis reveals that the prevalent labor market setting appears to be more decisive than the product market setting in shaping regime-specific TFP distributions. In both countries, average TFP growth rates are among the largest but TFP is more unequally distributed in the regime characterized by imperfect competition in the product market and perfect competition or right-to-manage bargaining in the labor market (IC-PR) whilst the opposite holds in the regime typified by imperfect competition in the product market and efficient bargaining in the labor market (IC-EB). In addition, our descriptive analysis demonstrates that TFP distributional characteristics vary to some extent by the degree of imperfections in product and labor markets, i.e. the levels of product and labor market power. Finally, in all regimes in both countries, we find that average TFP growth rates are higher in high-skilled enterprises compared to low-skilled enterprises, except for the regime characterized by perfect competition in both markets (PC-PR). In all predominant regimes in both countries, average TFP growth rates are found to be higher in services compared to their counterparts in manufacturing.

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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}	0.020	0.174	-0.059	0.017	0.098	32,598
Labor growth rate Δn_{it}	0.017	0.129	-0.037	0.000	0.065	32,598
Materials growth rate Δm_{it}	0.022	0.202	-0.074	0.019	0.116	32,598
Capital growth rate Δk_{it}	-0.040	0.227	-0.163	-0.063	0.061	32,598
$(\alpha_N)_j(\Delta n_{it} - \Delta k_{it}) + (\alpha_M)_j(\Delta m_{it} - \Delta k_{it})$	0.054	0.216	-0.068	0.064	0.184	32,598
$(\alpha_N)_j(\Delta k_{it} - \Delta n_{it})$	-0.013	0.056	-0.035	-0.012	0.011	32,598
SR_{it}	0.006	0.087	-0.032	0.006	0.044	32,598
Labor share in nominal output $(\alpha_N)_i$	0.210	0.162	0.093	0.167	0.281	37,876
Materials share in nominal output $(\alpha_M)_i$	0.678	0.206	0.565	0.730	0.838	37,876
$1 - (\alpha_N)_i - (\alpha_M)_i$	0.112	0.126	0.038	0.071	0.132	37,876
Number of employees N_{it}	129	610	17	38	86	37,876
Share of high-skilled employees $N_{HS,it}$	0.201	0.209	0.029	0.148	0.300	33,124
Share of medium-skilled employees $N_{MS,it}$	0.510	0.231	0.364	0.512	0.667	33,124
Share of low-skilled employees $N_{LS,it}$	0.290	0.264	0.059	0.227	0.467	33,124
THE NETHERLANDS (1999-2008)						
Variables	Mean	Sd.	Q_1	Q_2	Q_3	N
Real firm output growth rate Δq_{it}	0.029	0.193	-0.064	0.022	0.113	57,360
Labor growth rate Δn_{it}	0.011	0.153	-0.032	0.000	0.043	57,360
Materials growth rate Δm_{it}	0.038	0.286	-0.096	0.023	0.153	57,360
Capital growth rate Δk_{it}	0.021	0.237	-0.096	0.020	0.136	57,360
$(\alpha_N)_j(\Delta n_{it} - \Delta k_{it}) + (\alpha_M)_j(\Delta m_{it} - \Delta k_{it})$	-0.008	0.163	-0.096	-0.013	0.076	57,360
$(\alpha_N)_j(\Delta k_{it} - \Delta n_{it})$	0.004	0.071	-0.030	0.005	0.039	57,360
SR_{it}	0.015	0.177	-0.079	0.011	0.105	57,360
Labor share in nominal output $(\alpha_N)_i$	0.291	0.132	0.198	0.280	0.367	60,499
Materials share in nominal output $(\alpha_M)_i$	0.402	0.189	0.274	0.410	0.531	60,499
$1 - (\alpha_N)_i - (\alpha_M)_i$	0.307	0.123	0.224	0.291	0.375	60,499
Number of employees N_{it}	145	860	30	52	108	60,499
Share of high-skilled employees $N_{HS,it}$	0.165	0.149	0.065	0.129	0.221	60,499
Share of medium-skilled employees $N_{MS,it}$	0.488	0.183	0.364	0.500	0.619	60,499
Share of low-skilled employees $N_{LS,it}$	0.347	0.229	0.157	0.318	0.512	60,499

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: Industry classification by country

# ind. prop. of ind. (%) prop. of firms (%)	LABOR MARKET SETTING							
PRODUCT MARKET SETTING	**PR**		**EB**		**MO**			
	BE	*NL*	*BE*	*NL*	*BE*	*NL*	*BE*	*NL*
	1	2	0	0	2	0	3	2
PC	3.3	6.7	0	0	6.7	0	10.1	6.7
	8.6	3.0	0	0	2.8	0	11.4	3.0
	3	6	16	17	8	5	27	28
IC	10.0	20.0	53.3	56.7	26.7	16.7	90.0	93.3
	18.4	20.6	50.7	64.5	19.5	11.9	88.6	97.0
	4	8	16	17	10	5	30	30
	13.3	26.7	53.3	56.7	33.3	16.7	100	100
	27.0	23.6	50.7	64.5	22.3	11.9	100	100

Table 3: Sensitivity of classification to estimation methods

	SYS-GMM - OLS		*SYS-GMM - FE*		*SYS-GMM - W-LP*	
PRODUCT MARKET SETTING	*BE*	*NL*	*BE*	*NL*	*BE*	*NL*
PC						
prop. of ind. (%)	10.0	6.6	6.7	3.3	0.0	0.0
IC						
prop. of ind. (%)	66.7	86.7	50.0	66.7	90.0	93.3
TOTAL PMS						
prop. of ind. (%)	76.7	93.3	56.7	70.0	90.0	93.3
LABOR MARKET SETTING	*BE*	*NL*	*BE*	*NL*	*BE*	*NL*
PR						
prop. of ind. (%)	6.7	26.7	10.0	20.0	0.0	0.0
EB						
prop. of ind. (%)	50.0	13.3	43.3	26.7	36.7	26.7
MO						
prop. of ind. (%)	10.0	3.3	0.0	0.0	6.7	10.0
TOTAL LMS						
prop. of ind. (%)	66.7	43.3	53.3	46.7	43.3	36.7
REGIME	*BE*	*NL*	*BE*	*NL*	*BE*	*NL*
prop. of ind. (%)	53.3	66.7	26.7	33.3	20.0	36.7

Table 4: Industry-specific scale elasticity parameter $\widehat{\lambda}_j$, joint market imperfections parameter $\widehat{\psi}_j$, and corresponding price-cost mark-up $\widehat{\mu}_j$ and absolute extent of rent sharing $\widehat{\phi}_j$ or labor supply elasticity $\left(\widehat{\varepsilon}_w^N\right)_j$ by country

BELGIUM

Regime $R = IC\text{-}EB$ **[53.3% of industries, 50.7% 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	0.954 (0.043)	0.486 (0.294)	1.183 (0.106)	1.245 (0.103)	1.169 (0.555)	0.463 (0.167)
Industry Q_1	0.925 (0.025)	0.240 (0.179)	1.090 (0.041)	1.119 (0.053)	0.478 (0.357)	0.323 (0.072)
Industry Q_2	0.977 (0.038)	0.434 (0.239)	1.153 (0.062)	1.214 (0.058)	0.749 (0.477)	0.428 (0.105)
Industry Q_3	0.993 (0.058)	0.707 (0.397)	1.190 (0.094)	1.250 (0.098)	1.364 (0.76)	0.577 (0.274)
Regime $R = IC\text{-}MO$ **[26.7% of industries, 19.5% 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	1.012 (0.139)	-0.165 (0.872)	1.052 (0.116)	1.047 (0.163)	0.876 (0.462)	11.427 (50.46)
Industry Q_1	0.952 (0.028)	-0.176 (0.282)	1.016 (0.074)	1.035 (0.077)	0.850 (0.221)	6.309 (20.05)
Industry Q_2	0.978 (0.043)	-0.094 (0.312)	1.033 (0.085)	1.076 (0.094)	0.920 (0.251)	11.585 (36.13)
Industry Q_3	1.025 (0.056)	-0.072 (0.400)	1.090 (0.139)	1.099 (0.116)	0.938 (0.308)	15.803 (74.82)
Regime $R = IC\text{-}PR$ **[16.7% of industries, 11.9% of firms]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$		
Industry mean	1.076 (0.419)	0.265 (1.148)	1.167 (0.301)	1.092 (0.308)		
Industry Q_1	0.985 (0.015)	0.205 (0.232)	1.105 (0.025)	0.992 (0.031)		
Industry Q_2	1.014 (0.042)	0.222 (0.649)	1.178 (0.128)	1.122 (0.146)		
Industry Q_3	1.228 (1.198)	0.369 (2.563)	1.219 (0.750)	1.162 (0.746)		

THE NETHERLANDS

Regime $R = IC\text{-}EB$ **[56.7% of industries, 64.5% 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	0.977 (0.041)	0.444 (0.305)	1.360 (0.123)	1.391 (0.152)	0.364 (0.218)	0.249 (0.125)
Industry Q_1	0.965 (0.028)	0.282 (0.208)	1.242 (0.069)	1.281 (0.082)	0.244 (0.164)	0.196 (0.084)
Industry Q_2	0.977 (0.038)	0.453 (0.281)	1.305 (0.101)	1.335 (0.112)	0.355 (0.188)	0.262 (0.113)
Industry Q_3	1.004 (0.045)	0.573 (0.351)	1.453 (0.190)	1.465 (0.220)	0.466 (0.250)	0.318 (0.175)
Regime $R = IC\text{-}PR$ **[20.0% of industries, 20.6% of firms]**	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\left(\frac{\widehat{\mu}}{\widehat{\lambda}}\right)_j$		
Industry mean	1.064 (0.046)	-0.650 (0.401)	1.137 (0.142)	1.065 (0.150)		
Industry Q_1	0.997 (0.038)	-0.674 (0.374)	1.020 (0.112)	1.000 (0.118)		
Industry Q_2	1.087 (0.044)	-0.603 (0.405)	1.166 (0.132)	1.084 (0.150)		
Industry Q_3	1.099 (0.050)	-0.550 (0.410)	1.264 (0.193)	1.150 (0.199)		
Regime $R = IC\text{-}MO$ **[16.7% of industries, 11.9% 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	1.006 (0.052)	-0.301 (0.504)	1.130 (0.178)	1.121 (0.200)	0.809 (0.291)	10.657 (48.45)
Industry Q_1	0.982 (0.038)	-0.415 (0.274)	1.021 (0.092)	1.052 (0.109)	0.727 (0.182)	2.662 (6.742)
Industry Q_2	1.009 (0.045)	-0.145 (0.431)	1.105 (0.186)	1.054 (0.199)	0.904 (0.237)	9.413 (18.13)
Industry Q_3	1.023 (0.072)	-0.085 (0.631)	1.253 (0.216)	1.242 (0.245)	0.923 (0.368)	12.030 (62.42)

Table 5: Total factor productivity distribution by country, regime and skill type

		BELGIUM								THE NETHERLANDS						
Sample	**TFPGR**	**IC-EB**	**IC-MO**	**IC-PR**	**PC-MO**	**PC-PR**	**MANU.**	**SERV.**	**TOT.**	**IC-EB**	**IC-PR**	**IC-MO**	**PC-PR**	**MANU.**	**SERV.**	**TOT.**
Total	Mean	0.013	0.022	0.016	0.003	0.015	0.012	0.018	0.015	0.015	0.024	0.016	0.014	0.015	0.023	0.017
	Sd	0.193	0.254	0.260	0.245	0.185	0.209	0.231	0.221	0.252	0.338	0.244	0.276	0.240	0.359	0.270
	Skewness	2.339	1.590	1.201	1.777	3.474	1.347	2.238	1.893	2.550	1.928	1.200	1.273	2.663	1.511	2.242
	Kurtosis	18.717	8.730	51.891	8.441	26.396	50.835	14.722	28.590	22.221	12.468	7.091	6.860	21.958	9.671	17.257
	p10	-0.148	-0.231	-0.121	-0.242	-0.149	-0.154	-0.164	-0.159	-0.220	-0.302	-0.234	-0.265	-0.212	-0.347	-0.238
	p25	-0.080	-0.123	-0.082	-0.132	-0.089	-0.091	-0.086	-0.088	-0.123	-0.169	-0.132	-0.154	-0.121	-0.193	-0.132
	p50	-0.021	-0.017	-0.025	-0.037	-0.016	-0.015	-0.026	-0.022	-0.022	-0.023	-0.030	-0.032	-0.023	-0.026	-0.024
	p75	0.069	0.118	0.050	0.085	0.071	0.081	0.067	0.074	0.109	0.151	0.135	0.141	0.106	0.185	0.119
	p90	0.202	0.311	0.184	0.297	0.202	0.204	0.251	0.225	0.275	0.394	0.333	0.357	0.268	0.441	0.306
HS	Mean	0.014	0.021	0.018	0.008	0.020	0.013	0.020	0.016	0.016	0.027	0.017	0.010	0.017	0.025	0.019
	Sd	0.191	0.256	0.227	0.255	0.171	0.170	0.246	0.211	0.255	0.357	0.241	0.288	0.244	0.376	0.278
	Skewness	2.373	1.558	1.591	1.753	4.107	2.012	1.981	2.100	2.567	1.895	0.913	1.859	2.609	1.577	2.243
	Kurtosis	17.925	11.391	16.221	7.764	33.522	20.703	12.890	16.247	20.985	11.630	5.229	11.409	21.039	9.696	16.849
	p10	-0.145	-0.220	-0.153	-0.255	-0.121	-0.141	-0.186	-0.158	-0.222	-0.302	-0.231	-0.275	-0.213	-0.356	-0.239
	p25	-0.076	-0.109	-0.097	-0.129	-0.069	-0.081	-0.088	-0.084	-0.126	-0.170	-0.136	-0.159	-0.124	-0.195	-0.135
	p50	-0.018	-0.010	-0.019	-0.037	-0.012	-0.011	-0.023	-0.017	-0.022	-0.025	-0.021	-0.034	-0.021	-0.028	-0.022
	p75	0.068	0.110	0.081	0.083	0.061	0.077	0.075	0.077	0.114	0.152	0.138	0.136	0.110	0.190	0.123
	p90	0.199	0.298	0.229	0.279	0.185	0.197	0.268	0.225	0.279	0.404	0.334	0.315	0.273	0.440	0.311
LS	Mean	0.010	0.017	0.010	-0.008	0.021	0.008	0.016	0.012	0.011	0.007	0.015	0.009	0.012	0.006	0.010
	Sd	0.161	0.266	0.403	0.182	0.187	0.226	0.223	0.225	0.226	0.264	0.237	0.266	0.216	0.298	0.236
	Skewness	1.789	0.895	-7.051	2.000	4.657	-6.645	1.259	-3.066	2.437	1.012	1.857	0.977	2.608	0.935	1.965
	Kurtosis	13.695	23.049	118.081	10.631	36.327	226.148	25.214	136.171	20.764	6.325	13.290	5.297	22.149	5.995	15.482
	p10	-0.142	-0.206	-0.107	-0.192	-0.106	-0.140	-0.170	-0.150	-0.207	-0.265	-0.215	-0.274	-0.196	-0.321	-0.220
	p25	-0.071	-0.113	-0.065	-0.126	-0.070	-0.080	-0.076	-0.078	-0.113	-0.154	-0.125	-0.160	-0.112	-0.184	-0.122
	p50	-0.010	-0.022	-0.024	-0.022	-0.022	-0.015	-0.016	-0.016	-0.017	-0.028	-0.030	-0.029	-0.020	-0.025	-0.020
	p75	0.063	0.091	0.053	0.062	0.043	0.064	0.065	0.065	0.098	0.123	0.116	0.138	0.095	0.154	0.105
	p90	0.181	0.289	0.182	0.171	0.184	0.175	0.230	0.200	0.241	0.338	0.307	0.337	0.238	0.376	0.266

Table 6: Total factor productivity distribution by country, regime and manufacturing/services

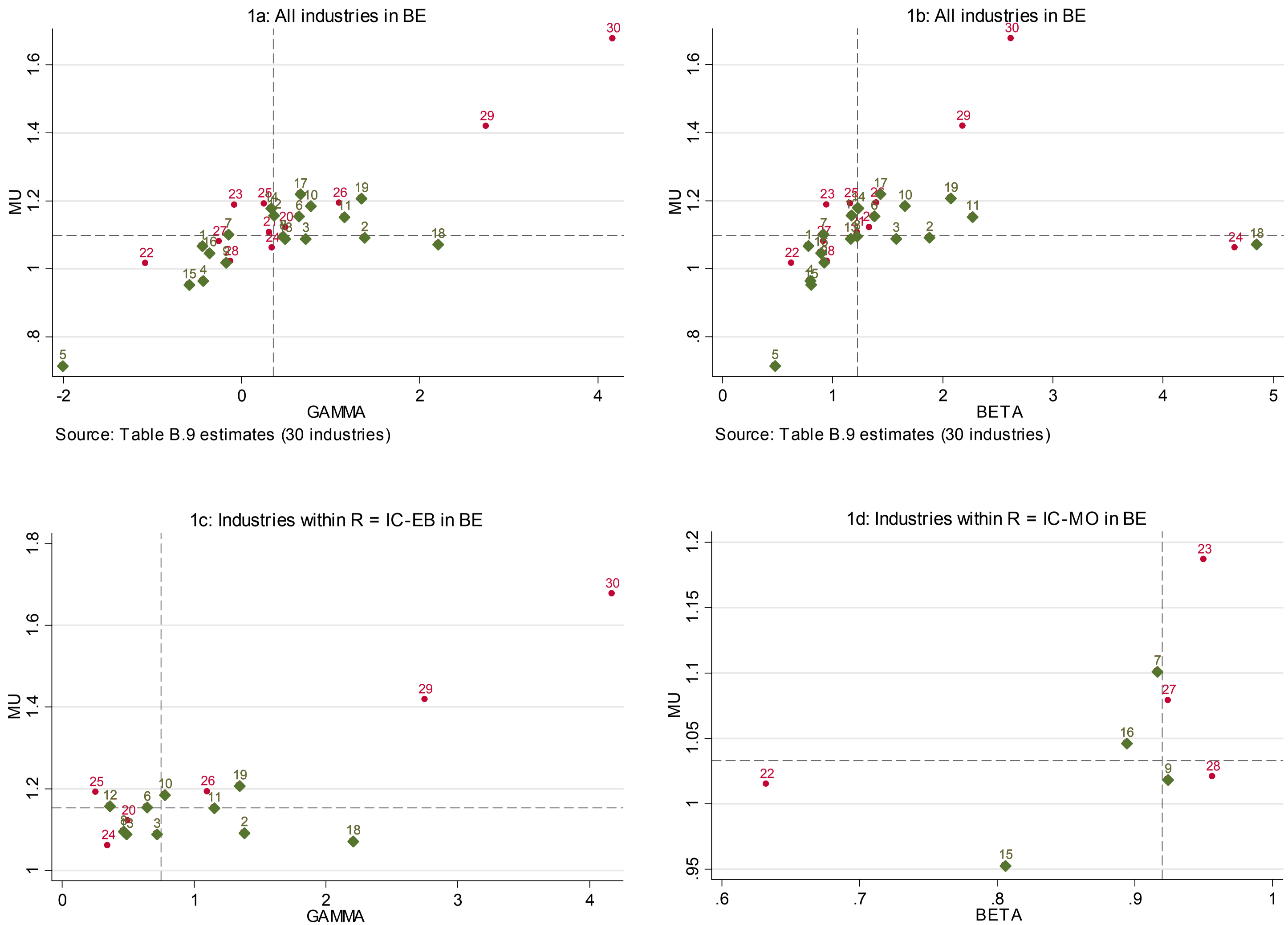
		BELGIUM				THE NETHERLANDS			
		MANUFACTURING				MANUFACTURING			
Sample	**TFPGR**	**IC-EB**	**IC-MO**	**IC-PR**	**TOTAL**	**IC-EB**	**IC-PR**	**IC-MO**	**TOTAL**
Total	Mean	0.011	0.014	0.012	0.012	0.015	0.015	0.019	0.015
	Sd	0.161	0.170	0.754	0.209	0.238	0.244	0.255	0.240
	Skewness	2.002	2.548	-0.046	1.347	3.154	1.278	1.480	2.663
	Kurtosis	13.202	20.304	10.242	50.835	27.689	7.464	7.559	21.958
	p10	-0.148	-0.152	-0.262	-0.154	-0.204	-0.223	-0.244	-0.212
	p25	-0.088	-0.084	-0.112	-0.091	-0.117	-0.130	-0.145	-0.121
	p50	-0.014	-0.012	0.004	-0.015	-0.022	-0.032	-0.017	-0.023
	p75	0.081	0.080	0.147	0.081	0.099	0.125	0.127	0.106
	p90	0.191	0.199	0.724	0.204	0.250	0.322	0.320	0.268
		SERVICES				SERVICES			
Sample	**TFPGR**	**IC-EB**	**IC-MO**	**IC-PR**	**TOTAL**	**IC-EB**	**IC-PR**	**IC-MO**	**TOTAL**
Total	Mean	0.014	0.017	0.030	0.018	0.019	0.022	0.029	0.023
	Sd	0.220	0.185	0.316	0.231	0.330	0.300	0.413	0.359
	Skewness	2.355	3.818	1.202	2.238	0.789	0.888	1.845	1.511
	Kurtosis	18.260	27.717	5.510	14.722	5.296	5.313	10.652	9.671
	p10	-0.147	-0.119	-0.294	-0.164	-0.343	-0.338	-0.375	-0.347
	p25	-0.074	-0.081	-0.181	-0.086	-0.192	-0.175	-0.209	-0.193
	p50	-0.025	-0.026	-0.031	-0.026	-0.023	-0.012	-0.031	-0.026
	p75	0.055	0.045	0.178	0.067	0.196	0.185	0.189	0.185
	p90	0.215	0.174	0.430	0.251	0.442	0.386	0.484	0.441

Table 7: Correlations between 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					
$\widehat{\mu}_j$	-0.239 [0.126]	-0.018 [0.092]	0.022 [-0.221]	-0.123 [-0.210]	-0.087 [-0.099]
$\widehat{\gamma}_j$	-0.248 [0.016*]	0.133 [0.255]	-0.244 [-0.382]	-0.141 [-0.171]	-0.042 [-0.025]
$\widehat{\beta}_j$	-0.183[-0.050]	0.119 [0.177]	-0.126 [-0.401]	-0.153 [-0.237]	-0.015 [-0.084]
$R = IC\text{-}EB$					
$\widehat{\mu}_j$	-0.300 [0.098]	-0.306 [0.151]	0.359 [-0.219**]	-0.209 [-0.207]	-0.226 [-0.159]
$\widehat{\gamma}_j$	-0.221 [0.035]	0.341 [0.299]	0.215 [-0.417]	-0.188 [-0.123]	-0.206 [-0.042]
$R = IC\text{-}MO$					
$\widehat{\mu}_j$	0.024 [0.193]	-0.619* [0.220]	0.000 [-0.329]	0.309 [-0.079]	0.143 [-0.042]
$\widehat{\beta}_j$	-0.048 [-0.019]	-0.833*** [0.131***]	0.048 [-0.459*]	-0.071 [-0.177]	-0.071 [-0.104]
THE NETHERLANDS					
All industries					
$\widehat{\mu}_j$	-0.004 [0.309]	0.139 [0.168]	-0.210 [-0.235]	0.007 [0.156]	0.099 [0.116]
$\widehat{\gamma}_j$	-0.163 [-0.212]	0.248 [0.041*]	-0.358** [-0.166***]	0.067 [0.216]	0.248 [0.282]
$\widehat{\beta}_j$	-0.178 [-0.176]	0.274 [0.071*]	-0.374** [-0.199*]	0.097 [0.311]	0.281 [0.346]
$R = IC\text{-}EB$					
$\widehat{\mu}_j$	0.618*** [0.326]	-0.377 [0.131]	0.395 [-0.155]	-0.132 [0.182]	-0.096 [0.132]
$\widehat{\gamma}_j$	0.333 [-0.207**]	-0.167 [0.032]	0.039 [-0.164]	-0.157 [0.226]	-0.142 [0.276]
$R = IC\text{-}PR$					
$\widehat{\mu}_j$	-0.429 [0.330]	0.314 [0.200]	-0.771* [-0.269*]	-0.086 [0.159]	-0.257 [0.120]
$R = IC\text{-}MO$					
$\widehat{\mu}_j$	-0.600 [0.314]	-0.200 [0.244]	-0.900** [-0.418*]	-0.100 [0.115]	0.300 [0.111]
$\widehat{\beta}_j$	-0.300 [-0.078]	-0.100 [-0.036]	-0.700 [-0.066**]	0.700 [0.419]	0.900** [0.495**]

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

Graph 1: Product and labor market imperfection parameters in Belgium



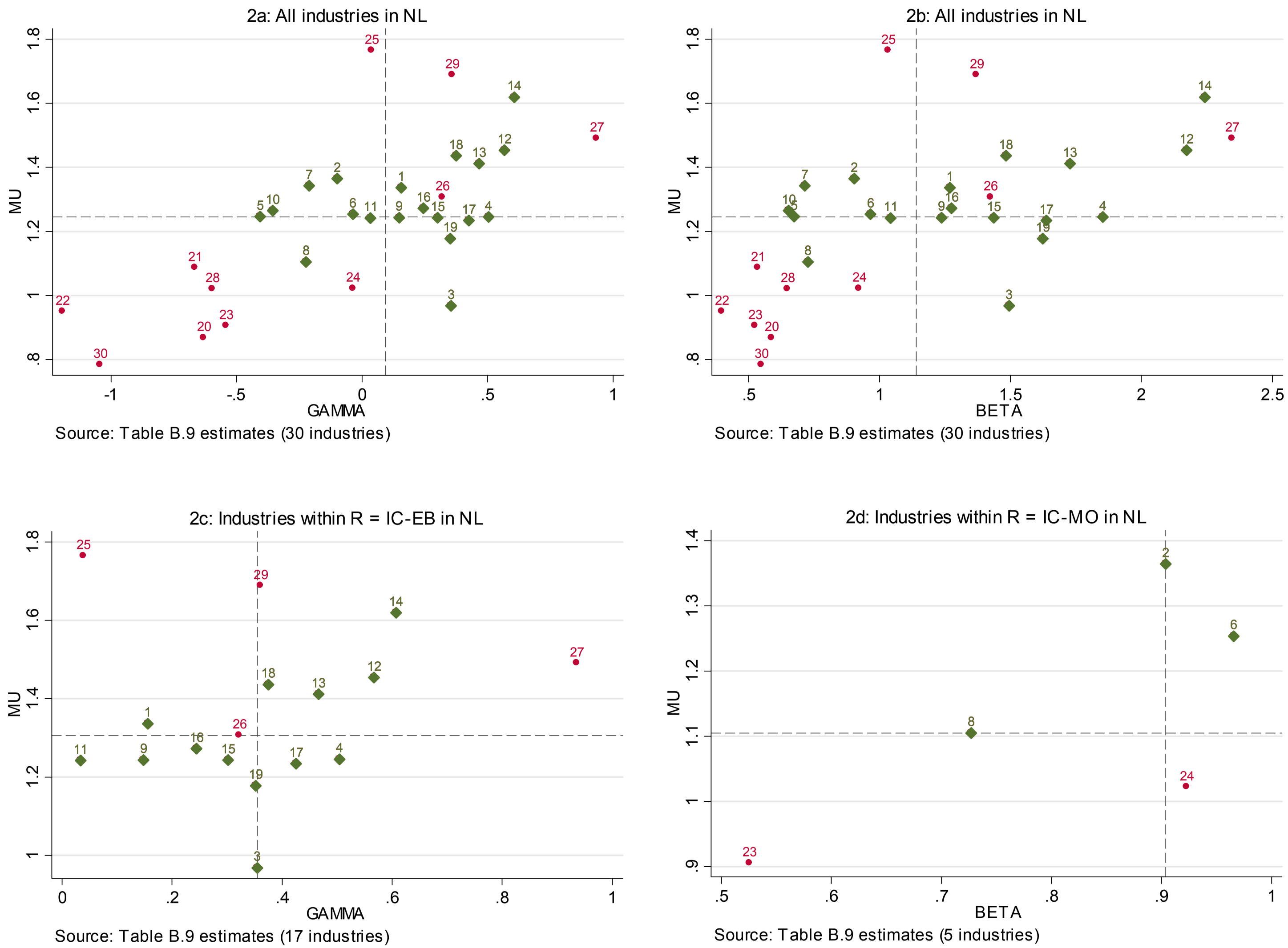
Source: Table B.9 estimates (30 industries)

Source: Table B.9 estimates (30 industries)

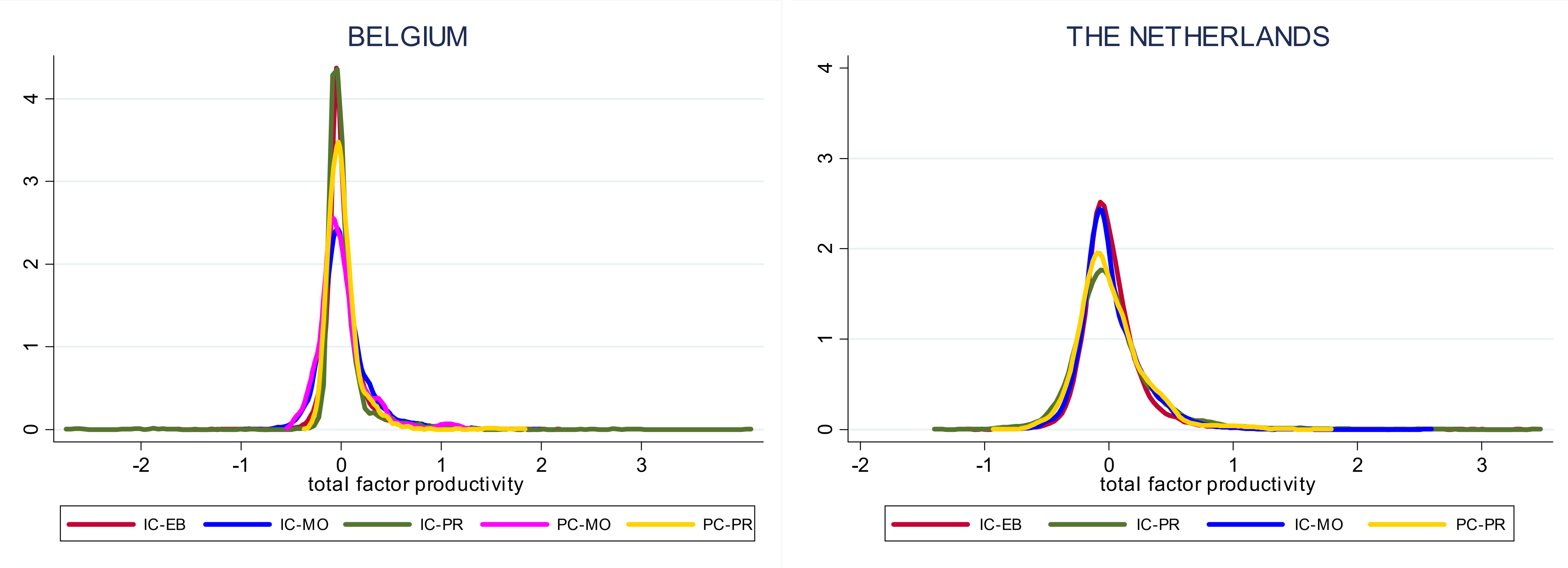
Source: Table B.9 estimates (16 industries)

Source: Table B.9 estimates (8 industries)

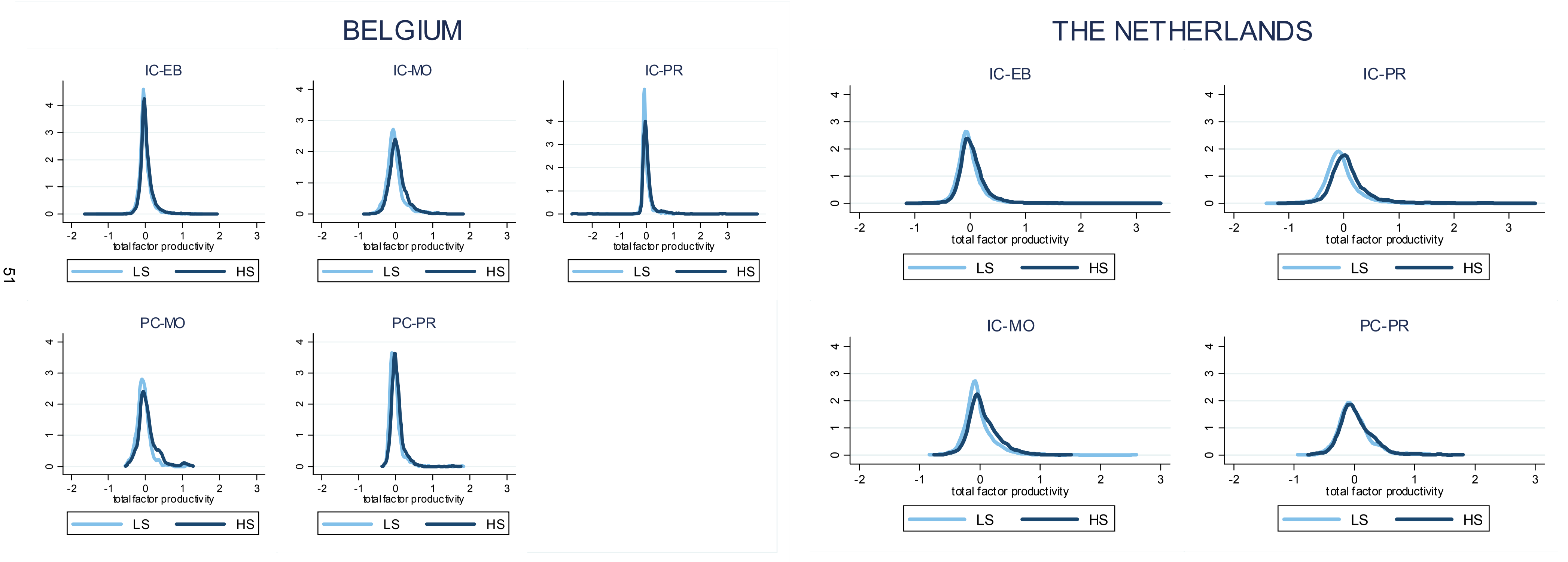
Graph 2: Product and labor market imperfection parameters in the Netherlands



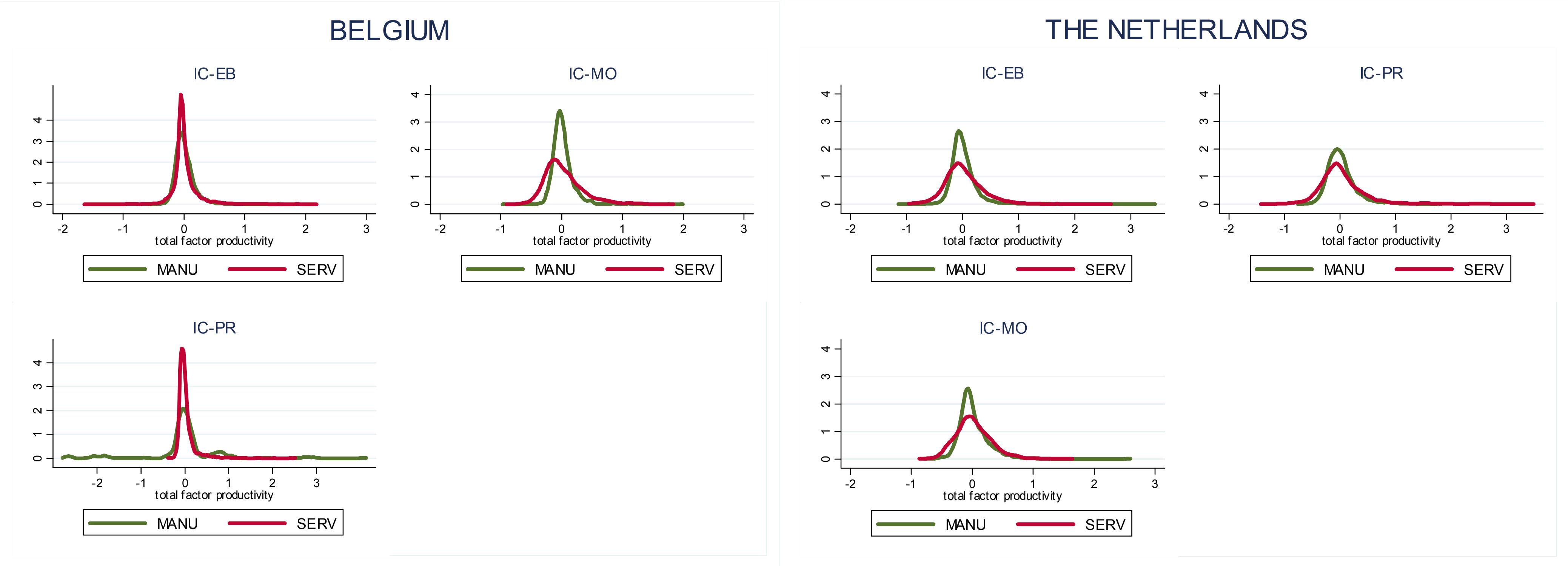
Graph 3: Distribution of total factor productivity, by country and regime



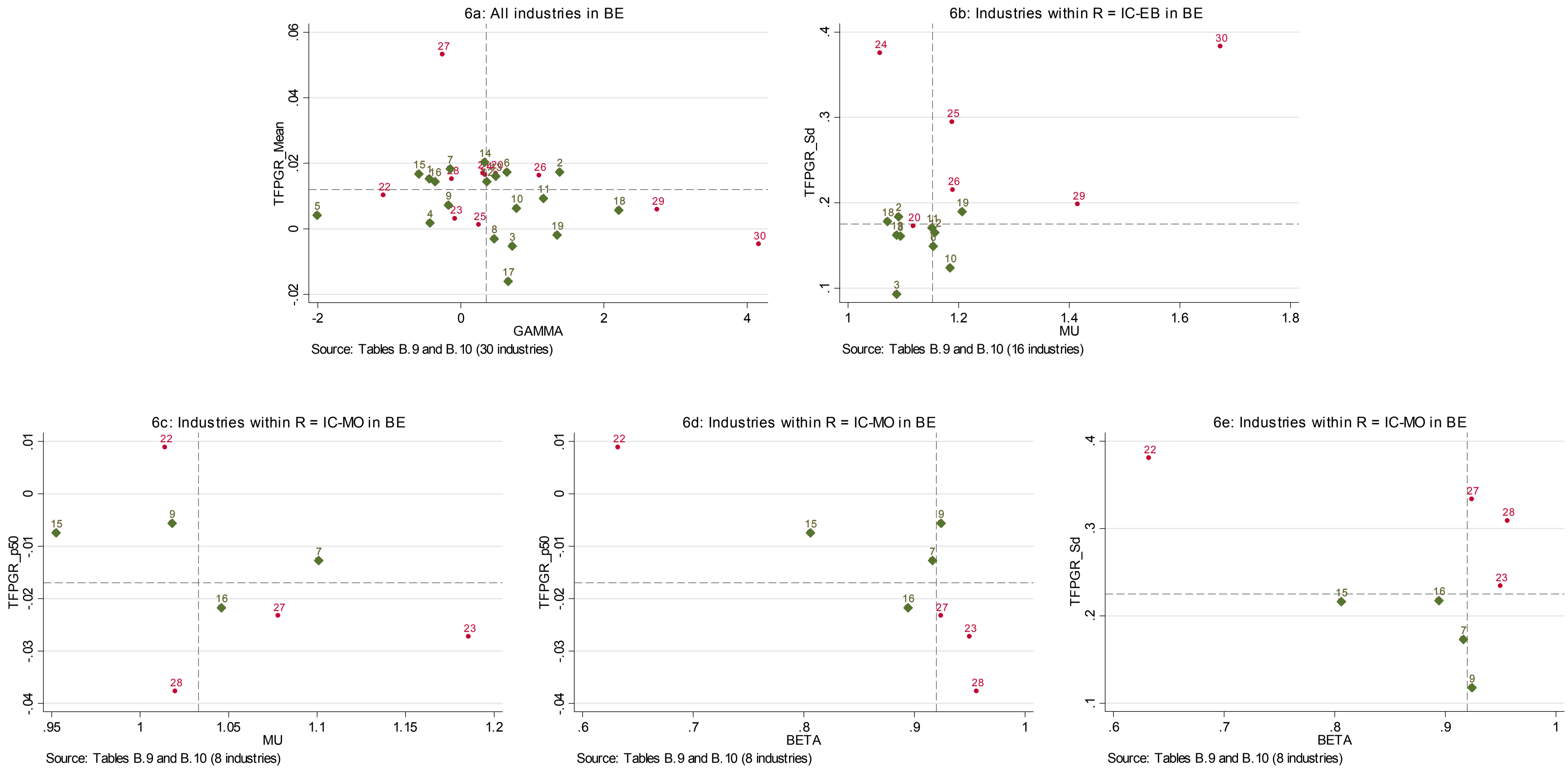
Graph 4: Distribution of total factor productivity, by country, regime and firms' skill type



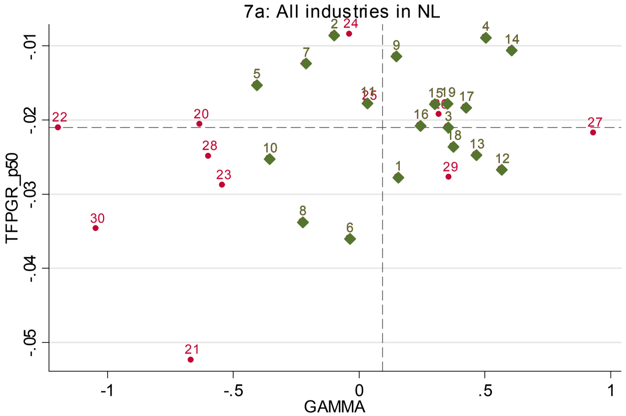
Graph 5: Distribution of total factor productivity, by country, regime and manufacturing/services



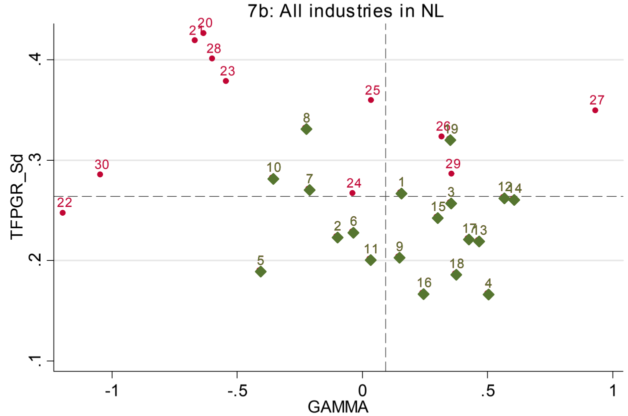
Graph 6: TFP distributional characteristics and market imperfection parameters in Belgium



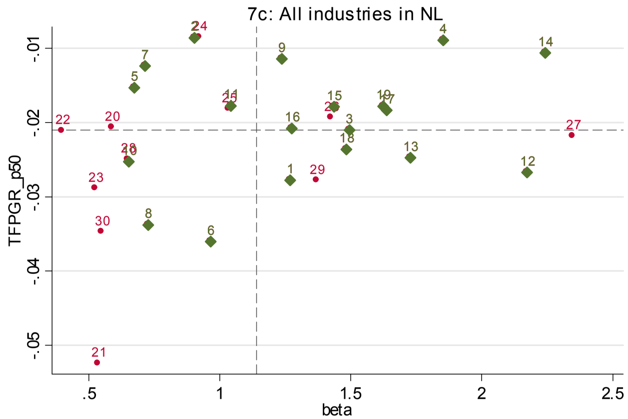
Graph 7: TFP distributional characteristics and market imperfection parameters in the Netherlands



Source: Tables B.9 and B.10 (30 industries)

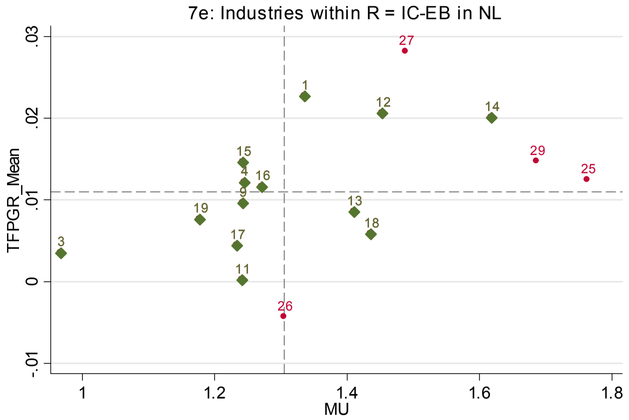


Source: Tables B.9 and B.10 (30 industries)

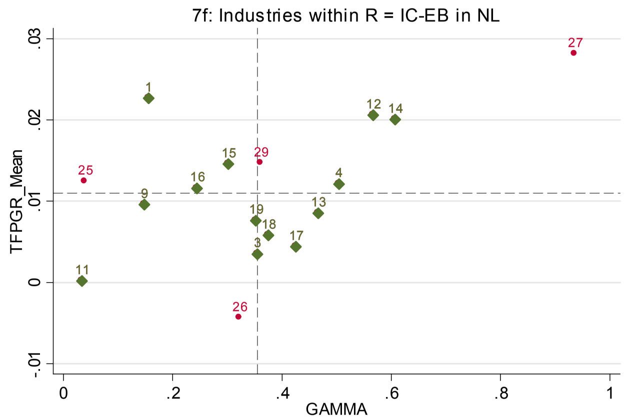


Source: Tables B.9 and B.10 (30 industries)

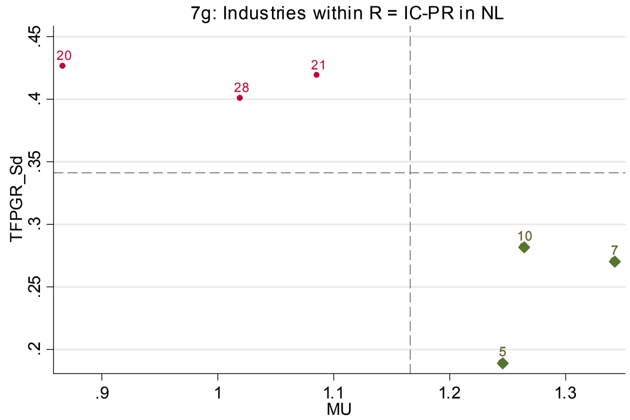
Graph 7 (ctd): TFP distributional characteristics and market imperfection parameters in the Netherlands



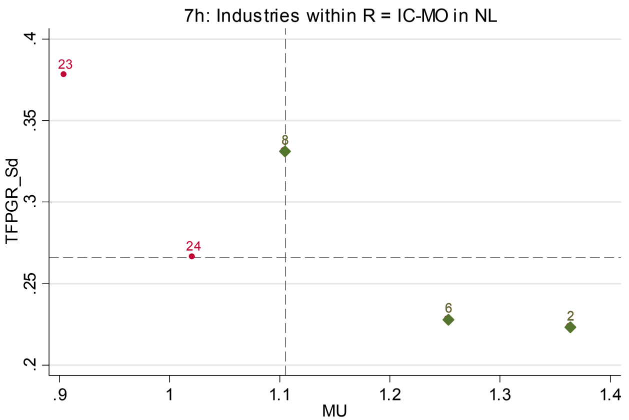
Source: Tables B.9 and B.10 (17 industries)



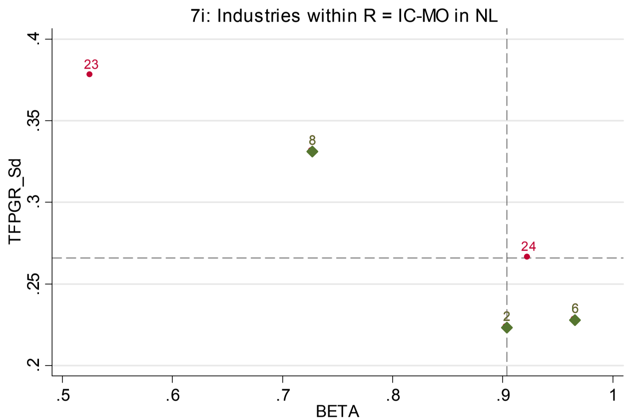
Source: Tables B.9 and B.10 (17 industries)



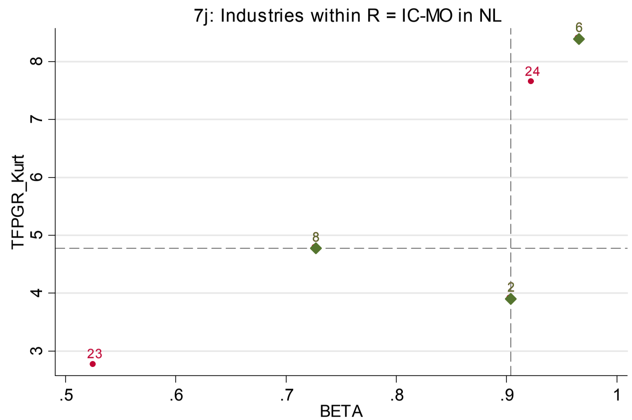
Source: Tables B.9 and B.10 (6 industries)



Source: Tables B.9 and B.10 (5 industries)



Source: Tables B.9 and B.10 (5 industries)



Source: Tables B.9 and B.10 (5 industries)

Appendix A : Measurement of skill heterogeneity

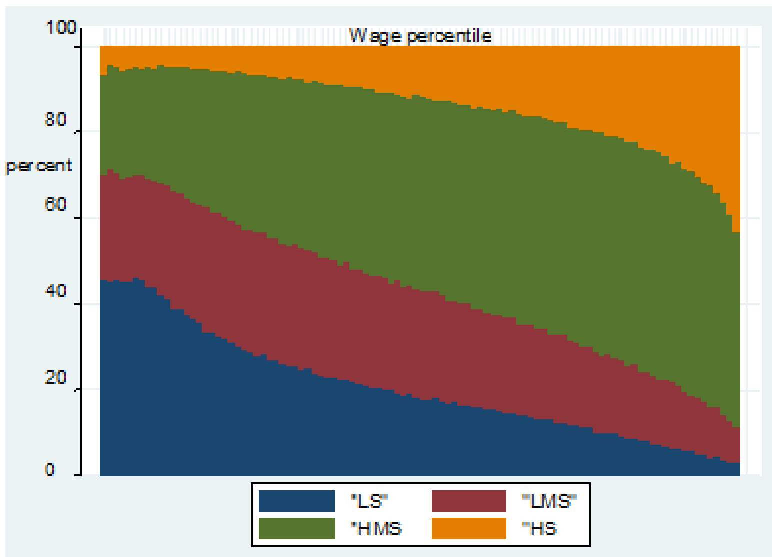
To ascertain comparability of the human capital variables across both countries, our approach of defining skill heterogeneity is based on the concept of *knowledge workers* where we rely on classifying jobs into low- to high-paid level classifications according to certain threshold values based on the entire wage distribution. There are good reasons to believe that skills correlate with the remuneration that employees receive. Specifically, the so called skill-biased technical change hypothesis is often used to explaining the returns to education and the increased wage differentials between skilled and unskilled labor. This has motivated a large literature investigating whether technological change is also skill biased. This literature suggests that technological change has induced a process of rising skill demand, which in turn has led to a rising income inequality (see Acemoglu and Autor, 2010 for a survey). Factor augmenting technical change is generally driven by an increased productivity in input factors such the optimal mix between high- and low-skilled labor that can be endogenously or exogenously explained. The skill concept is hereby seen as a source of a technological endowment of capabilities for performing the job.

Focusing on the type of skills required for carrying out a particular job, a recent literature has examined the complexity of tasks to analyze job skill requirements (see Autor and Handel , 2013 for a survey). The underlying idea of this "task" approach is to classify jobs according to their core task requirements. For instance, Antonczyck *et al.* (2009) show that changes in tasks to be performed as a result of IT explain the wage inequality in Germany. Similarly, Kok and ter Weel (2013) find evidence that job opportunities are rising at the tails of the wage distribution in the Netherlands. Elsayed *et al.* (2014) show that the complexity of tasks, the effectiveness of task performances and IT usage are positively associated with higher wages, even after controlling for observable work characteristics. Autor and Handel (2013) and Goos *et al.* (2014) also rely on the task approach to explore links between technological change, change in task inputs, and shifts in the wage structure. Employees also tend to be more efficient if their job tasks are complementary to the skills they possess. The realization of matching job-demanding and worker-skill endowments might have implications on different aspect of economics activities. For instance, Helsey and Strange (1990) and Amiti and Pissarides (2005) show that the matching process increases the likelihood that an industry will agglomerate, thereby creating a larger local market. At the level of the individual worker, Petrongolo and Pissarides (2005) measure the quality of the match by the wage offer. The authors assume that a higher wage offer reflects a better match between job requirements and employee capabilities and validate this assumption. Similarly, Kok (2013) finds a positive correlation between the quality of the match and wages. This correlation appears to differ across educational backgrounds: employees with a secondary education benefit more than either low- or high-educated employees.

In order to validate our skill heterogeneity measure based on income percentile groups, we performed two exercises using the Dutch data. The first validation exercise consists in examining the correlation between individual wages and the level of education –which is at the core of the skill-biased technological change hypothesis– controlling for age groups and industry dummies. The data are sourced from the Social Statistics Database (SSB), the Labor Force Study (EBB) and a matched employee-employer database (LEEDS). The resulting data set includes all tax-paying employees with a current address in the Netherlands in 2011. The unit of observation in our analysis is the job level. In order to rank income-level categories, we only selected full-time jobs that have lasted at least for an entire year. In addition, we also selected only those employees that worked during that year in firms belonging to non-agricultural industries (NACE Rev. 2 10-99). After trimming the data to delete extreme values, we end up with around 2.3 million employees.

Graph A.1 looks at the relationship between education and wages. In line with O'Mahoney *et al.* (2008), we define four levels of education on the basis of SOI codes (Dutch education classification: **S**tandaard **O**nderwijs**i**ndeling): primary and lower-secondary education (low-skilled (LS): code 20, 30-33); higher-secondary education (low-medium-skilled (LMS): code 41-43); post-secondary education (high-medium-skilled (HMS): code 43, 51-52) and higher education (high-skilled (HS): code 53, 60). Graph A.1 shows the percentage of employees according to each education category for each percentile ranked from low to high. The percentiles are derived from the entire income distribution corrected by four age categories ($\leq$ 30, 31-40, 41-50 and $>$ 51 years) and NACE 2-digit industries.

Graph A.1: Percentage of employees by education type at each percentile of the income distribution



The graph shows that (i) each education type is represented throughout the entire income distribution and (ii) the percentage of employees with a post-secondary and higher education rises significantly with income while an opposite pattern is observed for the lower-educated groups. Looking at the percentage of each education type within the corresponding wage percentile categories confirms the positive correlation between income and education: the higher-educated workforce represent 35.5% of the high-wage percentile category and only 4.1% of the low-wage percentile category while the low-educated workforce represent 34.2% of the low-wage percentile category and only 5.5% of the high-wage percentile category. A simple regression of wages on the four education group dummies, the four age categories and industry dummies explains about 44% the variation in the logarithm of income.

On the basis of this graph, we decided to classify employees as having (i) a high-paid-job if their wage is $\geq$ the 81^{st} percentile of all registered jobs by age category and NACE 2-digit industry, (ii) a high-medium-paid job if their wage falls between the 56^{th} and 80^{th} percentile, (iii) a low-medium-paid job if their wage falls between the 31^{th} and 55^{th} percentile and a low-paid job if their wage fall $\leq$ the 30^{th} percentile. A firm is defined to be high-skilled if its employment share of high-skilled (i.e. high-paid) employees is equal to or exceeds the median value of the share of high-skilled labor in firm size class s of industry j (NACE 2-digit classification) in year t, whereas it is defined to be low-skilled if its employment share of high-skilled employees is lower than the aforementioned median value.

The second validation exercise consists in comparing our measure of the share of high-skilled employees (denoted by $Sh_{HS\_w,it}$) with the measure of the share of high-skilled employees that is derived from the education type of employees (denoted by $Sh_{HS\_educ,it}$). In particular, the education type of employees ($LS/LMS/HMS/HS$) is either directly taking from the Education database which provides the highest level of education attained by an individual or determined by estimates of reverse Mincer equations using a matched employer-employee microdata set.[1] This measurement comparison is based on a subset of matched (CIS∩PS)-enterprises covering the period 1999-2008 used in Bartelsman *et al.* (2014) and amounts to 39% of our Dutch sample including 50% of our firms. Table A.1 reports the means, standard deviations and quartile values of both high-skilled employment shares for all matched firms and for manufacturing and service firms respectively.

Table A.1: Comparing different measures of the share of high-skilled employees, 1999-2008

MATCHED SAMPLE						
Variables	Mean	Sd.	Q_1	Q_2	Q_3	N
$Sh_{HS\_w,it}$	0.170	0.141	0.074	0.136	0.225	23,493
$Sh_{HS\_educ,it}$	0.218	0.190	0.082	0.162	0.295	23,493
$\overline{Sh}_{HS\_w,i}$	0.180	0.150	0.077	0.144	0.240	4,825
$\overline{Sh}_{HS\_educ,i}$	0.201	0.193	0.064	0.136	0.273	4,825
MANUFACTURING						
Variables	Mean	Sd.	Q_1	Q_2	Q_3	N
$Sh_{HS\_w,it}$	0.169	0.133	0.080	0.139	0.222	17,279
$Sh_{HS\_educ,it}$	0.191	0.148	0.083	0.154	0.264	17,279
$\overline{Sh}_{HS\_w,i}$	0.176	0.138	0.083	0.146	0.233	3,442
$\overline{Sh}_{HS\_educ,i}$	0.172	0.148	0.067	0.132	0.237	3,442
SERVICES						
Variables	Mean	Sd.	Q_1	Q_2	Q_3	N
$Sh_{HS\_w,it}$	0.170	0.162	0.055	0.127	0.232	6,214
$Sh_{HS\_educ,it}$	0.294	0.259	0.078	0.199	0.511	6,214
$\overline{Sh}_{HS\_w,i}$	0.190	0.176	0.062	0.143	0.258	1,383
$\overline{Sh}_{HS\_educ,i}$	0.274	0.261	0.056	0.161	0.500	1,383

Notes: $\overline{Sh}_{HS\_w,i} = \frac{1}{T}\sum_{t=1}^{T} Sh_{HS\_w,it}$, $\overline{Sh}_{HS\_educ,i} = \frac{1}{T}\sum_{t=1}^{T} Sh_{HS\_educ,it}$.

From Table A.1, it follows that both measures of the share of high-skilled employment shares are very close for the total matched sample and for manufacturing. For example, the median share of high-skilled employees amounts to 0.14 (0.16) based on the wage distribution (employees' education type) for the total matched sample, and 0.14 (0.15) for manufacturing. The discrepancy between both measures appears to be larger for services: the respective median shares are equal to 0.13 (0.20). Taking firm averages, however, closes the

[1] For details on this measurement, we refer to Appendix A of Bartelsman *et al.* (2014).

gap between both measures. For both measures, we define the skill type of enterprises based on the median value of the share of high-skilled employees at the firm size-industry level. We find that the match in terms of firms' skill types amounts to 63%. This holds for both manufacturing and services. To examine firm-level persistence in the skill types of firms, we looked at one-year transition probability rates from period t to period $(t + 1)$ of skill types across states over the considered periods according to both measures of high-skilled employment shares. The states are defined as high-skilled and low-skilled. Irrespective of the measurement of high-skilled employment shares, we find strong persistence in skill types as we observe the highest values on the diagonal for each state: about 84% of the high-skilled firms and 83% of the low-skilled firms remain in their initial state according to both measures.

From both validation exercises, we conclude that our measure of skill heterogeneity captures well the underlying variation in the education types of employees.

Appendix B : Statistical annex

Table B.1: Panel structure: Number of participations by country

	BELGIUM				THE NETHERLANDS			
# of participations$^{a)}$	**# obs**	%	**# firms**	%	**# obs**	%	**# firms**	%
3	1,206	3.18	402	7.61	3,900	6.45	1,300	13.47
4	1,432	3.78	358	6.77	5,204	8.60	1,301	13.48
5	2,190	5.78	438	8.29	6,745	11.15	1,349	13.97
6	2,706	7.14	451	8.53	8,064	13.33	1,344	13.92
7	4,536	11.98	648	12.26	9,100	15.04	1,300	13.47
8	8,688	22.94	1,086	20.55	9,208	15.22	1,151	11.92
9	17,118	45.19	1,902	35.99	7,218	11.93	802	8.31
10					11,060	18.28	1,106	11.46
Total	37,876	100.0	5,285	100.0	60,499	100.0	9,653	100.0

Note: a) Median number of observations per firm: 8 [BE] and 6 [NL].

Table B.2: Estimation sample by country and industry (7-industry classification), firm size and year

		BELGIUM					THE NETHERLANDS				
Ind. j_{IND7}	Name	NACE Rev. 2	# obs.	%	# firms	%	NACE Rev. 1.1	# obs.	%	# firms	%
1	High-technology manufacturing (HTM)	21, 26, 30.3	634	1.67	82	1.55	24.4, 30, 32-33, 35.3	2,226	3.68	346	3.58
2	Medium-high-technology manufacturing (MHTM)	20, 25.4, 27-29, 30 (excl. 30.1 & 30.3), 32.5	3,632	9.59	479	9.06	4 (excl. 24.4), 29, 31, 34, 35 (excl. 35.1 & 35.3)	11,027	18.23	1,587	16.44
3	Medium-low-technology manufacturing (MLTM)	18.2, 19, 22-24, 25 (excl. 25.4), 30.1, 33	5,223	13.79	692	13.09	23, 25-28, 35.1	13,399	22.15	1,984	20.18
4	Low-technology manufacturing (LTM)	10-17, 18 (excl. 18.2), 31, 32 (excl. 32.5)	6,929	18.29	928	17.56	15-22, 36-37	17,540	28.99	2,578	26.71
5	High-tech knowledge-intensive services (HTKIS)	58-63, 72	2,218	5.86	332	6.28	64, 72-73	1,852	3.06	391	4.05
6	Knowledge-intensive market services (KIMS)	50-51, 64-66, 69-71, 73-75, 78, 80	4,582	12.10	709	13.42	61-62, 65-67, 74	6,533	10.80	1,264	13.09
7	Less knowledge-intensive market services (LKIMS)	45-47, 49, 52, 55-56, 68, 77, 79, 81-82, 95	14,658	38.70	2,063	39.04	50-52, 60, 63, 70-71	7,922	13.09	1,539	15.94
Firm size	10-19		11,099	29.30	1,905	36.05		4,945	8.17	1,469	15.22
	20-49		11,859	31.31	1,657	31.35		24,108	39.85	3,816	39.53
	50-99		6,720	17.74	811	15.35		14,900	24.63	2,101	21.77
	100-249		4,951	13.07	550	10.41		10,802	17.85	1,459	15.11
	250-500		1,796	4.74	193	3.65		3,366	5.56	447	4.63
	500-999		877	2.32	104	1.97		1,460	2.41	219	2.27
	1000+		574	1.52	65	1.23		918	1.52	142	1.47
Year	1999							5,789	9.57	-	
	2000							4,631	7.65	-	
	2001							5,328	8.81	-	
	2002							6,639	10.97	-	
	2003		3,963	10.46	-			7,058	11.67	-	
	2004		3,824	10.10	-			7,233	11.96	-	
	2005		4,029	10.64	-			7,052	11.66	-	
	2006		4,095	10.81	-			5,968	9.86	-	
	2007		4,231	11.17	-			5,712	9.44	-	
	2008		4,356	11.50	-			5,089	8.41	-	
	2009		4,560	12.04	-						
	2010		4,472	11.81	-						
	2011		4,346	11.47	-						
Total			37,876	100.00	5,285	100.00		60,499	100.0	9,653	100.0

Table B.3: *SYS-GMM* estimates of output elasticities and market imperfection parameters by country (7-industry classification)

	BELGIUM								
	Manufacturing					*Services*			
	HTM	*MHTM*	*MLTM*	*LTM*	*TOTAL*	*HTKIS*	*KIMS*	*LKIMS*	*TOTAL*
$\widehat{\varepsilon}_N^Q$	0.187	0.138	0.145	0.215	0.309	0.266	0.386	0.182	0.225
	(0.046)	(0.042)	(0.032)	(0.036)	(0.044)	(0.053)	(0.055)	(0.031)	(0.041)
$\widehat{\varepsilon}_M^Q$	0.764	0.797	0.815	0.815	0.752	0.680	0.543	0.789	0.716
	(0.038)	(0.025)	(0.024)	(0.034)	(0.036)	(0.046)	(0.049)	(0.027)	(0.035)
$\widehat{\varepsilon}_K^Q$	0.051	0.053	0.017	-0.024	0.001	0.018	0.020	0.013	0.000
	(0.065)	(0.062)	(0.044)	(0.055)	(0.062)	(0.079)	(0.088)	(0.052)	(0.062)
$\widehat{\lambda}$	1.002	0.977	0.977	1.006	1.062	0.965	0.948	0.984	0.941
	(0.030)	(0.018)	(0.025)	(0.027)	(0.038)	(0.039)	(0.046)	(0.017)	(0.038)
$\widehat{\psi}$	0.398	0.490	0.523	-0.099	-0.479	0.383	0.126	-0.099	0.059
	(0.051)	(0.053)	(0.028)	(0.053)	(0.249)	(0.051)	(0.055)	(0.054)	(0.226)
$\widehat{\mu}$	1.176	1.140	1.189	1.112	1.064	1.214	1.173	1.079	1.090
	(0.058)	(0.036)	(0.035)	(0.046)	(0.050)	(0.082)	(0.106)	(0.037)	(0.053)
$\widehat{\gamma}$	0.736	1.018	0.996			0.851	0.234		
	(0.392)	(0.451)	(0.301)			(0.455)	(0.419)		
$\widehat{\phi}$	0.424	0.505	0.499			0.460	0.190		
	(0.130)	(0.111)	(0.076)			(0.133)	(0.275)		
$\widehat{\beta}$				0.919	0.690			0.916	
				(0.177)	(0.118)			(0.183)	
$\widehat{\varepsilon}_w^N$				11.281	2.221			10.864	
				(26.75)	(1.227)			(25.77)	
$\widehat{\frac{\mu}{\lambda}}$	1.174	1.167	1.219	1.106	1.002	1.258	1.237	1.096	1.159
	(0.058)	(0.047)	(0.047)	(0.043)	(0.054)	(0.085)	(0.109)	(0.041)	(0.062)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
# obs.	634	3,632	5,223	6,929	16,418	2,218	4,582	14,658	21,458
Sargan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen	0.291	0.458	0.004	0.006	0.000	0.519	0.208	0.000	0.000
Dif-Hansen (lev)	0.272	0.470	0.042	0.217	1.000	0.146	0.114	0.041	0.261
Dif-Hansen (L2-dif)	0.250	0.806	0.357	0.073	0.001	0.644	0.643	0.240	0.889
Dif-Hansen (L3-dif)	0.141	0.767	0.707	0.132	0.005	0.739	0.744	0.149	0.167
m1	-1.27	-5.79	-6.90	-5.74	-10.80	-3.08	-4.51	-6.18	-4.56
m2	-0.811	-1.95	-1.77	-0.67	-2.47	1.33	0.53	-3.58	-1.89

Table B.3 (ctd): *SYS-GMM* estimates of output elasticities and market imperfection parameters by country (7-industry classification)

	THE NETHERLANDS								
	Manufacturing					*Services*			
	HTM	$MHTM$	$MLTM$	LTM	$TOTAL$	$HTKIS$	$KIMS$	$LKIMS$	$TOTAL$
$\widehat{\varepsilon}_N^Q$	0.214	0.282	0.220	0.265	0.301	0.498	0.537	0.532	0.589
	(0.060)	(0.037)	(0.039)	(0.034)	(0.009)	(0.069)	(0.058)	(0.063)	(0.009)
$\widehat{\varepsilon}_M^Q$	0.560	0.633	0.607	0.643	0.615	0.270	0.353	0.259	0.282
	(0.046)	(0.021)	(0.023)	(0.018)	(0.003)	(0.040)	(0.035)	(0.034)	(0.003)
$\widehat{\varepsilon}_K^Q$	0.189	0.071	0.128	0.072	0.046	0.156	0.105	0.159	0.138
	(0.060)	(0.037)	(0.039)	(0.034)	(0.008)	(0.069)	(0.058)	(0.063)	(0.008)
$\widehat{\lambda}$	0.963	0.985	0.955	0.980	0.963	0.924	0.996	0.950	1.009
	(0.036)	(0.021)	(0.027)	(0.023)	(0.008)	(0.050)	(0.039)	(0.036)	(0.008)
$\widehat{\psi}$	0.816	0.288	0.574	0.368	0.230	0.075	-0.074	-0.788	-0.602
	(0.274)	(0.175)	(0.182)	(0.159)	(0.038)	(0.253)	(0.236)	(0.285)	(0.031)
$\widehat{\mu}$	1.498	1.364	1.389	1.394	1.366	1.269	1.249	0.929	1.032
	(0.122)	(0.044)	(0.054)	(0.039)	(0.007)	(0.189)	(0.124)	(0.123)	(0.012)
$\widehat{\gamma}$	0.549	0.201	0.380	0.242	0.157				
	(0.151)	(0.117)	(0.109)	(0.100)	(0.025)				
$\widehat{\phi}$	0.354	0.168	0.275	0.195	0.136				
	(0.063)	(0.081)	(0.057)	(0.065)	(0.019)				
$\widehat{\beta}$								0.541	0.632
								(0.117)	(0.014)
$\widehat{\varepsilon}_w^N$								1.179	1.715
								(0.556)	(0.102)
$\frac{\widehat{\mu}}{\widehat{\lambda}}$	1.555	1.385	1.454	1.422	1.419	1.373	1.254	0.978	1.023
	(0.154)	(0.062)	(0.082)	(0.060)	(0.014)	(0.186)	(0.128)	(0.134)	(0.014)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
# obs.	2,223	11,025	13,394	17,537	44,179	1,822	6,500	7,819	16,141
Sargan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen	0.056	0.000	0.000	0.318	0.000	0.160	0.013	0.009	0.001
Dif-Hansen (lev)	0.379	0.013	0.025	0.551	0.845	0.952	0.183	0.484	0.942
Dif-Hansen (L2-dif)	0.306	0.455	0.598	0.281	0.235	0.228	0.035	0.036	0.094
Dif-Hansen (L3-dif)	0.286	0.676	0.864	0.541	0.694	0.112	0.174	0.027	0.225
m1	-4.38	-10.24	-12.59	-11.46	-19.80	-3.64	-6.93	-7.75	-10.48
m2	0.029	-4.60	-3.51	-4.44	-6.96	0.12	-2.09	-3.66	-3.63

Notes: *Sargan*, *Hansen*, *Dif-Hansen*: tests of overidentifying restrictions, asymptotically distributed as χ^2_{df}. p-values are reported. *Dif-Hansen* (*lev*) tests the validity of the 1-year lag of the first-differenced inputs as instruments in the levels equation while *Dif-Hansen* (*L2-dif*)/(*L3-dif*) test the validity of the 2-/3-year lags of the inputs as instruments in the first-diffferenced equation. $m1$ and $m2$: tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0, 1)$.

Table B.4: Detailed industry repartition by country

			BELGIUM					THE NETHERLANDS				
Industry j	Name	Ind. j_{IND7}	NACE Rev. 2	# obs.	%	# firms	%	NACE Rev. 1.1	# obs.	%	# firms	%
1	Food	LTM	10-12	3,179	8.39	417	7.89	15-16	6,044	9.99	905	9.38
2	Textile	LTM	13	983	2.60	140	2.65	17	1,047	1.73	152	1.57
3	Wearing apparel & Leather (products)	LTM	14-15	226	0.60	32	0.61	18-19	386	0.64	64	0.66
4	Wood (products)	LTM	16	502	1.33	67	1.27	20	1,565	2.59	222	2.30
5	Paper (products)	LTM	17	543	1.43	68	1.29	21	1,565	2.59	203	2.10
6	Printing and reproduction of recorded media	LTM	18	713	1.88	99	1.87	22	4,563	7.54	667	6.91
7	Chemicals	MHTM[1]	19-20	1,571	4.15	196	3.71	23-24 (excl. 24.4)	2,277	3.76	319	3.30
8	Pharmaceutical products & preparations	HTM	21	273	0.72	36	0.68	24.4	310	0.51	47	0.49
9	Plastics	MLTM	22	1,020	2.69	129	2.44	25	2,508	4.15	354	3.67
10	Non-metallic mineral products	MLTM	23	1,199	3.17	160	3.03	26	1,900	3.14	288	2.98
11	Basic metals	MLTM	24	622	1.64	78	1.48	27	690	1.14	90	0.93
12	Fabricated metal products	MLTM	25	2,113	5.58	287	5.43	28	7,615	12.59	1,113	11.53
13	Machinery and equipment, n.e.c.	MHTM	28, 33	1,377	3.64	191	3.61	29	6,241	10.32	899	9.31
14	Computer, electronic and optical products	HTM	26	314	0.83	40	0.76	30, 32-33	1,916	3.17	299	3.10
15	Electrical equipment	MHTM	27	403	1.06	55	1.04	31	1,166	1.93	173	1.79
16	Motor vehicles	MHTM	29	354	0.93	45	0.85	34	1,122	1.85	161	1.67
17	Other transport equipment	MHTM[2]	30	88	0.23	12	0.23	35	907	1.50	138	1.43
18	Furniture	LTM	31	600	1.58	78	1.48	36.1	1,923	3.18	289	2.99
19	Other manufacturing, n.e.c.	LTM	32	338	0.89	51	0.96	36 (excl. 36.1)-37	447	0.74	76	0.79
20	Retail	LKIMS	45, 47	5,477	14.46	786	14.87	50	1,389	2.30	274	2.84
21	Wholesale	LKIMS	46	6,053	15.98	837	15.84	51	1,505	2.49	325	3.37
22	Travel agencies and other reservation service	LKIMS	79	86	0.23	12	0.23	63.3	324	0.54	59	0.61
23	Telecommunications	HTKIS	60-61	276	0.73	39	0.74	64	273	0.45	57	0.59
24	Renting	KIMS	C44-C46	577	1.52	83	1.57	71	729	1.20	131	1.36
25	Publishing activities	HTKIS	58-59, 63	726	1.92	102	1.93	72.2, 72.4	1,040	1.72	232	2.40
26	Other computer and related activities	HTKIS	62	1,162	3.07	182	3.44	72.1, 72.3, 72.5-72.6	253	0.42	50	0.52
27	Other business related activities	KIMS[3]	72, 74, 80-82	1,416	3.74	211	3.99	73, 74.6-74.8	2,001	3.31	372	3.85
28	Consultancy	KIMS	69-70, 73	1,608	4.25	257	4.86	74.1, 74.4	2,134	3.53	425	4.40
29	Architectural and engineering activities	KIMS	71	650	1.72	97	1.84	74.2-74.3	1,590	2.63	292	3.02
30	Employment activities	KIMS	78	317	0.84	46	0.87	74.5	1,008	1.67	210	2.18
31	Financial intermediation, Insurance & pension funding (BE) / Land transport (NL)	LKIMS	64-65	1,346	3.55	210	3.97	60	3,009	4.97	564	5.84
32	Supporting financial & insurance activities (BE) / Water & air transport (NL)	KIMS	66	484	1.28	72	1.36	61-62	86	0.14	17	0.18
33	Real estate activities (BE) / Supporting transport activities (NL)	LKIMS	68	1,271	3.36	169	3.20	63.1-63.2, 63.4	966	1.60	186	1.93
34	Veterinary activities (BE)	LKIMS	75	9	0.02	1	0.02					
Total				37,876	100.0	5,285	100.0		60,499	100.0	9,653	100.0

Table B.5: Details on 30-industry classification by country

		Regime R	
Industry j	Name	BE	NL
1	Food	PC-PR	IC-EB
2	Textile	IC-EB	IC-MO
3	Wearing apparel & Leather (products)	IC-EB	IC-EB
4	Wood (products)	PC-MO	IC-EB
5	Paper (products)	PC-MO	IC-PR
6	Printing and reproduction of recorded media	IC-EB	IC-MO
7	Chemicals	IC-MO	IC-PR
8	Pharmaceutical products & preparations	IC-EB	IC-MO
9	Plastics	IC-MO	IC-EB
10	Non-metallic mineral products	IC-EB	IC-PR
11	Basic metals	IC-EB	IC-EB
12	Fabricated metal products	IC-EB	IC-EB
13	Machinery and equipment, n.e.c.	IC-EB	IC-EB
14	Computer, electronic and optical products	IC-PR	IC-EB
15	Electrical equipment	IC-MO	IC-EB
16	Motor vehicles	IC-MO	IC-EB
17	Other transport equipment	IC-PR	IC-EB
18	Furniture	IC-EB	IC-EB
19	Other manufacturing, n.e.c.	IC-EB	IC-EB
20	Retail	IC-EB	IC-PR
21	Wholesale	IC-PR	IC-PR
22	Travel agencies and other reservation service	IC-MO	PC-PR
23	Telecommunications	IC-MO	IC-MO
24	Renting	IC-EB	IC-MO
25	Publishing activities	IC-EB	IC-EB
26	Other computer and related activities	IC-EB	IC-EB
27	Other business related activities	IC-MO	IC-EB
28	Consultancy	IC-MO	IC-PR
29	Architectural and engineering activities	IC-EB	IC-EB
30	Employment activities	IC-EB	PC-PR

Table B.6: Underpinnings of common threshold of $|0.20|$ for ψ_j by country

BELGIUM				
	Mean	Q_1	Q_2	Q_3
$(\alpha_N)_j$	0.239	0.165	0.219	0.259
$(\alpha_M)_j$	0.656	0.615	0.672	0.720
$(\alpha_K)_j$	0.105	0.079	0.097	0.113
$\left(\widehat{\varepsilon}_N^Q\right)_j$	0.213	0.134	0.210	0.264
$\left(\widehat{\varepsilon}_M^Q\right)_j$	0.723	0.645	0.746	0.807
$\left(\widehat{\varepsilon}_K^Q\right)_j$	0.045	0.007	0.028	0.047
$\widehat{\gamma}_j$	0.415	0.399	0.406	0.407
$\widehat{\phi}_j$	0.293	0.285	0.289	0.289
$\widehat{\beta}_j$	5.509	5.238	5.552	5.605
$\left(\widehat{\varepsilon}_w^N\right)_j$	0.846	0.840	0.847	0.849
THE NETHERLANDS				
	Mean	Q_1	Q_2	Q_3
$(\alpha_N)_j$	0.288	0.239	0.273	0.327
$(\alpha_M)_j$	0.402	0.327	0.433	0.485
$(\alpha_K)_j$	0.310	0.266	0.301	0.359
$\left(\widehat{\varepsilon}_N^Q\right)_j$	0.347	0.235	0.305	0.425
$\left(\widehat{\varepsilon}_M^Q\right)_j$	0.492	0.323	0.535	0.621
$\left(\widehat{\varepsilon}_K^Q\right)_j$	0.161	0.109	0.135	0.218
$\widehat{\gamma}_j$	0.152	0.182	0.147	0.142
$\widehat{\phi}_j$	0.132	0.154	0.128	0.125
$\widehat{\beta}_j$	6.119	4.939	6.178	6.402
$\left(\widehat{\varepsilon}_w^N\right)_j$	0.860	0.832	0.861	0.865

Notes: This table shows that when we choose a common threshold of $|0.20|$ for $|\psi_{j0}|$, the average and median values (in square brackets) 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: $\widehat{\gamma}_j = 0.20 \frac{(\alpha_M)_j}{\left(\widehat{\varepsilon}_M^Q\right)_j} \frac{(\alpha_N)_j}{(\alpha_K)_j} = 0.415$.

Table B.7: Correlations between estimates of product and labor market imperfections by country

	$\rho_{\widehat{\mu}_j,\widehat{\gamma}_j}$	$\rho_{\widehat{\mu}_j,\widehat{\beta}_j}$
BELGIUM		
All industries	0.704*** [0.690***]	0.601*** [0.674***]
$R = IC\text{-}EB$	0.353 [0.661***]	
$R = IC\text{-}MO$		0.571 [0.690]
THE NETHERLANDS		
All industries	0.628*** [0.185***]	0.571*** [0.216***]
$R = IC\text{-}EB$	0.292 [0.219]	
$R = IC\text{-}MO$		0.500 [0.036]

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

Table B.8: Compositional variation of predominant regimes by country

prop. of ind. (%)	IC-EB		IC-MO		IC-PR	
	BE	***NL***	***BE***	***NL***	***BE***	***NL***
MANUFACTURING	62.50	76.47	50.00	60.00	66.66	50.00
HTM	6.25	5.88	0	20.00	33.33	0
MHTM	6.25	23.53	37.50	0	33.33	16.67
MLTM	18.75	17.65	12.50	0	0	16.67
LTM	31.25	0	0	40.00	0	16.67
SERVICES	37.50	23.53	50.00	40.00	33.33	50.00
HTKIS	12.50	11.76	12.50	20.00	0	0
KIMS	18.75	11.76	25.00	20.00	0	16.67
LKIMS	6.25	0	12.50	0	33.33	33.33

Table B.9: Industry-specific input shares $(\alpha_J)_j$ $(J = N, M, K)$, output elasticities $\left(\widehat{\varepsilon}_J^Q\right)_j$, scale elasticity $\widehat{\lambda}_j$, joint market imperfections parameter $\widehat{\psi}_j$, and corresponding price-cost mark-up $\widehat{\mu}_j$ and absolute extent of rent sharing $\widehat{\phi}_j$ or labor supply elasticity $\left(\widehat{\varepsilon}_w^N\right)_j$ by country

BELGIUM

Regime $R = IC\text{-}EB$ [53% of industries, 51% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\widehat{\gamma}_j$	$\widehat{\phi}_j$	*Sargan*	*Hansen*	*Dif-Hansen (lev)*	*Dif-Hansen (L2-dif)*	*Dif-Hansen (L3-dif)*	*m1*	*m2*
25	0.259	0.600	0.142	0.264 (0.056)	0.713 (0.059)	0.010 (0.111)	0.987 (0.026)	0.170 (0.305)	1.190 (0.099)	0.261 (0.148)	0.207 (0.093)	0.000	0.537	0.732	0.237	0.207	-1.98	1.12
24	0.143	0.538	0.320	0.032 (0.067)	0.570 (0.065)	0.200 (0.054)	0.802 (0.080)	0.832 (0.502)	1.059 (0.120)	0.350 (0.200)	0.260 (0.110)	0.000	0.406	0.782	0.561	0.731	-0.14	0.27
12	0.241	0.662	0.097	0.238 (0.051)	0.766 (0.026)	0.025 (0.055)	1.028 (0.033)	0.170 (0.235)	1.157 (0.040)	0.363 (0.495)	0.266 (0.266)	0.000	0.297	0.121	0.759	0.614	-5.21	-0.64
8	0.252	0.651	0.097	0.226 (0.105)	0.713 (0.095)	0.051 (0.136)	0.990 (0.082)	0.197 (0.489)	1.095 (0.146)	0.468 (0.123)	0.319 (0.057)	0.000	1.000	1.000	1.000	1.000	-1.45	-1.06
13	0.260	0.665	0.075	0.243 (0.053)	0.723 (0.035)	0.032 (0.079)	0.998 (0.019)	0.154 (0.247)	1.088 (0.053)	0.488 (0.264)	0.328 (0.164)	0.000	0.615	0.213	0.849	0.938	-5.37	-1.25
20	0.124	0.814	0.062	0.104 (0.015)	0.911 (0.014)	-0.009 (0.023)	1.006 (0.009)	0.284 (0.130)	1.120 (0.018)	0.503 (0.225)	0.335 (0.100)	0.000	0.048	0.832	0.196	0.296	-3.88	-2.27
6	0.270	0.615	0.115	0.225 (0.040)	0.710 (0.030)	0.007 (0.013)	0.942 (0.038)	0.317 (0.156)	1.154 (0.049)	0.645 (0.310)	0.392 (0.115)	0.000	0.658	0.712	0.638	0.528	-2.39	-0.40
3	0.150	0.774	0.076	0.103 (0.070)	0.842 (0.056)	0.035 (0.110)	0.981 (0.046)	0.398 (0.519)	1.088 (0.072)	0.720 (0.401)	0.419 (0.305)	0.000	1.000	1.000	1.000	1.000	-3.69	-0.25
10	0.195	0.706	0.099	0.139 (0.025)	0.836 (0.029)	0.022 (0.049)	0.997 (0.019)	0.470 (0.161)	1.184 (0.042)	0.778 (0.243)	0.438 (0.077)	0.000	0.280	0.498	0.564	0.776	-4.98	-2.02
26	0.378	0.523	0.098	0.321 (0.075)	0.623 (0.044)	0.030 (0.096)	0.974 (0.040)	0.343 (0.258)	1.191 (0.084)	1.108 (0.773)	0.526 (0.174)	0.000	0.441	0.426	0.509	0.608	-2.30	0.85
11	0.202	0.701	0.098	0.102 (0.046)	0.807 (0.022)	0.034 (0.048))	0.943 (0.031)	0.645 (0.244)	1.152 (0.032)	1.155 (0.419)	0.536 (0.090)	0.000	0.427	0.083	0.646	0.795	-1.66	-1.34
19	0.231	0.681	0.089	0.134 (0.039)	0.821 (0.035)	0.000 (0.065)	0.956 (0.024)	0.624 (0.210)	1.206 (0.051)	1.346 (0.405)	0.574 (0.074)	0.000	0.997	1.000	1.000	1.000	-2.59	0.00
2	0.210	0.718	0.071	0.122 (0.033)	0.784 (0.030)	-0.003 (0.051)	0.904 (0.039)	0.510 (0.184)	1.091 (0.041)	1.383 (0.465)	0.580 (0.082)	0.000	0.390	0.409	0.064	0.467	-1.49	-1.47
18	0.219	0.702	0.079	0.048 (0.045)	0.752 (0.053)	0.066 (0.068)	0.866 (0.071)	0.850 (0.201)	1.071 (0.076)	2.208 (0.526)	0.688 (0.051)	0.000	0.310	0.676	0.201	0.091	-2.29	1.12
29	0.455	0.455	0.090	0.295 (0.050)	0.645 (0.040)	0.047 (0.073)	0.986 (0.041)	0.769 (0.175)	1.417 (0.088)	2.755 (0.489)	0.734 (0.035)	0.000	0.272	0.372	0.270	0.516	-3.65	2.00
30	0.6760	0.224	0.100	0.431 (0.061)	0.375 (0.153)	0.102 (0.065)	0.907 (0.097)	1.038 (0.687)	1.675 (0.683)	4.173 (1.101)	0.807 (0.041)	0.000	0.998	1.000	1.000	1.000	-1.102	-1.12

Regime $R = IC\text{-}MO$ [27% of industries, 19% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\widehat{\beta}_j$	$(\widehat{\varepsilon}_w^N)_j$	*Sargan*	*Hansen*	*Dif-Hansen (lev)*	*Dif-Hansen (L2-dif)*	*Dif-Hansen (L3-dif)*	*m1*	*m2*
22	0.089	0.862	0.049	0.143 (0.405)	0.874 (0.253)	0.240 (0.854)	1.258 (0.836)	-0.589 (4.780)	1.014 (0.294)	0.633 (1.723)	1.944 (14.41)	0.000	1.000	1.000	1.000	1.000	-0.12	0.65
15	0.251	0.646	0.103	0.297 (0.059)	0.615 (0.086)	0.031 (0.088)	0.943 (0.063)	-0.229 (0.301)	0.952 (0.133)	0.806 (4.156)	0.220 (5.85)	0.000	0.980	1.000	1.000	1.000	-0.09	-1.59
16	0.219	0.708	0.072	0.257 (0.076)	0.741 (0.058)	-0.021 (0.095)	0.976 (0.034)	-0.124 (0.371)	1.046 (0.082)	0.894 (8.462)	0.287 (25.68)	0.000	0.992	1.000	1.000	0.999	-1.57	-1.11
7	0.165	0.733	0.102	0.198 (0.043)	0.807 (0.029)	0.013 (0.063)	1.018 (0.022)	-0.100 (0.289)	1.101 (0.039)	0.917 (10.993)	0.223 (32.05)	0.000	0.410	0.946	0.677	0.587	-3.48	-0.85
9	0.190	0.720	0.089	0.210 (0.050)	0.733 (0.048)	0.018 (0.093)	0.961 (0.021)	-0.084 (0.323)	1.018 (0.066)	0.924 (12.177)	0.275 (47.80)	0.000	0.245	0.337	0.462	0.479	-4.43	-1.53
27	0.373	0.502	0.125	0.435 (0.057)	0.542 (0.073)	0.002 (0.111)	0.979 (0.044)	-0.088 (0.276)	1.078 (0.144)	0.925 (12.298)	0.227 (40.21)	0.000	0.465	0.371	0.708	0.561	-3.91	-0.07
23	0.205	0.643	0.153	0.255 (0.075)	0.762 (0.052)	0.015 (0.112)	1.033 (0.050)	-0.061 (0.429)	1.186 (0.081)	0.951 (19.308)	0.329 (135.8)	0.000	1.000	1.000	1.000	1.000	-0.05	-0.36
28	0.325	0.547	0.129	0.346 (0.045)	0.558 (0.048)	0.026 (0.076)	0.930 (0.043)	-0.046 (0.205)	1.020 (0.088)	0.957 (22.303)	0.188 (101.8)	0.000	0.812	0.837	0.975	0.791	-2.53	-1,20

Regime $R = IC\text{-}PR$ [10% of industries, 18% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	*Sargan*	*Hansen*	*Dif-Hansen (lev)*	*Dif-Hansen (L2-dif)*	*Dif-Hansen (L3-dif)*	*m1*	*m2*
14	0.130	0.795	0.075	0.117 (0.028)	0.879 (0.020)	-0.010 (0.040)	0.985 (0.016)	0.205 (0.233)	1.105 (0.025)	0.000	0.092	0.997	0.440	0.351	-4.62	-1.45
17	0.219	0.656	0.125	0.210 (0.118)	0.773 (0.084)	0.032 (0.187)	1.014 (0.043)	0.222 (0.649)	1.178 (0.128)	0.000	0.999	1.000	1.000	0.999	-1.40	0.16
21	0.247	0.641	0.113	0.210 (0.608)	0.781 (0.481)	0.238 (0.416)	1.228 (1.198)	0.369 (2.563)	1.219 (0.750)	0.000	1.000	1.000	1.000	1.000	-0.26	-0.79

Table B.9 (ctd): Industry-specific input shares $(\alpha_J)_j$ $(J = N, M, K)$, output elasticities $\left(\widehat{\varepsilon}_J^Q\right)_j$, scale elasticity $\widehat{\lambda}_j$, joint market imperfections parameter $\widehat{\psi}_j$, and corresponding price-cost mark-up $\widehat{\mu}_j$ and absolute extent of rent sharing $\widehat{\phi}_j$ or labor supply elasticity $\left(\widehat{\varepsilon}_w^N\right)_j$ by country

BELGIUM (ctd)

Regime $R = PC\text{-}MO$ [7% of industries, 3% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\widehat{\beta}_j$	$(\widehat{\varepsilon}_w^N)_j$	*Sargan*	*Hansen*	*Dif-Hansen (lev)*	*Dif-Hansen (L2-dif)*	*Dif-Hansen (L3-dif)*	*m1*	*m2*
5	0.207	0.680	0.113	0.310 (0.121)	0.485 (0.081)	0.123 (0.175)	0.918 (0.061)	-0.785 (0.674)	0.714 (0.119)	0.476 (0.910)	0.248 (0.906)	0.000	0.424	0.355	0.785	0.512	-1.21	-0.82
4	0.157	0.750	0.093	0.190 (0.079)	0.723 (0.072)	0.031 (0.070)	0.944 (0.081)	-0.247 (0.532)	0.964 (0.096)	0.796 (3.909)	0.356 (8.568)	0.000	0.434	0.316	0.223	0.870	-1.48	0.32

Regime $R = PC\text{-}PR$ [3% of industries, 9% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$			*Sargan*	*Hansen*	*Dif-Hansen (lev)*	*Dif-Hansen (L2-dif)*	*Dif-Hansen (L3-dif)*	*m1*	*m2*
1	0.138	0.772	0.090	0.189 (0.023)	0.823 (0.020)	-0.034 (0.036)	0.978 (0.020)	-0.304 (0.184)	1.066 (0.026)			0.000	0.090	0.600	0.396	0.253	-3.91	-1.72

THE NETHERLANDS

Regime $R = IC\text{-}EB$ [57% of industries, 64% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\widehat{\gamma}_j$	$\widehat{\phi}_j$	*Sargan*	*Hansen*	*Dif-Hansen (lev)*	*Dif-Hansen (L2-dif)*	*Dif-Hansen (L3-dif)*	*m1*	*m2*
11	0.234	0.485	0.280	0.279 (0.054)	0.602 (0.031)	0.164 (0.081)	1.046 (0.042)	0.050 (0.281)	1.242 (0.063)	0.034 (0.188)	0.033 (0.176)	0.000	0.444	0.363	0.452	0.640	-4.00	-0.39
25	0.438	0.183	0.379	0.746 (0.103)	0.323 (0.040)	-0.081 (0.128)	0.987 (0.046)	0.060 (0.388)	1.763 (0.216)	0.040 (0.250)	0.038 (0.231)	0.000	0.604	0.951	0.564	0.747	-4.71	0.27
9	0.239	0.452	0.309	0.240 (0.042)	0.562 (0.024)	0.164 (0.045)	0.966 (0.028)	0.239 (0.197)	1.243 (0.053)	0.148 (0.120)	0.129 (0.091)	0.000	0.714	0.854	0.347	0.810	-6.06	-0.91
1	0.204	0.519	0.277	0.215 (0.039)	0.693 (0.017)	0.092 (0.042)	1.001 (0.026)	0.282 (0.208)	1.336 (0.034)	0.156 (0.112)	0.135 (0.084)	0.000	0.331	0.775	0.204	0.332	-6.06	-2.37
16	0.242	0.545	0.213	0.241 (0.042)	0.693 (0.039)	0.072 (0.058)	1.006 (0.023)	0.274 (0.207)	1.272 (0.071)	0.245 (0.177)	0.197 (0.114)	0.000	0.556	0.876	0.505	0.460	-3.26	-1.87
15	0.272	0.455	0.274	0.235 (0.067)	0.565 (0.047)	0.169 (0.080)	0.969 (0.030)	0.378 (0.298)	1.243 (0.104)	0.302 (0.223)	0.232 (0.132)	0.000	0.638	0.713	0.886	0.802	-2.45	-1.97
26	0.395	0.240	0.365	0.361 (0.160)	0.314 (0.059)	0.248 (0.168)	0.923 (0.099)	0.390 (0.588)	1.306 (0.247)	0.323 (0.437)	0.244 (0.250)	0.000	0.997	1.000	1.000	1.000	-0.39	-0.03
19	0.278	0.419	0.303	0.202 (0.115)	0.493 (0.079)	0.218 (0.168)	0.913 (0.072)	0.453 (0.548)	1.178 (0.190)	0.352 (0.383)	0.260 (0.209)	0.000	0.615	0.821	0.225	0.540	-2.13	-0.81
3	0.274	0.471	0.255	0.177 (0.081)	0.456 (0.064)	0.279 (0.103)	0.912 (0.045)	0.320 (0.351)	0.968 (0.135)	0.355 (0.364)	0.262 (0.198)	0.000	0.805	0.949	0.995	1.000	-2.83	0.34
29	0.469	0.179	0.351	0.578 (0.073)	0.302 (0.039)	0.125 (0.090)	1.005 (0.038)	0.457 (0.317)	1.687 (0.218)	0.361 (0.210)	0.265 (0.113)	0.000	0.268	0.210	0.391	0.504	-3.92	-0.94
18	0.299	0.441	0.260	0.290 (0.058)	0.633 (0.034)	0.105 (0.065)	1.028 (0.026)	0.468 (0.228)	1.436 (0.077)	0.375 (0.172)	0.273 (0.091)	0.000	0.446	0.474	0.081	0.145	-3.83	-1.58
17	0.251	0.519	0.230	0.189 (0.051)	0.640 (0.044)	0.136 (0.085)	0.965 (0.035)	0.480 (0.261)	1.234 (0.084)	0.425 (0.209)	0.298 (0.103)	0.000	0.258	0.402	0.608	0.547	-3.59	-0.24
13	0.294	0.440	0.266	0.240 (0.040)	0.621 (0.025)	0.123 (0.058)	0.984 (0.023)	0.594 (0.181)	1.411 (0.057)	0.466 (0.126)	0.318 (0.059)	0.000	0.573	0.338	0.947	0.920	-8.84	-3.80
4	0.264	0.494	0.241	0.178 (0.072)	0.615 (0.050)	0.179 (0.113)	0.971 (0.042)	0.573 (0.359)	1.245 (0.101)	0.504 (0.280)	0.335 (0.124)	0.000	0.538	0.819	0.193	0.592	-3.25	-1.98
12	0.294	0.426	0.280	0.197 (0.044)	0.619 (0.029)	0.122 (0.062)	0.937 (0.031)	0.784 (0.200)	1.453 (0.069)	0.567 (0.123)	0.362 (0.050)	0.000	0.012	0.146	0.868	0.921	-9.40	-3.42
14	0.327	0.375	0.298	0.236 (0.068)	0.607 (0.048)	0.135 (0.098)	0.977 (0.039)	0.897 (0.302)	1.619 (0.129)	0.607 (0.167)	0.378 (0.065)	0.000	0.109	0.371	0.385	0.445	-4.37	0.25
27	0.504	0.187	0.309	0.320 (0.044)	0.279 (0.047)	0.418 (0.076)	1.017 (0.054)	0.855 (0.281)	1.490 (0.251)	0.937 (0.164)	0.484 (0.044)	0.000	0.065	0.277	0.305	0.129	-4.04	-1.29

Table B.9 (ctd): Industry-specific input shares $(\alpha_J)_j$ $(J = N, M, K)$, output elasticities $\left(\widehat{\varepsilon}_J^Q\right)_j$, scale elasticity $\widehat{\lambda}_j$, joint market imperfections parameter $\widehat{\psi}_j$, and corresponding price-cost mark-up $\widehat{\mu}_j$ and absolute extent of rent sharing $\widehat{\phi}_j$ or labor supply elasticity $\left(\widehat{\varepsilon}_w^N\right)_j$ by country

THE NETHERLANDS (ctd)

Regime $R = IC\text{-}PR$ [20% of industries, 21% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	Sargan	Hansen	Dif-Hansen (lev)	Dif-Hansen (L2-dif)	Dif-Hansen (L3-dif)	m1	m2
20	0.357	0.248	0.394	0.525 (0.120)	0.215 (0.048)	0.246 (0.135)	0.987 (0.038)	-0.604 (0.465)	0.867 (0.193)	0.000	0.920	0.536	0.943	0.891	-3.27	-0.31
28	0.353	0.327	0.320	0.555 (0.110)	0.333 (0.04)	0.110 (0.126)	0.997 (0.068)	-0.550 (0.410)	1.020 (0.144)	0.000	0.098	0.123	0.650	0.073	-4.83	-1.14
21	0.355	0.182	0.463	0.719 (0.075)	0.198 (0.041)	0.169 (0.097)	1.086 (0.050)	-0.938 (0.374)	1.086 (0.223	0.000	0.380	0.441	0.678	0.169	-3.45	-3.14
5	0.238	0.477	0.284	0.441 (0.076)	0.595 (0.053)	0.053 (0.113)	1.088 (0.045)	-0.602 (0.405)	1.246 (0.112)	0.000	0.722	0.374	0.575	0.866	-5.85	-2.28
10	0.240	0.402	0.359	0.464 (0.084)	0.508 (0.049)	0.127 (0.092)	1.099 (0.044)	-0.674 (0.404)	1.264 (0.121)	0.000	0.319	0.547	0.170	0.219	-4.89	-2.16
7	0.173	0.499	0.328	0.324 (0.057)	0.670 (0.031)	0.131 (0.055)	1.125 (0.034)	-0.535 (0.348)	1.342 (0.062)	0.000	0.026	0.003	0.331	0.253	-3.69	-1.12

Regime $R = IC\text{-}MO$ [17% of industries, 12% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	$\widehat{\beta}_j$	$(\widehat{\varepsilon}_w^N)_j$	Sargan	Hansen	Dif-Hansen (lev)	Dif-Hansen (L2-dif)	Dif-Hansen (L3-dif)	m1	m2
23	0.247	0.340	0.413	0.425 (0.126)	0.307 (0.073)	0.249 (0.168)	0.982 (0.072)	-0.816 (0.631)	0.905 (0.216)	0.526 (0.237)	1.109 (1.055)	0.000	0.889	1.000	1.000	1.000	-0,77	-1,23
8	0.234	0.371	0.395	0.356 (0.155)	0.410 (0.115)	0.284 (0.258)	1.050 (0.079)	-0.415 (0.941)	1.105 (0.310)	0.727 (0.503)	2.662 (6.742)	0.000	0.998	1.000	1.000	0.982	-1,97	0.47
2	0.258	0.465	0.276	0.389 (0.060)	0.635 (0.041)	-0.001 (0.080)	1.023 (0.038)	-0.145 (0.274)	1.364 (0.088)	0.904 (0.167)	9.41 (18.13)	0.000	0.552	0.694	0.331	0.293	-3,626	-2,16
24	0.203	0.300	0.497	0.225 (0.071)	0.307 (0.056)	0.438 (0.081)	0.969 (0.045)	-0.085 (0.431)	1.021 (0.186)	0.923 (0.368)	12.03 (62.42)	0.000	0.612	0.399	0.674	0.697	-2,28	-0,58
6	0.312	0.380	0.308	0.406 (0.053)	0.476 (0.035)	0.127 (0.076)	1.009 (0.028)	-0.045 (0.242)	1.253 (0.092)	0.966 (0.182)	28.07 (153.9)	0.000	0.452	0.242	0.710	0.703	-6,66	-1,39

Regime $R = PC\text{-}PR$ [7% of industries, 3% of firms]

Ind. j	$(\alpha_N)_j$	$(\alpha_M)_j$	$(\alpha_K)_j$	$(\widehat{\varepsilon}_N^Q)_j$	$(\widehat{\varepsilon}_M^Q)_j$	$(\widehat{\varepsilon}_K^Q)_j$	$\widehat{\lambda}_j$	$\widehat{\psi}_j$	$\widehat{\mu}_j$	Sargan	Hansen	Dif-Hansen (lev)	Dif-Hansen (L2-dif)	Dif-Hansen (L3-dif)	m1	m2
30	0.275	0.509	0.216	0.392 (0.047)	0.398 (0.042)	0.200 (0.084)	0.991 (0.034)	-0.642 (0.233)	0.783 (0.083)	0.000	0.690	0.549	0.699	0.823	-0.70	-0.19
22	0.119	0.730	0.151	0.283 (0.066)	0.693 (0.043)	0.045 (0.095)	1.022 (0.05)	-1.427 (0.582)	0.949 (0.058)	0.000	0.743	0.998	0.734	0.771	-2.62	-1.90

Notes: Robust standard errors in parentheses. Time dummies are included but not reported. *Sargan, Hansen, Dif-Hansen*: tests of overidentifying restrictions, asymptotically distributed as χ^2_{df}. p-values are reported. *Dif-Hansen (lev)* tests the validity of the 1-year lag of the first-differenced inputs as instruments in the levels equation while *Dif-Hansen (L2-dif)/(L3-dif)* test the validity of the 2-/3-year lags of the inputs as instruments in the first-differenced equation. $m1$ and $m2$: tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as $N(0,1)$. Industries within $R = PC\text{-}PR$ and $R = IC\text{-}PR$ are ranked according to $\widehat{\mu}_j$, industries within $R = IC\text{-}EB$ are ranked according to $\widehat{\gamma}_j$ and industries within $R = PC\text{-}MO$ and $R = IC\text{-}MO$ are ranked according to $\widehat{\beta}_j$.

Table B.10: Total factor productivity distribution by country, regime and industry

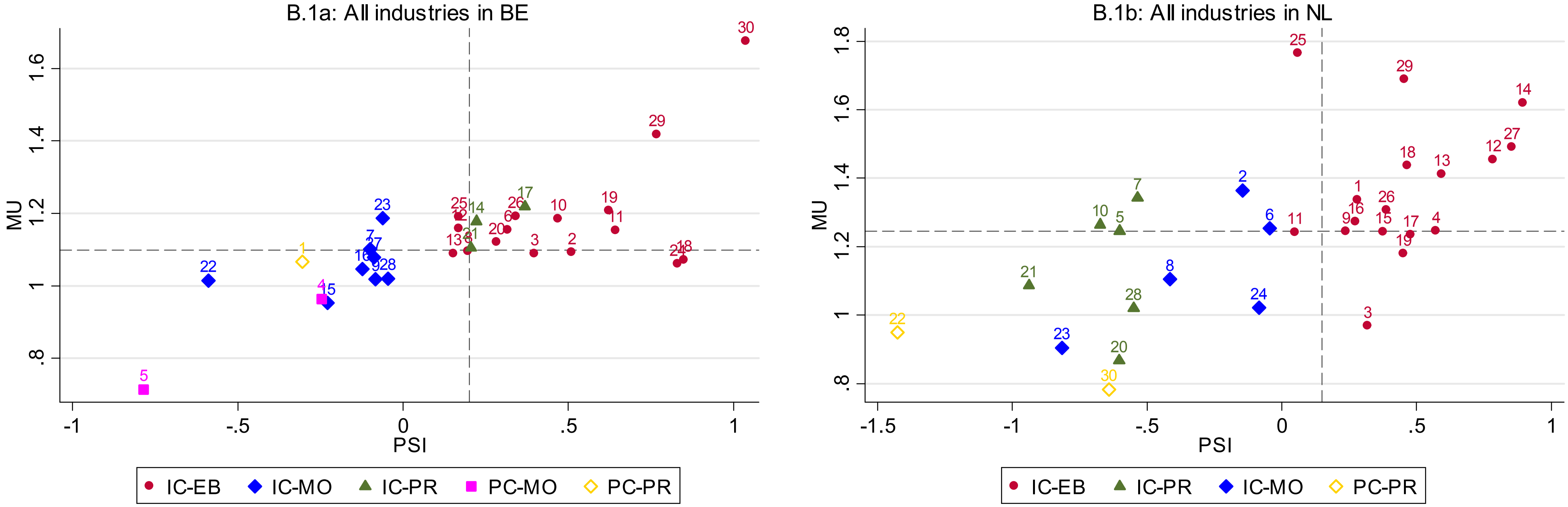
Sample	TFPGR	Mean	Sd	Skewness	Kurtosis	p10	p25	p50	p75	p90
BELGIUM										
R = IC-EB										
Ind. j	3	-0.005	0.093	0.600	3.175	-0.116	-0.071	-0.017	0.044	0.131
	30	-0.005	0.382	0.112	5.074	-0.399	-0.216	-0.017	0.224	0.380
	8	-0.003	0.161	0.513	3.692	-0.177	-0.114	-0.032	0.088	0.230
	19	-0.002	0.189	1.502	6.924	-0.192	-0.128	-0.030	0.080	0.231
	25	0.001	0.294	3.145	18.363	-0.234	-0.147	-0.057	0.087	0.218
	10	0.006	0.124	1.601	10.316	-0.118	-0.069	-0.012	0.064	0.146
	18	0.006	0.178	3.371	31.429	-0.183	-0.095	0.000	0.087	0.185
	29	0.006	0.197	0.539	3.744	-0.217	-0.132	-0.018	0.136	0.257
	11	0.009	0.171	1.318	5.818	-0.161	-0.107	-0.025	0.096	0.225
	12	0.014	0.165	1.977	10.522	-0.143	-0.088	-0.021	0.078	0.206
	13	0.016	0.162	1.472	7.810	-0.151	-0.091	-0.008	0.093	0.204
	24	0.016	0.375	0.775	7.880	-0.350	-0.206	-0.021	0.228	0.465
	26	0.016	0.214	1.294	5.896	-0.203	-0.118	-0.024	0.098	0.310
	2	0.017	0.184	2.462	16.423	-0.152	-0.099	-0.014	0.094	0.205
	6	0.017	0.149	2.099	1.977	-0.127	-0.070	-0.004	0.077	0.163
	20	0.017	0.172	4.501	29.304	-0.086	-0.059	-0.025	0.032	0.121
R = IC-MO										
Ind. j	23	0.003	0.233	0.835	3.790	-0.267	-0.162	-0.027	0.138	0.311
	9	0.007	0.118	0.721	4.122	-0.130	-0.076	-0.006	0.076	0.164
	22	0.010	0.380	0.321	2.454	-0.474	-0.270	0.009	0.301	0.451
	16	0.014	0.217	2.115	9.510	-0.181	-0.114	-0.022	0.066	0.240
	28	0.015	0.308	1.163	5.543	-0.307	-0.188	-0.038	0.160	0.392
	15	0.017	0.216	1.532	7.905	-0.226	-0.139	-0.007	0.117	0.275
	7	0.018	0.173	3.246	29.161	-0.138	-0.076	-0.013	0.074	0.208
	27	0.053	0.333	1.286	5.466	-0.285	-0.170	-0.023	0.205	0.486
R = IC-PR										
Ind. j	17	-0.016	1575	0.018	2.493	-2.124	-1.720	0.276	0.868	1.841
	21	0.017	0.185	3.818	27.717	-0.119	-0.081	-0.026	0.045	0.174
	14	0.020	0.196	1.793	8.189	-0.162	-0.099	-0.007	0.095	0.201
R = PC-MO										
Ind. j	4	0.002	0.189	2.682	14.585	-0.150	-0.104	-0.038	0.051	0.187
	5	0.004	0.288	1.410	6.063	-0.298	-0.191	-0.035	0.112	0.377
R = PC-PR										
Ind. j	1	0.015	0.185	3.474	26.396	-0.149	-0.089	-0.016	0.071	0.202

Table B.10 (ctd): Total factor productivity distribution by country, regime and industry

					THE NETHERLANDS					
Sample	**TFPGR**	Mean	Sd	Skewness	Kurtosis	p10	p25	p50	p75	p90
					R = IC-EB					
Ind. j	26	-0.004	0.323	0.076	2.865	-0.433	-0.213	-0.019	0.219	0.449
	11	0.000	0.201	5.063	70.360	-0.194	-0.109	-0.018	0.090	0.189
	3	0.003	0.257	0.957	5.413	-0.263	-0.158	-0.021	0.131	0.311
	17	0.004	0.221	1.148	7.098	-0.241	-0.127	-0.018	0.117	0.263
	18	0.006	0.186	1.731	10.850	-0.173	-0.104	-0.024	0.088	0.208
	19	0.008	0.320	0.907	6.430	-0.307	-0.176	-0.018	0.138	0.375
	13	0.009	0.219	2.891	27.626	-0.204	-0.121	-0.025	0.101	0.248
	9	0.010	0.203	2.324	16.777	-0.195	-0.105	-0.011	0.091	0.206
	4	0.012	0.166	2.154	15.557	-0.157	-0.088	-0.009	0.088	0.197
	16	0.012	0.167	2.486	16.181	-0.144	-0.089	-0.021	0.067	0.193
	25	0.012	0.359	0.524	3.883	-0.407	-0.224	-0.018	0.203	0.468
	15	0.015	0.242	1.775	13.342	-0.229	-0.143	-0.018	0.140	0.289
	29	0.015	0.285	0.975	7.464	-0.297	-0.171	-0.028	0.176	0.377
	14	0.020	0.260	1.361	9.111	-0.271	-0.147	-0.011	0.141	0.338
	12	0.021	0.262	3.688	33.175	-0.210	-0.126	-0.027	0.111	0.273
	1	0.023	0.267	3.887	28.674	-0.185	-0.111	-0.028	0.084	0.252
	27	0.028	0.348	0.898	5.169	-0.347	-0.194	-0.022	0.201	0.478
					R = IC-PR					
Ind. j	21	0.001	0.426	0.923	5.017	-0.453	-0.284	-0.052	0.233	0.543
	5	0.015	0.189	1.710	9.092	-0.179	-0.106	-0.015	0.101	0.238
	10	0.020	0.281	1.219	5.324	-0.272	-0.272	-0.025	0.145	0.373
	7	0.022	0.270	1.560	8.299	-0.261	-0.158	-0.012	0.146	0.335
	28	0.028	0.418	1.084	5.916	-0.384	-0.219	-0.025	0.220	0.502
	20	0.059	0.323	3.765	21.183	-0.245	-0.137	-0.021	0.119	0.334
					R = IC-MO					
Ind. j	2	0.012	0.223	0.404	3.901	-0.236	-0.123	-0.009	0.134	0.296
	6	0.015	0.228	1.470	8.394	-0.211	-0.128	-0.036	0.118	0.322
	23	0.021	0.378	0.507	2.752	-0.414	-0.294	-0.029	0.285	0.515
	24	0.023	0.266	1.211	7.636	-0.271	-0.145	-0.009	0.260	0.333
	8	0.025	0.331	1.054	4.773	-0.303	-0.184	-0.034	0.198	0.404
					R = PC-PR					
Ind. j	22	0.003	0.246	2.339	12.822	-0.216	-0.130	-0.021	0.072	0.204
	30	0.018	0.284	1.037	5.720	-0.279	-0.175	-0.035	0.172	0.382

Note: Within each regime, industries are ranked according to $TFPGR_{Mean,j}$.

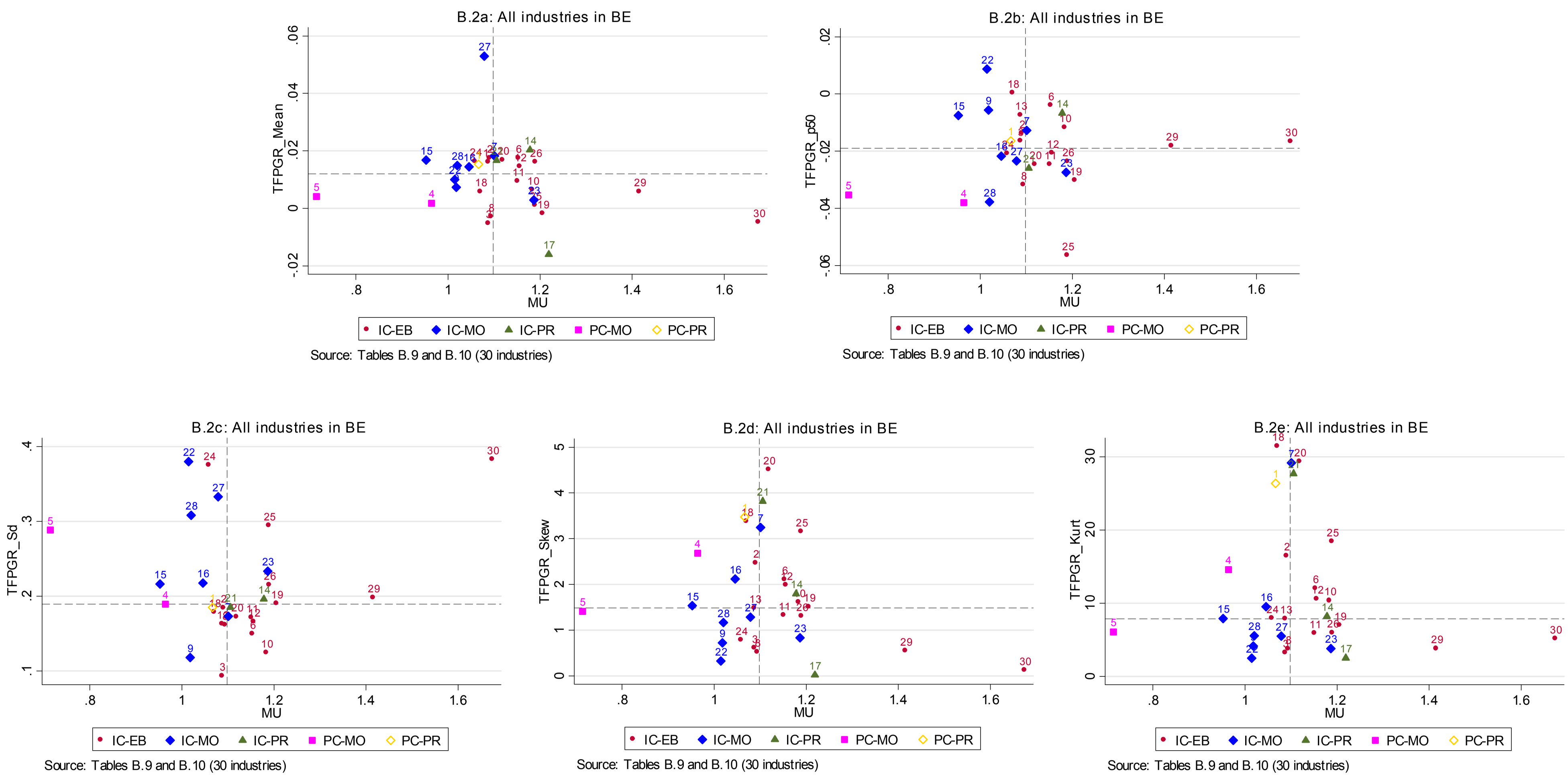
Graph B.1: Market imperfection parameters, by country and regime



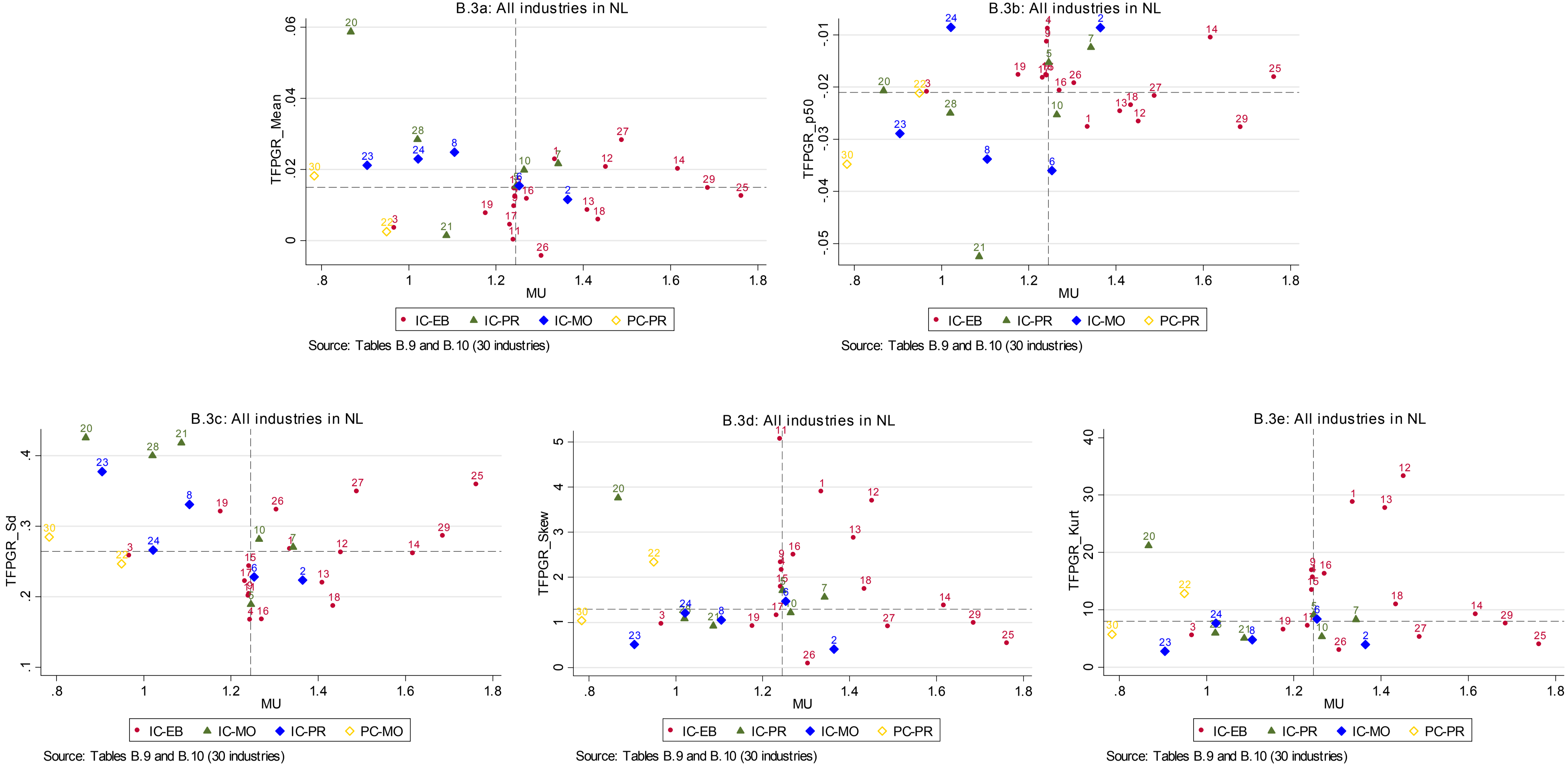
Source: Table B.9 estimates (30 industries)

Source: Table B.9 estimates (30 industries)

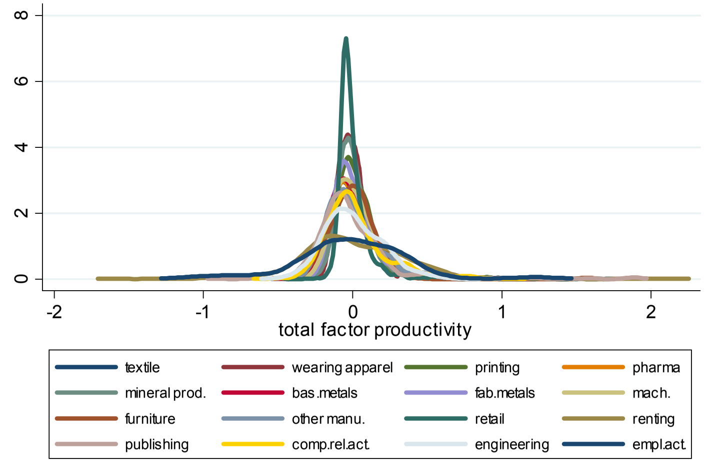
Graph B.2: TFP distributional characteristics and product market imperfection parameters by regime in Belgium



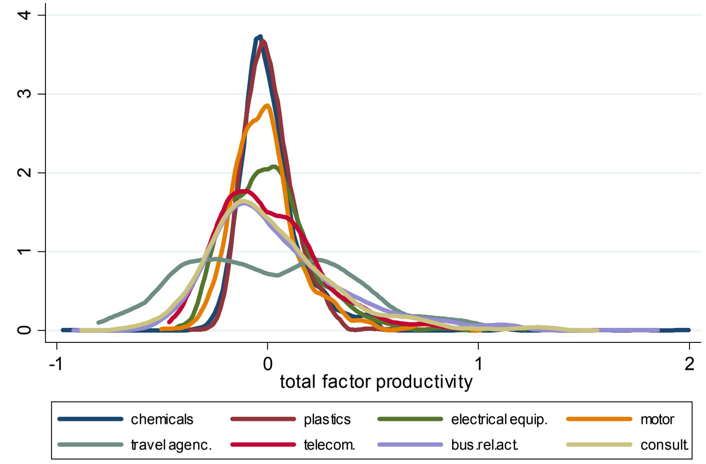
Graph B.3: TFP distributional characteristics and product market imperfection parameters by regime in the Netherlands



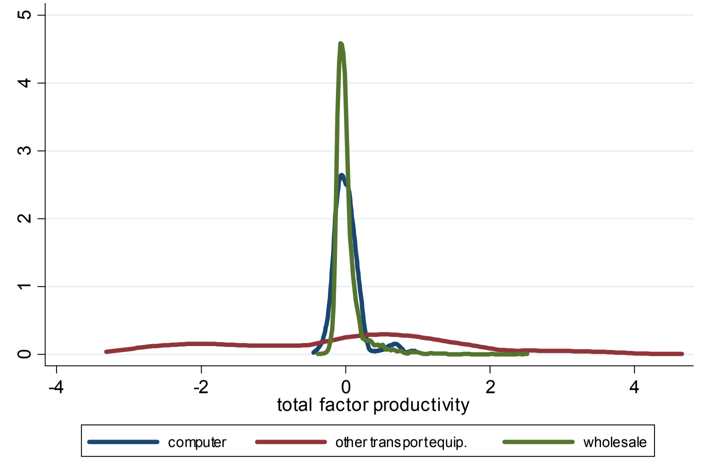
Graph B.4: Within-regime TFP distributions by industry in Belgium



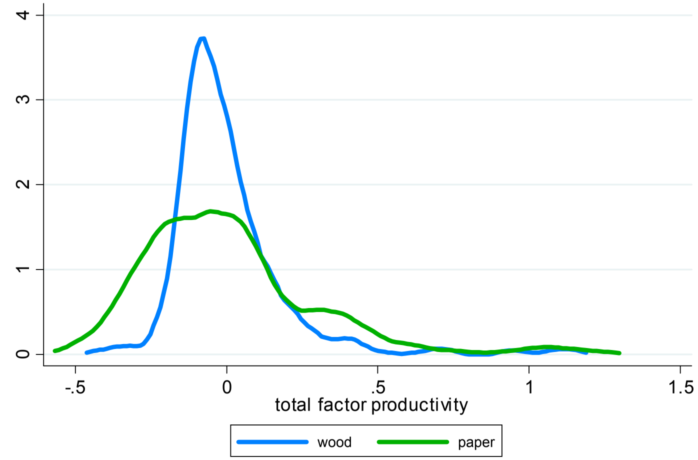
B.4a: Industries within R = IC-EB in BE



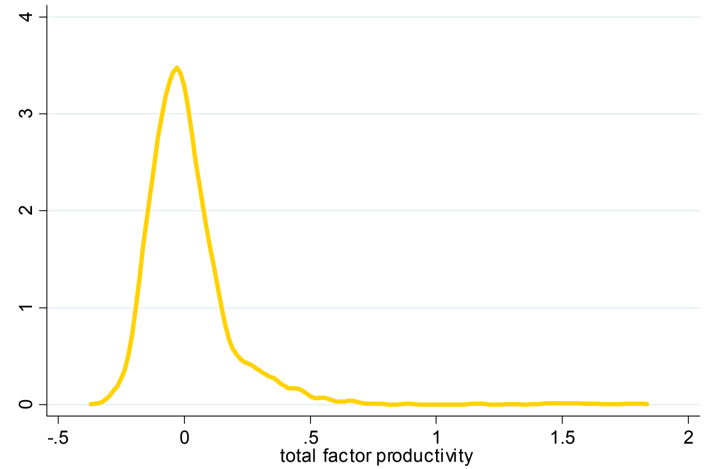
B.4b: Industries within R = IC-MO in BE



B.4c: Industries within R = IC-PR in BE

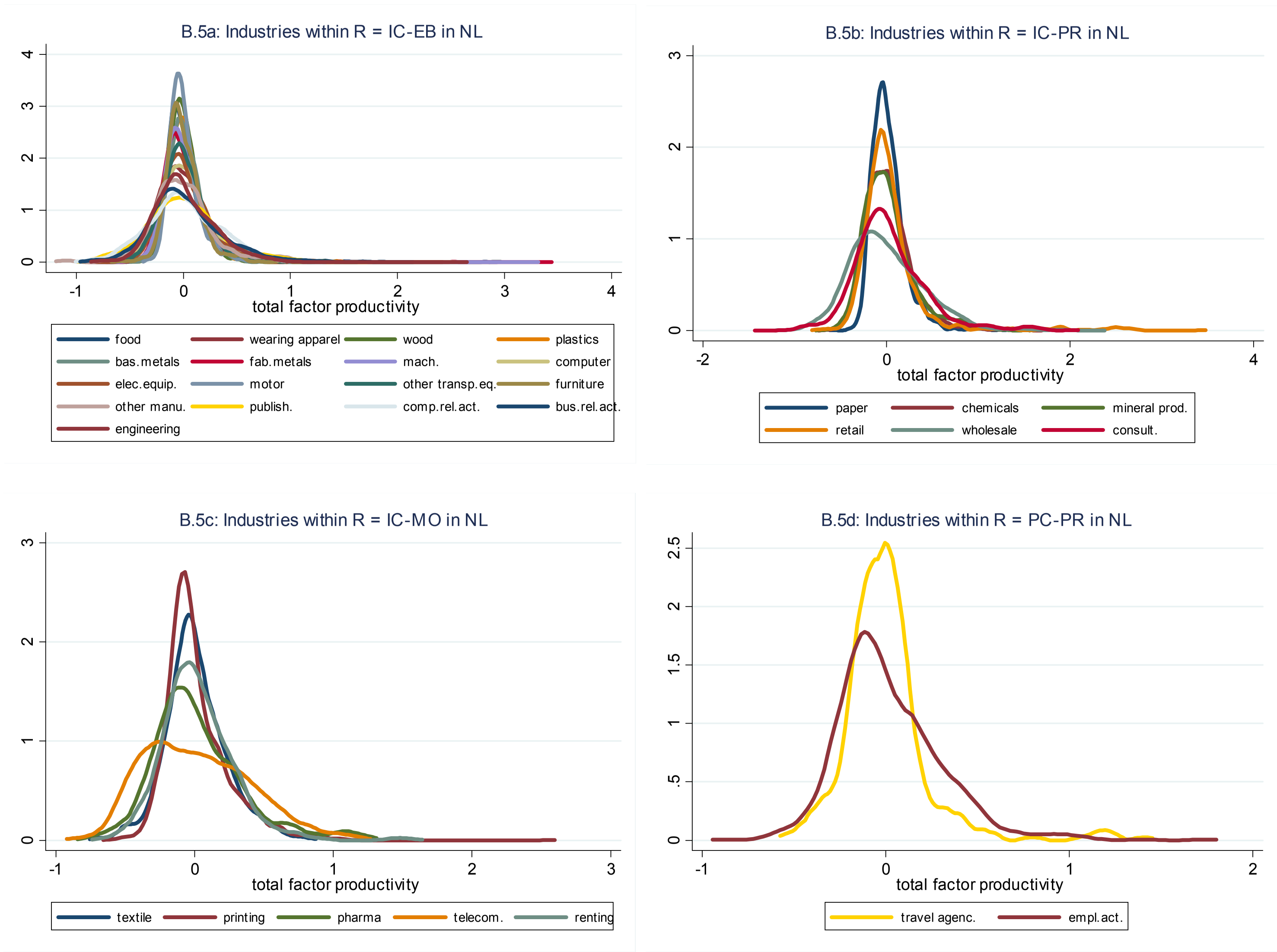


B.4d: Industries within R = PC-MO in BE



B.4e: Industries within R = PC-PR in BE

Graph B.5: Within-regime TFP distributions by industry in the Netherlands



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