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Abstract

This paper introduces a new method which allows to simultaneously estimate price-cost margins and fixed costs in production, using standard production data on expenditures of inputs and revenue at the firm level. In particular, we exploit properties of the primal and dual price based and cost based Solow residual, in which we allow not only for the flexible treatment of capital (either fixed, variable or a combination of both) but also for the flexible treatment of other input factors, such as labor and intermediate inputs. We use a 30 year long firm level panel of Belgian firms to estimate price-cost margins and fixed costs as a share of revenue to show the following key results: Ignoring fixed costs in production, as in most of the literature, underestimates price-cost margins and overestimates excess profit margins. We also find that fixed costs as well as price-cost margins decline in the last three decades, pushing excess profit margins downwards, suggesting highly competitive markets in Belgium.

Keywords: Price-cost margins, fixed costs, excess profits, market power, firm level data

JEL codes: D21, L13, L16

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1. Introduction

The economic implications of institutional change, trade liberalization and anti-trust policy on market power have been widely conjectured and researched. The long-term trend of the global rise in markups (De Loecker, Eeckhout & Unger, 2019; Diez, Leigh & Duval, 2018; Hall, 2018) has stirred concerns not only about the efficiency of competition policy, but also about the potential macroeconomic effects of market power. The documented rise in global markups has been accompanied by a fall in investment rates (Gutierrez & Philippon, 2017), declining business dynamism (Decker, Haltiwanger, Jarmin & Miranda 2016; Bijnens & Konings, 2018) and the fall in the labor share (Autor, Dorn, Katz, Patterson & Van Reenen, 2020). This suggests that increased market power may have detrimental effects going beyond a single industry, affecting the overall economy (Syverson, 2019).

A key aspect in this debate is the measurement of market power, which is typically proxied by the markup, i.e. the ratio of price over marginal cost. In the absence of fixed costs, rising markups may reflect increasing market power as they are a good proxy for profitability. But in the presence of fixed costs, the rise in markups may just reflect a rise in fixed costs associated with production, such as overhead costs (e.g. rents, advertising, administration). Just as marginal costs are hard to observe, fixed costs in production are also not easily observed. Hence most of the literature estimating markups tends to ignore the role of fixed costs and assumes that one or all inputs are entirely variable. Yet, changes in the environment in which firms operate do not only affect price-cost margins, but also the scale of operations and hence the share of fixed costs in production. For instance, De Loecker et al. (2019) show that the rise in U.S. markups has been accompanied by an increase in fixed costs.[5] But since markups have increased even faster, they argue that the rise in markups also reflects a rise in profitability and market power.

In this paper, we develop and illustrate a new method, which allows to simultaneously estimate price-cost margins and fixed costs in production, using standard production data on expenditures of inputs and revenue at the firm level. We start from the framework introduced by Hall (1988), and further extended by Roeger (1995), exploiting properties of the primal and the dual Solow residual for estimating price-cost margins using the observed variation in input and output values.

An important advantage of our approach is that it allows not only for the flexible treatment of capital (either fixed, variable or a combination of both) but also for the flexible treatment of other input

[5] U.S. firms report costs of production in two main categories: costs of goods sold (COGS) and selling, general & administrative costs (SGA). They can respectively be interpreted as a proxy for variable and fixed costs. De Loecker et al. (2019) document a rise of SG&A in total costs from 15% (1980) to 21% (2014). Unlike U.S. firms, European firms do not report their costs of production in these two categories. Instead, they report their costs by input without making a distinction between variable and fixed costs.

factors, such as labor and intermediate inputs. We do not have to classify costs as quasi-variable or quasi-fixed[6], nor do we have to assume that one or all inputs are entirely variable.[7] Instead, the model estimates the share of fixity for each input factor based on the underlying firm level data. Further, unlike most other approaches, we do not need to rely on unobserved product price data for deflating firm level sales or deflating input factors such as material costs. Our method allows to use nominal values. Another advantage of our approach is that it deals with the endogeneity problems caused by unobservable productivity shocks (Roeger, 1995). Finally, the method allows to directly estimate a weighted aggregate price-cost margin. To this end, we only need to make two assumptions, i.e., constant returns to scale in the variable input factors of production and the share of variable input factors adjusts freely within the time period.

We illustrate our method using longitudinal firm level data for Belgium for the period 1985-2014. We study both the level and the evolution of the price-cost margins over time. The rich time dimension of the data set enables us to distinguish cyclical variation from a secular trend.

Our main findings can be summarized as follows. First, accounting for the distinction between fixed and variable costs has a profound impact on the estimation of price-cost margins. Ignoring fixed costs typically underestimates price-cost margins and overestimates profitability. Second, the largest part of price-cost margins is needed to cover the fixed costs while only a smaller part remains left as excess profits ratio. These components are respectively equal to 25.9%, 23.4% and 2.5%. Third, Belgian price-cost margins decline by 5.6 percentage points between 1985 and 2014. Our method allows to decompose the change of the price-cost margin into a change in the fixed costs ratio on the one hand and a change in the excess profits ratio on the other hand. These components decrease respectively by 4.8 and 0.8 percentage points, thus reinforcing each other. Finally, we show that heterogeneity is present at the sectoral level, both in level and in trend.

The remainder of the paper is structured as follows. In the next section we introduce our model which allows us to simultaneously estimate the price-cost margin and the share of fixity for each input. In section 3, we describe our data set, while section 4 discusses the estimation results. Section 5 provides various robustness tests after which we conclude.

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[6] U.S. firms classify costs into costs of goods sold (COGS) or selling, general & administrative (SG&A). Classifying costs into the appropriate category is not always straightforward. Sometimes, costs are classified as COGS in one industry while being classified as SG&A in another industry, and vice versa.

[7] De Loecker and Warzynski (2012) develop a widely used method to estimate markups using production data. The assumption that at least one input is completely variable is key in this method. Often, capital and labor are thought of as at least partially fixed. Therefore, empirical applications often assume that intermediate inputs are entirely variable. However, it is very unlikely that each and every category within intermediate inputs is completely variable. In the robustness section (5.2 and 5.3), we compare the estimates from their and our method.

2 Methodology

We start by introducing the framework of Hall (1988), further extended by Roeger (1995), which allows to estimate price-cost margins under imperfect competition. It assumes that all inputs (i.e. capital, labor and intermediate inputs) are entirely variable. We relax this assumption by allowing inputs to be variable, fixed or a combination of both. In particular, we exploit properties of the primal and dual Solow residuals based on revenue and cost shares. These four components allow us to estimate price-cost margins in the presence of fixed costs. Finally, we decompose the price-cost margins into a fixed cost ratio and an excess profits ratio.

2.1 The Hall (1988) and related approaches

Consider a production function $\mathrm{Q}_{it} = \mathrm{F}(\mathrm{K}_{it}, \mathrm{L}_{it}, \mathrm{M}_{it})\Theta_{it}$ for firm *i* at time t, where Q, K, L and M are quantities of output, capital, labor and intermediate inputs, respectively. Θ is an index of Hicks-neutral technological progress.[8] Under the assumptions of perfect competition and constant returns to scale, the Solow residual given by $SRQ^R \equiv \Delta q - \frac{WL}{PQ}\Delta l - \frac{P^M M}{PQ}\Delta m - (1 - \frac{WL}{PQ} - \frac{P^M M}{PQ})\Delta k$ is an estimate of $\Delta\theta$ or the growth rate of total factor productivity (Solow, 1957). Define Δq , Δl, Δm and Δk as the growth rates of output, labor, intermediate inputs and capital, respectively. $\frac{\mathrm{WL}}{\mathrm{PQ}}$ and $\frac{\mathrm{P^M M}}{\mathrm{PQ}}$ are the shares of labor cost and intermediate input cost in operating revenue, respectively. By relaxing the condition that price equals marginal cost, Hall (1988) shows that the primal quantity-based Solow residual can be decomposed into a markup and a productivity factor:

$$\mathrm{SRQ^R} = \mathrm{B}(\Delta \mathrm{q} - \Delta \mathrm{k}) + (1 - \mathrm{B})\Delta\theta \quad (1)$$

where B is the price-cost margin defined as $\mathrm{B} \equiv \frac{\mathrm{P-MC}}{\mathrm{P}}$, which is directly related to markups via $\mu = \frac{1}{1-B}$. Price-cost margins are typically within the interval [0, 1] whereas markups are in the interval [0, +∞).

This approach has been used to obtain an average estimate of the price-cost margin. An estimate of B larger than 0 rejects the model of perfect competition. This approach has been used in many papers using industry level or firm level data (e.g. Amit, Domowitz & Fershtmann, 1988; Waldmann, 1991; Morrison, 1992; Levinsohn, 1993; Norrbin, 1993; Harrison, 1994; Basu and Fernald, 1993; Klette, 1999; Konings, Van Cayseele & Warzynski, 2001; Hall, 2018). An important issue, however, in estimating equation (1) is that unobserved productivity shocks may be positively correlated with output (or input)

[8] To simplify notation, we omit firm and time subscripts. The empirical analysis is at the firm-year level. F(.) is a linear homogenous production function.

growth. Thus instrumental variables are required to estimate B, but it has often turned out to be difficult to find good instruments, especially when firm level data are used. In addition, when the impact of policy changes is analyzed, not only price-cost margins may be affected, but also productivity and productivity growth (Harrison, 1994), which can bias the estimated change in price-cost margins. Finally, in equation (1) deflated sales are used to proxy for physical output, but with firm heterogeneity and multiple-product firms, this can introduce a bias (see Klette & Griliches, 1996; De Loecker, 2011; De Loecker & Warzynski, 2012).

One way to deal with these problems is the extension suggested by Roeger (1995), who also derives the dual price-based Solow residual by solving the cost minimization problem. Following Roeger (1995), corresponding to the production function, we define the cost function as $C(W, R, P^M, Q, \theta) = \frac{G(W,R,P^M)Q}{\theta}$. G(.) is homogeneous of degree one. The dual price-based Solow residual is:

$$SRP^R \equiv \frac{WL}{PQ}\Delta w + \frac{P^M M}{PQ}\Delta p^M + \left(1 - \frac{WL}{PQ} - \frac{P^M M}{PQ}\right)\Delta r - \Delta p = -B(\Delta p - \Delta r) + (1 - B)\Delta\theta \qquad (2)$$

where Δp, Δw, Δp^M and Δr are the growth rates of product price, wage per employee, intermediate input price and the rental price of capital, respectively. By subtracting the dual from the primal Solow residual, unobserved productivity shocks cancel out and the average price-cost margin B can be estimated consistently using equation (3), in which we add an i.i.d. error term, ϵ.[9]

$$SRQ^R - SRP^R = B[(\Delta p + \Delta q) - (\Delta k + \Delta r)] + \epsilon \qquad (3)$$

Equation (3) has the additional advantage that all variables are expressed in nominal terms, so that price deflators are not required for estimating B consistently. In equation (3), however, all factors of production are fully flexible and adjust to the equilibrium values, which is not realistic. Typically, there are substantial overhead costs which are fixed and not directly attributable to the short run variations in output. We therefore adjust our framework to allow for fixed factors of production, which will allow us to estimate both price-cost margins and the shares of unobserved fixed input factors in a consistent way.

2.2 Primal and Dual Solow Residuals in the Presence of Fixed Factors of Production

We continue by exploiting properties of the primal and dual Solow residuals based on revenue and cost shares. These components allow us to estimate price-cost margins in the presence of fixed costs.

[9] At this stage, we assume that there is no measurement error, nor any specification error. We come back to these issues in this section (2.3.3) and in the robustness tests (5.5 and 5.6).

2.2.1 Primal and Dual Solow Residuals with Revenue-based Shares

We start from a standard short run production function with constant returns to scale in the variable input factors for firm *i* at period *t*:[10]

$$Q = F(K^v, L^v, M^v)\Theta \qquad (4)$$

where output Q is produced with variable capital $K^v \equiv K - K^f$, variable labor input $L^v \equiv L - L^f$ and variable intermediate inputs $M^v = \mathrm{M} - \mathrm{M}^f$. This implies that fixed capital, fixed labor and fixed intermediate input do not directly enter into the short run production function.[11] We implicitly assume that firms are price-takers in their input markets.[12] Θ is defined as before. K^v(L^v ; M^v) is the fraction of total capital (labor; intermediates) which adjusts within a time period to current demand and cost changes without friction. On the other hand, K^f(L^f ; M^f) is the part of total capital (labor; intermediates) which does not adjust within a period to current demand and cost changes. The fixed shares of capital, labor and intermediate inputs might contain overhead costs, such as the rent for buildings, administration workers or insurance for buildings, etc. (Stigler, 1939). In a typical firm level dataset, there is information on the total amount of capital (labor; intermediates) used, but no clear distinction can be made between the variable and fixed component of capital (labor; intermediates).

Define sv^k, sv^l and sv^m as the share of variable capital $\frac{K^v}{K^v+K^f}$, the share of variable labor input $\frac{L^v}{L^v+L^f}$ and the share of variable intermediate inputs $\frac{M^v}{M^v+M^f}$, respectively. These terms capture the production technology that firms apply but are unobservable to the econometrician.

Under imperfect competition, the first order condition and Euler's law imply that the output growth is determined by a weighted sum of the variable input growth and the growth rate of productivity. Input weights are given by the corresponding shares of variable costs in revenue adjusted by markups.

$$\Delta \mathrm{q} = \frac{\mathrm{P}}{\mathrm{MC}}\left(\frac{\mathrm{sv^k RK}}{\mathrm{PQ}}\Delta \mathrm{k^v} + \frac{\mathrm{sv^l WL}}{\mathrm{PQ}}\Delta \mathrm{l^v} + \frac{\mathrm{sv}^m P^M M}{\mathrm{PQ}}\Delta \mathrm{m^v}\right) + \Delta\theta \qquad (5)$$

where $\frac{\mathrm{sv^k RK}}{\mathrm{PQ}}$, $\frac{\mathrm{sv^l WL}}{\mathrm{PQ}}$ and $\frac{\mathrm{sv}^m P^M M}{\mathrm{PQ}}$ are shares of variable capital cost, variable labor cost and variable intermediate input cost in revenue, respectively. Constant returns to scale on variable inputs implies

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[10] The production function F(.) is homogeneous of degree one in variable capital, variable labor and variable intermediate inputs.

[11] A firm uses both fixed and variable inputs to produce. Every period, the firm has to pay, or allocate, a certain level of fixed factor inputs in order to be able to produce. This fixed input is necessary but, by definition, does not produce any output. For this, the firm needs variable input. At the margin, the firm can only vary its variable input whereas it cannot change its fixed input anymore within that time period.

[12] Crépon, Desplatz and Mairesse (2005) extend Hall's (1988) approach relaxing the condition that the labor market is perfectly competitive. For applications of this approach, see Dobbelaere (2004) and Dobbelaere and Mairesse (2009).

that the total variable cost is $C^v = MC \cdot Q = sv^k RK + sv^l WL + sv^m P^M M$. Marginal costs are defined as $MC = \frac{G(W,R,P^M)}{\theta}$. As in Hall (1988), the primal Solow residual with revenue-based shares is defined as:

$$SRQ^R \equiv \Delta q - \frac{WL}{PQ}\Delta l - \frac{P^M M}{PQ}\Delta m - (1 - \frac{WL}{PQ} - \frac{P^M M}{PQ})\Delta k \qquad (6)$$

Substituting equation (5) into (6), we get the primal Solow residual with revenue-based shares.

$$SRQ^R = B(\Delta q - \Delta k) + \frac{(1-sv^l)WL}{PQ}(\Delta k - \Delta l) + \frac{(1-sv^m)P^M M}{PQ}(\Delta k - \Delta m) + \frac{sv^k RK}{PQ}(\Delta k^v - \Delta k) + \frac{sv^l WL}{PQ}(\Delta l^v - \Delta l) + \frac{sv^m P^M M}{PQ}(\Delta m^v - \Delta m) + (1 - B)\Delta\theta \qquad (7)$$

Equation (7) shows that the presence of fixed factors introduces additional wedges between SRQ^R and $\Delta\theta$, which are proportional to the share of fixed factors of production.

The bias linked to the second and third component of equation (7) arises if labour and intermediate inputs are not entirely variable, i.e., sv^l or sv^m are smaller than one. In this case, the shares of labor and intermediate inputs in revenues overestimate the share of variable labor and variable intermediate inputs in revenues. This leads to a positive term which we multiply by $(\Delta k - \Delta l)$ and $(\Delta k - \Delta m)$ in respectively the second and third component. Considering the second component, assume for example that $sv^l = 0$, $\Delta k > \Delta l$ and $\Delta l > 0$. This implies that SRQ^R underestimates the true efficiency improvement $\Delta\theta$. It assumes that part of Δq is due to Δl^v, but l^v is zero.

The bias in the fourth, fifth and sixth component appears as soon as fixed inputs grow at a different rate than the total input. Looking at the fifth component, assume for example that $0 < sv^l < 1$, $\Delta l^v > 0$, $\Delta l^f = 0$, such that $\Delta l^v > \Delta l$. This implies that the growth rate of labor underestimates the true increase of variable labor and therefore attributes part of Δq to an increase in efficiency. In the extreme case that all inputs are fixed (e.g. $sv^l = 0$), this bias disappears again.

Similar to the approach adopted by Roeger (1995), we consider alternative representations of the Solow residual to eliminate the unobservable components. First we consider the dual Solow residual to eliminate the growth rate of productivity in equation (7). Logarithmic differentiation of marginal cost and Shepard's lemma gives:

$$\Delta p = \frac{P}{MC}\left(\frac{sv^k RK}{PQ}\Delta r + \frac{sv^l WL}{PQ}\Delta w + \frac{sv^m P^M M}{PQ}\Delta p^M\right) - \Delta\theta \qquad (8)$$

Substituting equation (8) into the dual Solow residual, defined by equation (9), we obtain equation (10).

$$SRP^R \equiv \frac{WL}{PQ}\Delta w + \frac{P^M M}{PQ}\Delta p^M + \left(1 - \frac{WL}{PQ} - \frac{P^M M}{PQ}\right)\Delta r - \Delta p \qquad (9)$$

$$SRP^R = -B(\Delta p - \Delta r) + \frac{(1-\mathrm{sv^l})WL}{PQ}(\Delta w - \Delta r) + \frac{(1-\mathrm{sv^m})P^M M}{PQ}(\Delta p^M - \Delta r) + (1 - B)\Delta\theta \qquad (10)$$

As with the primal Solow residual, the total revenue shares of labour and materials overstate the revenue shares of variable labour and variable materials. By subtracting equation (10) from (7), we can eliminate the unobservable component $(1 - B)\Delta\theta$.

$$SRQ^R - SRP^R = B[(\Delta p + \Delta q) - (\Delta k + \Delta r)] + \frac{(1-\mathrm{sv^l})WL}{PQ}(\Delta k + \Delta r) + \frac{(1-\mathrm{sv^m})P^M M}{PQ}(\Delta k + \Delta r) + \frac{(\mathrm{sv^l}-1)WL}{PQ}(\Delta w + \Delta l) + \frac{(\mathrm{sv^m}-1)P^M M}{PQ}(\Delta p^M + \Delta m) + \frac{\mathrm{sv^k RK}}{\mathrm{PQ}}(\Delta \mathrm{k^v} - \Delta \mathrm{k}) + \frac{\mathrm{sv^l WL}}{\mathrm{PQ}}(\Delta \mathrm{l^v} - \Delta \mathrm{l}) + \frac{\mathrm{sv^m} P^M M}{\mathrm{PQ}}(\Delta m^v - \Delta \mathrm{m}) \qquad (11)$$

Equation (11) shows that the difference of the primal Solow residual and the price-based dual Solow residual can be explained by capital (labor; intermediates) fixity and imperfect competition.[13] In contrast to equation (3), seven additional terms appear in equation (11) which make the prediction of the direction of the estimation bias of Roeger’s (1995) approach impossible. The omission of the second, third and fourth component leads to a downward bias. The omission of the fifth, sixth and seventh component leads to an upward bias. Hence, equation (11) cannot be used to estimate B. The average share of fixed capital $sf^k \equiv 1 - sv^k$, the average share of fixed labor input $sf^l \equiv 1 - sv^l$ and the average share of fixed intermediate inputs $sf^m \equiv 1 - sv^m$ and the growth rates of variable inputs Δk^v, Δl^v and Δm^v are unobservable in the firm level data. The components Δk^v, Δl^v and Δm^v are likely to be positively correlated with the growth rate of output, which may lead to an upward bias in the estimate of the price-cost margins using equation (11). In the next section we show that the unobservable terms, containing variations in variable factor inputs also appear in Solow residuals with cost based shares. This opens the possibility of eliminating these unobservables by appropriately combining revenue and cost based Solow residuals.[14]

2.2.2 Primal and Dual Solow Residuals with Cost-based Shares

Hall (1990) proposes a cost-weighted measure as a way of avoiding the bias caused by imperfect competition. However, in the presence of fixed inputs, the cost-weighted Solow residual captures not

[13] Shapiro (1987) focuses on the capital fixity to explain why the primal Solow residual might be poorly correlated to the dual Solow residual. Roeger (1995) stresses imperfect competition in explaining the difference between the primal Solow residual and dual Solow residual. Konings, Roeger and Zhao (2011) consider fixed capital and fixed labor to explain the difference between the primal and dual Solow residual.

[14] Roeger and Warzynski (2004) derive a similar estimation equation. However, they assume that the unobservable growth rate of variable capital in equation (11) can be proxied by the growth rate in labor productivity. Further, they do not allow for quasi-fixed labor nor for quasi-fixed intermediate inputs.

only productivity growth but also the fixity of inputs. In this section, we derive cost-weighted primal and dual Solow residuals allowing for the presence of fixed inputs.

Similarly, the growth rate of output can be written as a cost-weighted average of the growth rate of variable inputs plus the growth rate of productivity. Using $MC * Q = C^v$, equation (5) can be rewritten with weights equal to the respective share of the variable factor in total variable cost.

$$\Delta q = \frac{sv^k RK}{C^v}\Delta k^v + \frac{sv^l WL}{C^v}\Delta l^v + \frac{sv^m P^M M}{C^v}\Delta m^v + \Delta\theta \qquad (12)$$

The primal Solow residual with cost-based shares SRQ^C is defined as follows:

$$SRQ^C \equiv \Delta q - \frac{WL}{C}\Delta l - \frac{P^M M}{C}\Delta m - \frac{RK}{C}\Delta k \qquad (13)$$

Substituting equation (12) into (13), we have

$$SRQ^C = \left(1 - sv^k\right)\frac{RK}{C}(\Delta q - \Delta k) + \left(1 - sv^l\right)\frac{WL}{C}(\Delta q - \Delta l) + (1 - sv^m)\frac{P^M M}{C}(\Delta q - \Delta m) + sv^k\frac{RK}{C}(\Delta k^v - \Delta k) + sv^l\frac{WL}{C}(\Delta l^v - \Delta l) + sv^m\frac{P^M M}{C}(\Delta m^v - \Delta m) + \frac{C^v}{C}\Delta\theta \qquad (14)$$

While SRQ^C is a correct measure of $\Delta\theta$ irrespective of the level of the price-cost margin, it is nevertheless sensitive to the presence of fixed factors of production. In the presence of fixed factors, SRQ^C underestimates $\Delta\theta$ by the factor $\frac{C^v}{C}$ and is otherwise subject to the same types of bias as SRQ^R.

The dual cost minimization problem implies that the growth rate of price can be written as a cost-weighted average of the growth rate of inputs' prices minus the growth rate of productivity.

$$\Delta p = \frac{sv^k RK}{C^v}\Delta r + \frac{sv^l WL}{C^v}\Delta w + \frac{sv^m P^M M}{C^v}\Delta p^M - \Delta\theta \qquad (15)$$

The dual Solow residual with cost-based shares is then

$$SRP^C \equiv \frac{RK}{C}\Delta r + \frac{WL}{C}\Delta w + \frac{P^M M}{C}\Delta p^M - \Delta p = -\left(1 - sv^k\right)\frac{RK}{C}(\Delta p - \Delta r) - (1 - sv^l)\frac{WL}{C}(\Delta p - \Delta w) - (1 - sv^m)\frac{P^M M}{C}(\Delta p - \Delta p^M) + \frac{C^v}{C}\Delta\theta \qquad (16)$$

By subtracting (16) from equation (14), the growth rate of productivity $\frac{C^v}{C}\Delta\theta$ is eliminated. The difference of the primal and dual Solow residual with cost-based shares is,

$$SRQ^C - SRP^C = \left(1 - sv^k\right)\frac{RK}{C}[(\Delta p + \Delta q) - (\Delta k + \Delta r)] + \left(1 - sv^l\right)\frac{WL}{C}[(\Delta p + \Delta q) - (\Delta w + \Delta l)] + (1 - sv^m)\frac{P^M M}{C}[(\Delta p + \Delta q) - (\Delta m + \Delta p^M)] + \frac{sv^k RK}{C}(\Delta k^v - \Delta k) + \frac{sv^l WL}{C}(\Delta l^v - \Delta l) + \frac{sv^m P^M M}{C}(\Delta m^v - \Delta m) \qquad (17)$$

2.3.3 Difference-in-differences Approach

We find that in equation (11) and (17) the unobservable parts are similar except for the denominator. Multiplying both sides of equation (11) by firm-specific PQ and multiplying both sides of equation (17) by firm-specific C gives:

$$(SRQ^R - SRP^R)PQ = B \cdot PQ[(\Delta p + \Delta q) - (\Delta k + \Delta r)] + \left(1 - \mathrm{sv}^{\mathrm{l}}\right)WL(\Delta k + \Delta r) + \left(\mathrm{sv}^{\mathrm{l}} - 1\right)WL(\Delta w + \Delta l) + (1 - \mathrm{sv}^{\mathrm{m}})P^M M(\Delta k + \Delta r) + (\mathrm{sv}^m - 1)P^M M(\Delta p^M + \Delta m) + \mathrm{sv}^k RK(\Delta k^v - \Delta k) + \mathrm{sv}^l WL(\Delta l^v - \Delta l) + \mathrm{sv}^m P^M M(\Delta m^v - \Delta m) \qquad (18)$$

$$(SRQ^C - SRP^C)C = \left(1 - \mathrm{sv}^k\right)RK[(\Delta p + \Delta q) - (\Delta k + \Delta r)] + \left(1 - \mathrm{sv}^{\mathrm{l}}\right)WL[(\Delta p + \Delta q) - (\Delta w + \Delta l)] + (1 - \mathrm{sv}^m)P^M M[(\Delta p + \Delta q) - (\Delta m + \Delta p^M)] + \mathrm{sv}^k RK(\Delta k^v - \Delta k) + \mathrm{sv}^l WL(\Delta l^v - \Delta l) + \mathrm{sv}^m P^M M(\Delta m^v - \Delta m) \qquad (19)$$

We allow for firm-specific heterogeneity and assume that B_i, sf_i^k, sf_i^l and sf_i^m are i.i.d. with unconditional mean $B, sf^k, sf^l\ and\ sf^m$ and stochastic terms $\epsilon_i^B, \epsilon_i^k, \epsilon_i^l, \epsilon_i^m$ with a mean of zero and variance $\sigma_i^B, \sigma_i^k, \sigma_i^l, \sigma_i^m$ respectively, in each year t. There may also be a measurement error ϵ_{it}. We regard firm-specific heterogeneity as the main source of the error term.

By subtracting equation (18) from equation (19), the unobserved parts $\mathrm{sv}^k RK(\Delta k^v - \Delta k)$, $\mathrm{sv}^l WL(\Delta l^v - \Delta l)$ and $\mathrm{sv}^m P^M M(\Delta m^v - \Delta m)$ cancel out. This yields the static correlated random coefficient model,

$$\left(SRQ_{it}^C - SRP_{it}^C\right)C_{it} - \left(SRQ_{it}^R - SRP_{it}^R\right)PQ_{it} = -(B_t + \epsilon_{it}^B)PQ_{it}[(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}] + (sf_t^k + \epsilon_{it}^k)RK_{it}[(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}] + (sf_t^l + \epsilon_{it}^l)WL_{it}[(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}] + (sf_t^m + \epsilon_{it}^m)P^M M_{it}[(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}] + \epsilon_{it} \qquad (20).$$

All variables in equation (20) are observable except for B, sf^k, sf^l and sf^m, so equation (20) can be estimated with firm level data to obtain the estimates of the price-cost margin B, the share of fixed capital sf^k, the share of fixed labor input sf^l and the share of fixed intermediate input sf^m. Since the left-hand side of equation (20) is the difference of the difference of the primal and dual Solow residual with cost-based shares and the difference of the primal and dual Solow residual with revenue-based shares, we call it a "difference-in-differences" (DID) approach.

As shown by Hsiao et al. (2019) the unconditional mean of the price-cost margin and the shares of fixed costs can be estimated consistently with a fixed effects estimator, even if the error terms are correlated with the regressors, provided regressors and error terms are distributed symmetrically.

Notice that the right hand sides of equation (18) and (19) have some common components capturing fixed inputs, which implies a positive correlation between $(SRQ^R - SRP^R)PQ$ and $(SRQ^C - SRP^C)C$.[15] If a firm's price-cost margin can exactly cover fixed cost, i.e., $B \cdot PQ = sf^K RK + sf^L WL + sf^m P^M M$, the right hand side of equation (20) is equal to 0 and thus $(SRQ^C - SRP^C)C = (SRQ^R - SRP^R)PQ$. In particular, the correlation between the difference of the primal and dual Solow residuals with revenue-based shares and that of the primal and dual Solow residuals with cost-based shares is stronger if price-cost margins go in the same direction as fixed costs.

The advantages of our approach are: (i) it solves the endogeneity problem between productivity shocks and growth in output or input factors, (ii) we do not need to rely on price deflators, which solves the problem of unobserved price heterogeneity, particularly for multiple-product firms, (iii) we obtain an estimate of the unobserved shares of fixed input factors as well as an estimate of the price-cost margin in the presence of fixed costs.

One potential problem, however, might be measurement error in input factors. Since our model is estimated in first differences, it may exacerbate measurement errors, which leads to a downward bias of the estimates as suggested by Griliches and Hausman (1986) and Griliches and Mairesse (1995). However, this conclusion rests on the classical errors in variables in models under strict exogeneity. So whether the bias in first differences is larger than that in OLS, or vice versa, is unknown (Wooldridge, 2002).

Furthermore, all variables are measured in nominal variables, rather than input or output quantities, which limits the scope of mismeasurement. Nevertheless, the nominal cost of capital is not observed. Given that it is challenging to estimate this variable, we will provide various robustness tests at the end of the paper (section 5.5) and show that our results are robust to alternative definitions of the cost of capital. Another concern might be a specification error. Following Roeger (1995), we allow the price-cost margin *B* and the various shares of fixed factor inputs sf^l, sf^k and sf^m to vary systematically with firm size. We provide a discussion about these concerns in the robustness section (5.6).

2.3.4 Price-cost margins = Fixed costs ratio + Excess profits ratio

Price-cost margins can be decomposed into two components: the fixed costs ratio and the excess profits ratio. The former is needed to cover fixed costs whereas the latter represents the remaining profitability.[16] In absence of fixed costs, price-cost margins $\hat{B}$ are equal to firms' profitability. However, the existence of fixed costs introduces a wedge. We calculate the fixed costs ratio as $\widehat{FCR} \equiv$

[15] In the absence of fixed costs, the primal and dual cost-based Solow residual are equal.

[16] The excess profits ratio might be negative for some firms. This might happen if a firm generates a price-cost margin which is not large enough to cover its fixed costs.

$(\widehat{sf}^k RK + \widehat{sf}^l WL + \widehat{sf}^m P^M M) \;/\; PQ$. The difference between the price-cost margins and the fixed costs ratio leads to the excess profits ratio $\widehat{EPR}$. This decomposition looks as follows:

$$\hat{B} = \widehat{FCR} + \widehat{EPR}. \tag{21}$$

Equation (21) shows that price-cost margins are no longer equal to profitability in the presence of fixed costs. Firms generate a margin to cover their fixed costs and to obtain excess profits. The evolution of price-cost margins depends on the combination of the evolution of the fixed costs ratio and the excess profits ratio. These components might reinforce, or offset each other.

3 Data

We illustrate our method by applying it to Belgian unconsolidated firm level data, obtained from the National Bank of Belgium.[17] This dataset covers all for-profit firms from 1985 until 2014. We use the following balance sheet variables in our analysis: operating revenue[18], wage costs, intermediate input costs, tangible fixed assets and depreciation. In order to compute the cost of capital, we extend the definition used by Hall and Jorgenson (1967). We refer to the data appendix in section 7 for more detailed information about the data.

Table 1 Summary Statistics

Variable	Mean	SD	P25	P50	P75	N
PQ	34.05	282.16	2.90	7.67	18.79	358,143
WL	4.44	29.81	0.39	1.07	2.59	358,143
$P^M M$	26.63	258.09	1.57	5.19	13.96	358,143
TFA	6.92	81.84	0.11	0.57	2.05	358,143
Depreciation	1.30	13.86	0.04	0.16	0.53	253,451
ΔPQ	7.1%	24.4%	-2.5%	4.7%	13.9%	316,232
ΔWL	4.8%	21.8%	2.0%	3.7%	10.1%	316,232
$\Delta P^M M$	7.3%	26.3%	-3.1%	5.0%	15.5%	316,232
ΔTFA	1.7%	34.2%	-11.4%	-1.5%	1.04%	316,232
LS	0.126	0.137	0.022	0.085	0.170	358,143
MS	0.779	0.199	0.687	0.838	0.940	358,143
CS	0.096	0.119	0.029	0.052	0.115	358,143

Notes: : *The mean, standard deviation, P25, P50 and P75 are shown in nominal million EUR for operating revenue, wage costs, intermediate input costs, tangible fixed assets and depreciation. The number of observations are shown in units. The summary statistics for the growth rates and the input shares have been weighted by firm-year operating revenue. The labor (intermediates) share is calculated as total labor (intermediate input) cost divided by operating revenue.*

[17] We provide a robustness test in which we exploit a proxy for consolidated accounts in section 5.7.

[18] Operating revenue captures the value of output produced in one period. We link this to the value of inputs used in the same period. On the other hand, sales capture the value of output sold and is not directly linked to the value of inputs. Taken to the extreme, a firm which does not produce anything (and thus uses no inputs) might still be able to sell some of its inventory. In this case, the operating revenue will be zero whereas sales will be positive. Note that we use operating revenue rather than revenue.

Table 1 provides summary statistics. A Belgian firm generates on average an operating revenue of 34.05 million EUR. It pays 4.44 million EUR in wage costs and 26.63 million EUR in intermediate input costs. Belgian firms increase their nominal operating revenue on average by 7.1% while they face a 4.8% increase for their labor costs and a 7.3% for their intermediate input costs.[19] Tangible fixed assets increase by 1.7%. Further, we observe that the intermediate input share (77.9%) is the most dominant input factor, followed by the labor share (12.6%) and the capital share (9.6%).

4 Results

We start our analysis with the estimation of price-cost margins in the absence of fixed factors of production, after which we relax this assumption and allow each input factor to have a variable and a fixed component. We compare these estimation results, and show that ignoring fixed input factors overestimates the excess profits ratio while it underestimates price-cost margins. Finally, we look at heterogeneity over time and across sectors.

4.1 Price-cost margins in the absence of fixed factors

Following Roeger (1995), we use equation (3) in order to estimate price-cost margins. We assume that capital, labor and intermediate inputs are fully flexible and adjust immediately to their equilibrium values without any adjustment costs. We add the corresponding subscripts and use,

$$SRQ_{it}^{R} - SRP_{it}^{R} = B[(\Delta q + \Delta p)_{it} - (\Delta k + \Delta r)_{it}] + FE + \varepsilon_{it}, \tag{22}$$

which regresses the difference of the primal and dual, revenue-based, Solow residual on the difference of the growth rate of operating revenue and the growth rate of the cost of capital. The variable ε_{it} captures the error term at the firm-year level. We weigh our regression by firm-year operating revenue to obtain a weighted aggregate price-cost margin for Belgium. We include a broad set of fixed effects: year, industry[20] and year-industry fixed effects. Table 2 summarizes the estimation results. Going from column (1) to column (6), we expand our set of fixed effects.

All specifications in Table 2 show that price-cost margins are statistically significant and larger than zero, hence, imperfect competition is clearly present in the output market. Firms are able to charge a price above their marginal cost. According to column (6), Belgian price-cost margins equal 8.0%.[21] Converting this into a markup gives a value of 1.087.

[19] We calculate the growth rate in year t as the increase (decrease) between year t-1 and year t relative to the average of the values in year t-1 and year t. This ensures that growth rates are part of the interval [-2.00, 2.00].
[20] An industry is defined as a NACE (rev. 2) two digits category.
[21] Konings, Roeger and Zhao (2011) find an unweighted Belgian price-cost margin of 9.0% for Belgian firms in manufacturing and services between 1999 and 2008.

Table 2 Price-cost margins

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Price-cost Margins	0.079***	0.079***	0.080***	0.079***	0.080***	0.080***	0.259***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)	(0.016)
Share of Fixed Capital							0.679***
							(0.036)
Share of Fixed Labor							0.169***
							(0.028)
Share of Fixed Intermediates							0.236***
							(0.017)
Year FE	No	Yes	No	Yes	No	Yes	Yes
Industry FE	No	No	Yes	Yes	No	Yes	Yes
Year-Industry FE	No	No	No	No	Yes	Yes	Yes
N	280,252	280,252	280,252	280,252	280,252	280,252	280,252
r2	0.272	0.276	0.274	0.278	0.349	0.349	0.510

Notes: *Columns (1)-(6) show results from equation (23). Column (7) shows results from equation (23). Regressions are weighted by operating revenue at the firm-year level. Standard errors in parentheses (+ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001) . Standard errors are clustered by NACE 2 digits.*

4.2 Price-cost margins in the presence of fixed factors

We extend our framework and allow each input factor to have a variable and a fixed part. This enables us to jointly estimate price-cost margins and the share of fixity for each input. We start from equation (20), add fixed effects and use:

$$\begin{aligned}
&\left(SRQ_{it}^{C} - SRP_{it}^{C}\right) * C_{it} - \left(SRQ_{it}^{R} - SRP_{it}^{R}\right) * PQ_{it} \\
&= -B * PQ_{it} * \ [(\Delta q + \Delta p)_{it} - (\Delta k + \Delta r)_{it}] \\
&+ sf^{k} * RK_{it} * [(\Delta q + \Delta p)_{it} - (\Delta k + \Delta r)_{it})] \\
&+ sf^{l} * WL_{it} * [(\Delta q + \Delta p)_{it} - (\Delta k + \Delta r)_{it}] \\
&+ sf^{m} * P^{M} M_{it} * \ [(\Delta q + \Delta p)_{it} - (\Delta k + \Delta r)_{it}] \\
&\qquad\qquad + FE + \varepsilon_{it} \ .
\end{aligned} \tag{23}$$

Column (7) in Table 2 shows the results and reveals two interesting features. First, if there would be truly no fixed costs, then we would estimate three insignificant coefficients for the shares of fixed inputs. In that case, equation (23) would collapse to equation (22). However, the estimated shares of fixed input factors show that this is clearly not the case as they are all highly significant. The highest share of fixed costs is found for capital (67.9%), followed by intermediate inputs (23.6%) and labor (16.9%).[22] Second, price-cost margins exhibit a large increase, as they go from 8.0% to 25.9%, once we account for the existence of fixed inputs.

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[22] This does not mean that fixed capital will also be the largest component in terms of absolute fixed costs. In particular, the intermediate input share is 8.1 time as large as the capital share but the estimated share of fixed capital is 'only' 2.9 times as large as the estimated share of fixed intermediate inputs. Ignoring the presence of fixed intermediate inputs in the estimation of price-cost margins might induce a substantial bias.

Table 3 Decomposition of price-cost margins

Panel A	*Without Fixed Costs*	
(1)	Price-cost Margins	.080*** (0.012)
(2)	Fixed Costs Ratio	-
(3)	Excess Profits Ratio	.080*** (0.012)
Panel B	*With Fixed Costs*	
(4)	Price-cost Margins	.259*** (0.016)
(5) = |(7)| + |(8)|	Fixed Costs Ratio	.234*** (0.016)
(6)	Excess Profits Ratio	.025*** (0.002)
(7) = (1) – (4)	**Bias: PCM**	-.179*** (0.020)
(8) = (3) – (6)	**Bias: EPR**	.055*** (0.012)

Notes: *Panel A and B show respectively results without and with fixed costs. All components are weighted by operating revenue at the firm-year level. Standard errors in parentheses (+ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001). Standard errors are clustered by NACE 2 digits.*

As long as inputs are fully variable, price-cost margins are equal to the excess profits ratio because there are no fixed costs to cover. However, the introduction of fixed input factors leads to a decomposition of price-cost margins into two components: one part is needed to cover fixed costs while the remaining part represents firms' profitability. Table 3 shows this decomposition. Considering first the scenario without fixed costs in panel A, we find that a price-cost margin of 8.0% maps one-to-one into an excess profits ratio of 8.0% due to the fact that the fixed costs ratio equals 0.0%. Panel B shows the estimation results once we allow for fixed costs. Price-cost margins rise to a value of 25.9% but this does not mean that firms generate the same level for the excess profits ratio. Instead, the largest part (23.4%) is needed to cover fixed costs as a percentage of operating revenue while only a smaller part remains left as excess profits ratio (2.5%).[23, 24]

A comparison of panels A and B permits to calculate two types of bias. Row (7) defines the price-cost margins bias as the difference between the two price-cost margins with and without fixed costs. Row (8) the excess profits ratio bias as the difference between the two values of the excess profit ratios. Ignoring fixed inputs underestimates price-cost margins by 17.9% while overestimating the excess profits ratio by 5.5%. The sum of the two types of bias, 23.4%, is equal to the fixed costs ratio.

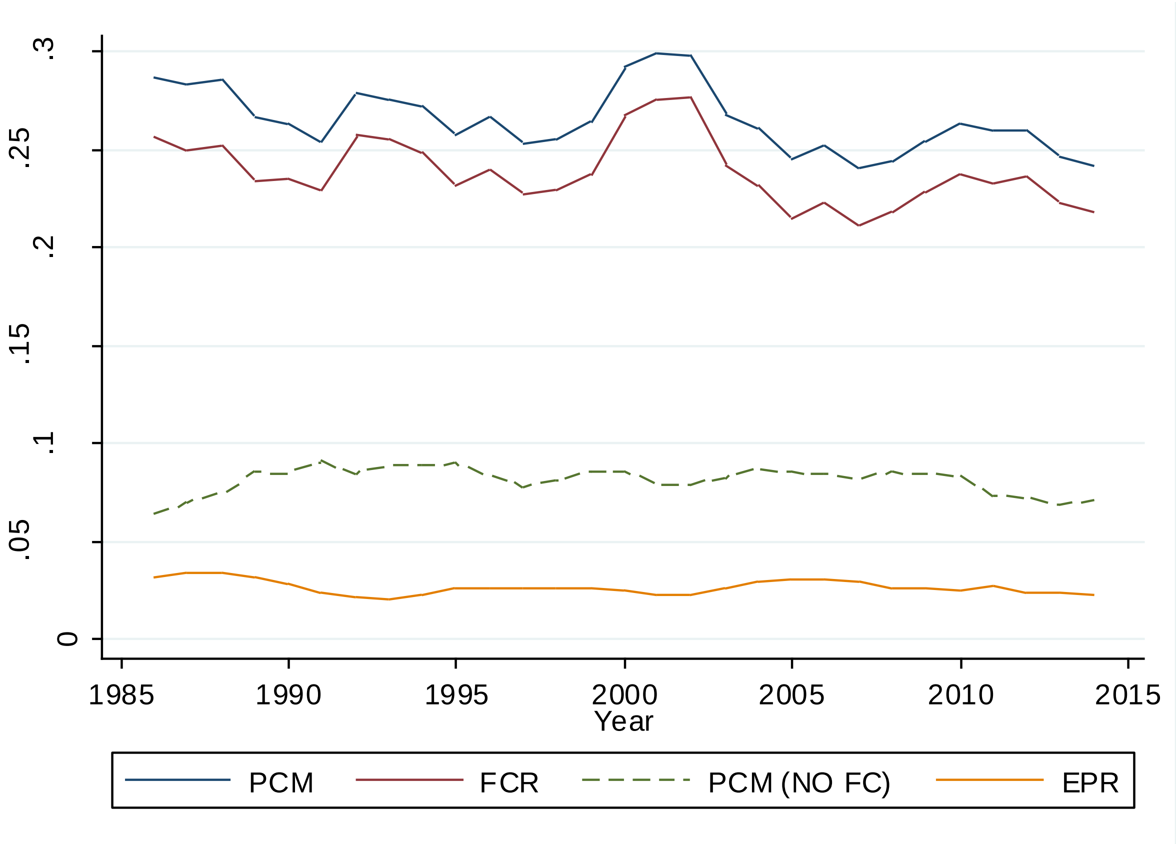
[23] Note that total costs do not increase once we account for fixed costs. Rather, we are able to estimate which share of total costs is variable and which share is fixed. We exploit information on the mix of variable and fixed costs of each input to estimate price-cost margins.

[24] Traina (2018) defines the share of fixed costs in total costs as SG&A / (SG&A + COGS). Considering U.S. firms in 2016, it approximately equals 22%.

4.3 Evolution of price-cost margins in the presence of fixed factors

We have assumed that price-cost margins and the shares of fixed input factors remain constant over time. This may well be an unrealistic assumption. Firms are likely to vary their price-cost margins as well as their mix of variable and fixed input factors in response to changing economic circumstances. In this section, we allow price-cost margins and the shares of fixed input factors to vary over time by estimating equation (23) on a yearly basis for the period 1985-2014.

Figure 1 Evolution of price-cost margins



Notes: *This figure shows the evolution of price-cost margins (equation 22), and the evolution of the price-cost margins, fixed cost ratio and the excess profits ratio (equation 23) at the yearly level. The evolution of variables has been smoothed. Each observation is the simple average of its current observations and one observation before and after its current observation.*

Figure 1 shows the evolution of Belgian price-cost margins, the fixed costs ratio and the excess profits ratio in the presence of fixed costs.[25] As a comparison, we add the evolution of price-cost margins in the absence of fixed costs. Note that we lose the year 1985 due to the fact that we use growth rates in our regressions.[26]

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[25] (Appendix) Table 10 displays the corresponding actual values for the price-cost margin, fixed-cost ratio and excess profits ratio. Figures display smoothed values. We also include standard errors and significance stars. Note that figures and numbers in the text refer to smoothed values.

[26] We omit confidence intervals in the figures in order to simplify it. All yearly coefficients are always significant in Figure 1.

It reveals various interesting patterns. Overall, the Belgian price-cost margin displays a moderately decreasing trend and goes from 28.7% in 1986 to 24.1% in 2014.[27] This evolution seems to be driven by the fixed costs ratio which drops from 25.6% in 1986 to 21.9% in 2014. Both components experience quite some fluctuations from year to year.[28] Further, the excess profits ratio has been rather stable, especially during the past two decades. It falls from 3.1% in 1986 to 2.0% in 1993 after which it increases again until 3.0% in 2006. From 2007 onwards, the Belgian economy is hit by respectively the financial and European debt crisis such that the excess profits ratio falls again to a value of 2.2% in 2014.

Turning to price-cost margins in the absence of fixed costs, we find that they increase and decrease moderately at respectively the beginning and the end of the sample period while they barely move between 1990 and 2009. This pattern differs clearly from the evolution of the price-cost margins in the presence of fixed costs and the excess profits ratio.

4.4 Sectoral results: Industry, Trade & Services

Aggregate price-cost margins might hide heterogeneity at a lower level. We look at the sectoral level and consider three broad sectors: Industry, Trade and Services. The sectors consists respectively of NACE rev. 2 categories 10/33, 45/47 and 49/82. This section follows the same structure as before: we start from the assumption that all inputs are fully variable after which we introduce fixed costs. Finally, we look at the evolution of the sectoral price-cost margins over time.

Table 4 shows the Belgian result in column (1) and the sectoral results in columns (2) until (4). This shows sizable heterogeneity among sectors. For example, price-cost margins in Services (12.6%) and Industry (9.1%) are above the Belgian price-cost margins (8.0%) while price-cost margins in Trade (5.1%) are below this value. Moreover, price-cost margins in Services are two and a half times as large as price-cost margins in Trade.

We extend our estimation framework again by allowing for variable and fixed input factors in the production process, and show these results in columns (5) until (8) in Table 4. This reveals two interesting findings. First, price-cost margins increase, probably because firms need part of it to cover their fixed costs. Second, the order of the price-cost margins changes once we include fixed costs. For example, Industry rather than Services has the largest price-cost margins once we account for fixed

[27] De Loecker, Fuss and Van Biesebroeck (2018) also find that Belgian price-cost margins are falling in recent decades.

[28] Moreover, part of the variation in the price-cost margin and the fixed costs ratio seems to be linked to the business cycle. The price-cost margins and the fixed costs ratio reach a peak around the early '90s, the early '00s and the end of the '00s, which corresponds to years with an economic slowdown or recession in Belgium.

costs. The ranking reversal is mainly due to the fact that the estimated shares of fixed input factors are higher for each input in Industry compared to Services. Firms charge a higher margin as they have to cover more fixed costs.

Table 4 Price-cost margins: Sectoral level

	(1)	(2) Industry	(3) Trade	(4) Services	(5)	(6) Industry	(7) Trade	(8) Services
Price-cost Margins	0.080***	0.091***	0.051**	0.126***	0.259***	0.339***	0.246**	0.237***
	(0.012)	(0.008)	(0.003)	(0.010)	(0.016)	(0.029)	(0.022)	(0.025)
Share of Fixed					0.679***	0.713***	0.988**	0.699***
Capital					(0.036)	(0.045)	(0.047)	(0.069)
Share of Fixed					0.169***	0.264***	0.185*	0.104*
Labor					(0.028)	(0.044)	(0.041)	(0.046)
Share of Fixed					0.236***	0.317***	0.219*	0.234***
Intermediates					(0.017)	(0.031)	(0.022)	(0.025)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	280,252	68,703	101,709	85,671	280,252	68,703	101,709	85,671
r2	0.349	0.370	0.338	0.393	0.510	0.505	0.646	0.465

Notes: *This table shows the results from equation (22) at the sectoral level. Regressions are weighted by operating revenue at the firm-year level. Standard errors in parentheses (+ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001). Standard errors are clustered by NACE 2 digits. Industry, Trade and Services consist respectively of NACE categories 10/33, 45/47 and 49/82.*

Further, we use the estimated shares of fixed input factors in order to calculate the fixed costs ratio. We subtract the fixed costs ratio from the price-cost margin and obtain the excess profits ratio. Table 5 shows this decomposition. In Panel B, we observe that sectors with the highest price-cost margins also have the highest fixed costs ratio but not necessarily the highest excess profits ratio. This suggests that most of the price-cost margin goes to covering fixed costs. Looking at the excess profits ratio, we find that Trade (2.8%) and Industry (2.7%) have the highest profitability whereas Services (1.3%) has the lowest profitability.

Rows (7) and (8) respectively show the price-cost margins bias and the excess profits ratio bias. This confirms that ignoring fixed input factors underestimates price-cost margins while overestimating the excess profits ratio at the sectoral level. The price-cost margins bias is largest in Industry (-24.8%), followed by Trade (-19.5%) and then Services (-11.1%). On the other hand, the excess profits ratio bias is largest in Services (11.3%), followed by Industry (6.4%) and Trade (2.3%). The sum of the price-cost margins bias and the excess profits ratio bias is equal to the fixed costs ratio, as shown in row (5).

Next, we explore the time dimension of the sectoral price-cost margins. Figure 2 shows the evolution of aggregate and sectoral price-cost margins, and its two components, as well as the evolution of price-cost margins in the absence of fixed inputs. Due to the scale of the y-axis, it is challenging to recognize any trend in the excess profits ratio. Therefore, we adjust the scale of the y-axis and plot the evolutions again in Figure 3.[29] We show the evolution of the share of fixed capital, the share of fixed labor and the share of fixed intermediate inputs at the sectoral level in (appendix) Figure 15.

Table 5 Decomposition of price-cost margins: Sectoral level

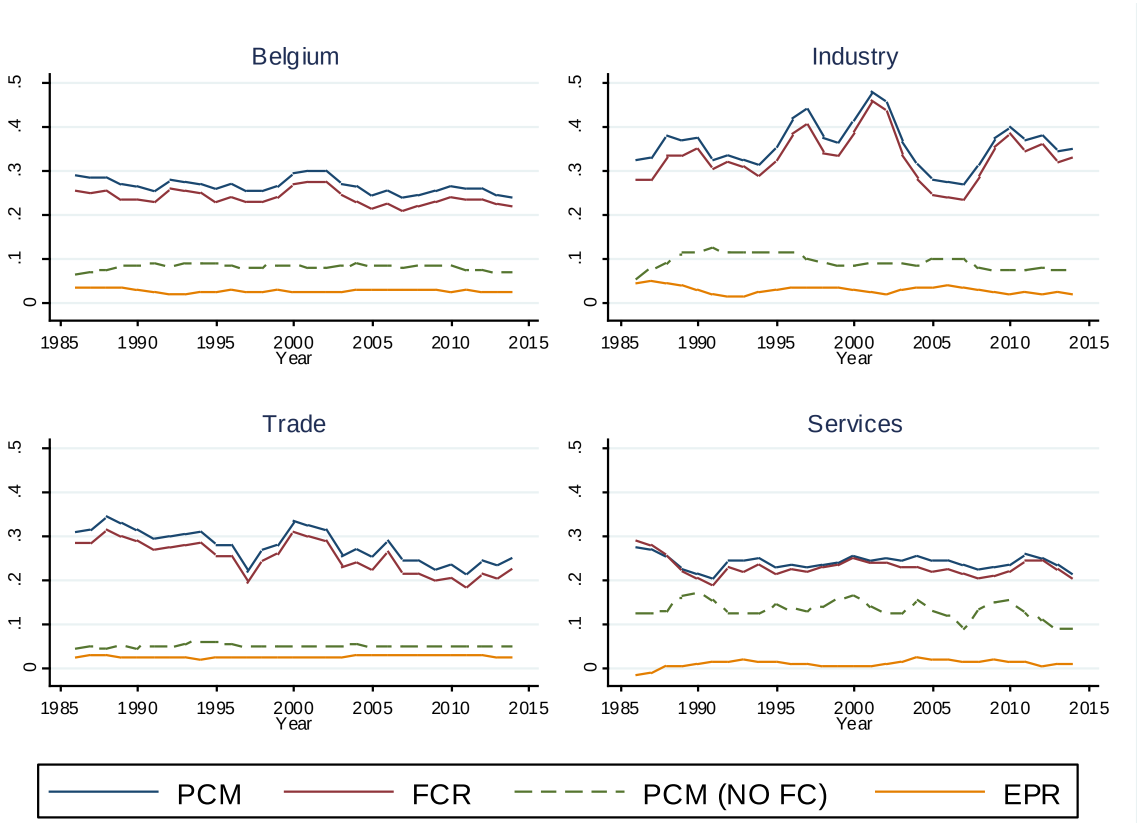
		(1)	(2) Industry	(3) Trade	(4) Services
Panel A	*Without Fixed Costs*				
(1)	Price-cost Margins	.080*** (0.012)	.091*** (0.008)	.051** (0.003)	.126*** (0.010)
(2)	Fixed Costs Ratio	-	-	-	-
(3)	Excess Profits Ratio	.080*** (0.012)	.091*** (0.008)	.051*** (0.003)	.126*** (0.010)
Panel B	*With Fixed Costs*				
(4)	Price-cost Margins	.259*** (0.016)	.339*** (0.029)	.246** (0.022)	.237*** (0.025)
(5) = |(7)| + |(8)|	Fixed Costs Ratio	.234*** (0.016)	.311*** (0.029)	.218*** (0.023)	.224*** (0.027)
(6)	Excess Profits Ratio	.025*** (0.002)	.027*** (0.002)	.028*** (0.001)	.013^{+} (0.007)
(7) = (1) – (4)	**Bias PCM**	-.179*** (0.020)	-.248*** (0.030)	-.195*** (0.022)	-.111*** (0.027)
(8) = (3) – (6)	**Bias EPR**	.052*** (0.012)	.064*** (0.008)	.023** (0.003)	.113** (0.012)

Notes *This table repeats the price-cost margins from Table 3. All components are weighted by operating revenue at the firm-year level. Industry, Trade and Services consist respectively of NACE categories 10/33, 45/47 and 49/82. Standard errors in parentheses ($^{+}$ p <0.10, * p < 0.05, ** p < 0.01, *** p < 0.001). Standard errors are clustered by NACE 2 digits.*

Looking first at the Belgian Industry, we find that price-cost margins and the fixed costs ratio increase over time. Price-cost margins increase from 32.5% in 1986 to 34.8% in 2014 while the fixed costs ratio rises from 28.1% to 32.8% in the same period. The rise is not always gradual, but experiences quite some fluctuation. For example, the price-cost margin and fixed costs ratio reach peak values around the early '00s whereas it reaches their minimum values on the eve of the Financial crisis. The secular increase, especially until the early '00s, suggests that firms' market power has substantially increased in Industry. However, the increasing fixed costs ratio dominates the rising price-cost margins such that the excess profits ratio has declined from 4.4% in 1986 to 2.0% in 2014. Firms are thus charging a higher price-cost margin. In the absence of fixed costs, this would also imply a higher profitability, but it turns out that an even larger part of the price-cost margin is needed to cover fixed costs over time. This might be due to a change in the production process (i.e., more fixed costs and less variable costs). In the end, firms in Industry are not capturing a higher excess profits ratio in Industry but a lower one, which might be linked to the declining share of Industry in GDP.

[29] (Appendix) Table 11, 12 and 13 display the corresponding actual (not smoothed) values for the price-cost margin, fixed-cost ratio and excess profits ratio for respectively Industry, Trade and Services. We also include standard errors and significance stars.

Figure 2 Evolution of price-cost margins (FC): Sectors

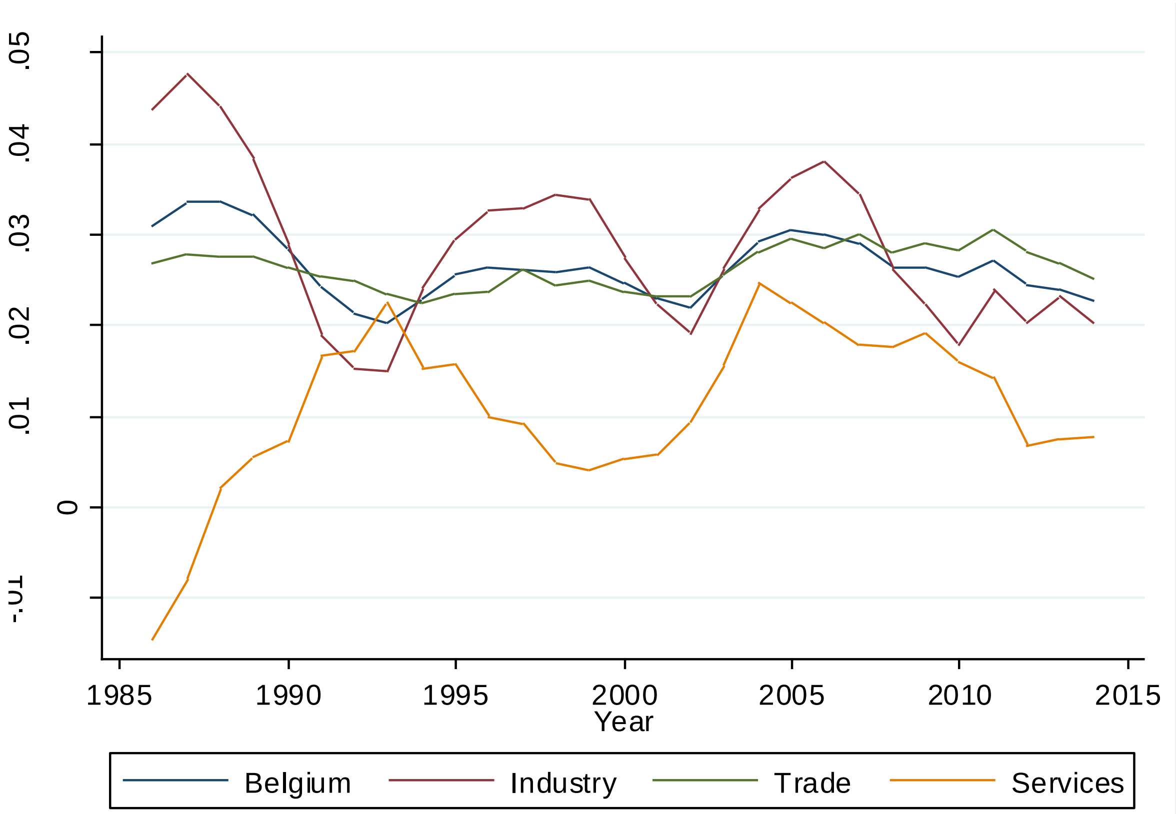


Notes: *This figure shows the evolution of price-cost margins (equation 23), and the evolution of the price-cost margins, fixed cost ratio and the excess profits ratio (equation 24) at the yearly level. The evolution of the variables has been smoothed. Each observation is the simple average of its current observations and one observation before and after its current observation.*

Next, other patterns are present in Trade. In particular, price-cost margins decreased from 31.1% in 1986 to 25.3% in 2014 while the fixed costs ratio fell from 28.5% in 1986 to 22.8% in 2014. These evolutions are approximately parallel, such that the excess profits ratio is roughly constant. It goes from 2.7% in 1986 to 2.5% in 2014, while its minimum value is 2.2% and its maximum value equals 3.1% in this period. Firms in Trade are experiencing a fall in price-cost margins, but this does not correspond to a decreasing profitability due to the fact that these firms are also able to lower their fixed costs ratio. In the most recent decade, everything seems to be very stable in Trade.

Further, price-cost margins and the fixed costs ratio in Services initially drop fast after which it becomes approximately stable. Price-cost margins move from 27.4% in 1986 to 21.5% in 1990 after which they remain stable. They equal 21.1% in 2014. The fixed costs ratio goes from 28.8% in 1986 to 20.8% in 1990 after which it still equals 20.4% in 2014. Looking at the evolution of the excess profits ratio in Figure 3, we observe an increase until the early '90s after which it becomes rather stable, although there is still some fluctuation over the sample period.

Figure 3 Evolution of excess profit ratios (FC)



Notes: *This figure shows the evolution the excess profits ratio (equation 20) at the yearly level. The evolution of variables has been smoothed. Each observation is the simple average of its current observations and one observation before and after its current observation. Industry, Trade and Services consist respectively of NACE categories 10/33, 45/47 and 49/82.*

Comparing our results with price-cost margins in the absence of fixed costs shows that these patterns are quite different in level and in trend. Price-cost margins in the absence of fixed costs do not allow to understand how the underlying components of the price-cost margins evolve. Moreover, price-cost margins without fixed costs are not able to track the evolution of the price-cost margins in the presence of fixed costs nor are they able to track the evolution of the excess profits ratio. Finally, we show the evolution of the price-cost margins and the excess profits ratio bias in Figure 16. This confirms that ignoring fixed costs underestimates price-cost margins and overestimates the excess profits ratio.

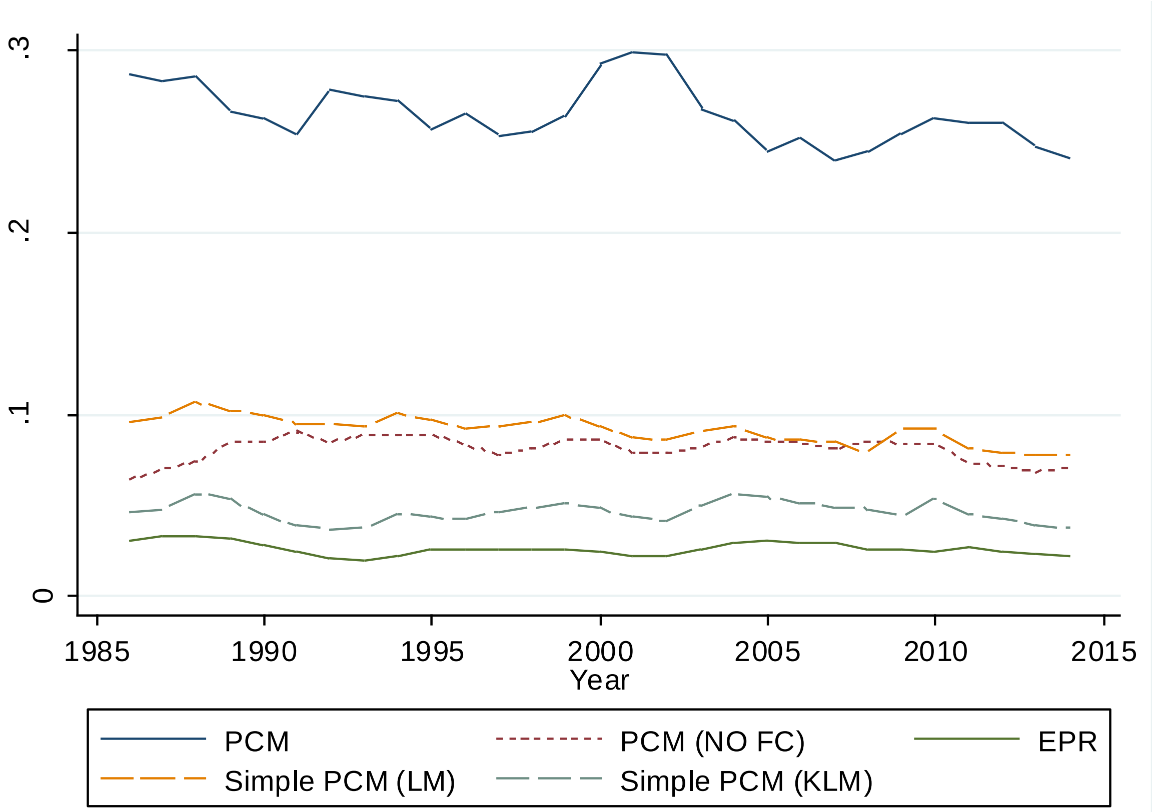
5. Robustness tests

In this section, we perform various robustness tests. First, we compare our estimation results with a 'simple' price-cost margins measure based on the accounting approach. Afterwards, we compare our estimation results to price-cost margins obtained from the De Loecker and Warzynski (2012) framework. Third, we compare our estimated share of fixed intermediate inputs to a proxy for this. The fourth part looks into the issue of weighted and unweighted aggregate price-cost margins. In the fifth and sixth part, we delve deeper into the error term. In particular, we discuss measurement issues, and especially so for the cost of capital. Next, we look into specification issues. Seventh and finally, we make use of a proxy for consolidated accounts.

5.1 Comparison: 'Simple' price-cost margins

Our baseline price-cost margin estimates originate from a so-called production function approach. Another well-known approach is the accounting approach. For example, Cavallerri et al. (2019) recently published an ECB Working Paper in which they explore the evolution of the markup in the euro area. Their 'simple markup' is defined as the ratio of operating revenue over the sum of wage costs and intermediate input costs at the country-year level. We calculate this markup and convert it into a price-cost margin. Additionally, we calculate a second simple markup as the ratio of operating revenue over the sum of wage costs, intermediate input costs and capital costs.

Figure 4 Evolution of price-cost margins (FC) and simple price-cost margins



Notes: *This figure shows the evolution of the price-cost margin, excess profits ratio (equation 23), price-cost margins (equation 22) and the two simple price-cost margins at the yearly level. The evolution of variables has been smoothed. Each observation is the simple average of its current observations and one observation before and after its current observation.*

Figure 4 shows the price-cost margins, with and without fixed costs, the excess profits ratio and the two simple price-cost margins (LM refers to labor and intermediate cost ; KLM refers to capital, labor and intermediate costs). We observe that the evolution of the price-cost margin in the absence of fixed cost and the two simple price-cost margins are reasonably similar in terms of level and trend over time.

These measures are not able to distinguish between variable and fixed costs, and rely on total costs. Therefore, the simple price-cost margin might be a good proxy for price-cost margins in the absence of fixed costs. However, these measures do not match the dynamics of our baseline estimation results.

5.2 Comparison: De Loecker and Warzynski (2012) framework

Next, we compare our estimation results to the markups obtained by the De Loecker and Warzynski (2012) framework. The markup can be obtained as follows:

$$\mu_{it} = \theta_{it}^{V} * (\alpha_{it}^{V})^{-1}$$

with μ_{it}, θ_{it}^{V} and $(\alpha_{it}^{V})^{-1}$ denoting respectively the markup, the output elasticity of the variable input and the inverse of the corresponding revenue share at the firm-year level. Firm-specific markups are then aggregated to an aggregate markup, taking firm size weights into account. This looks as follows:

$$\mu_t = \sum_i m_{it}\mu_{it}$$

with m_{it} denoting the market share for firm *i* in a specific market in year t.

The method requires one input which is entirely variable, and often intermediate inputs are used for this. However, De Loecker et al. (2018) claim that intermediate inputs might still contain a sizable quasi-fixed component. They exploit a unique feature of the Belgian firm level data: since 1996, firms have to break down their intermediate inputs into materials and service inputs.[30] De Loecker, Fuss & Van Biesebroeck (2018) suggest that service inputs are quasi-fixed whereas materials are quasi-variable. If this is true, then markups based on material inputs on the one hand and markups based on services inputs on the other hand should lead to different estimated markups. The former markup should be accurate while the latter one would be biased. We follow the estimation procedure used in De Loecker et al. (2018)[31] and estimate markups once based on material inputs and once based on intermediate inputs. We convert these aggregate markups in aggregate price-cost margins. Figure 5 shows the evolution of these estimates as well as the evolution of our baseline results.

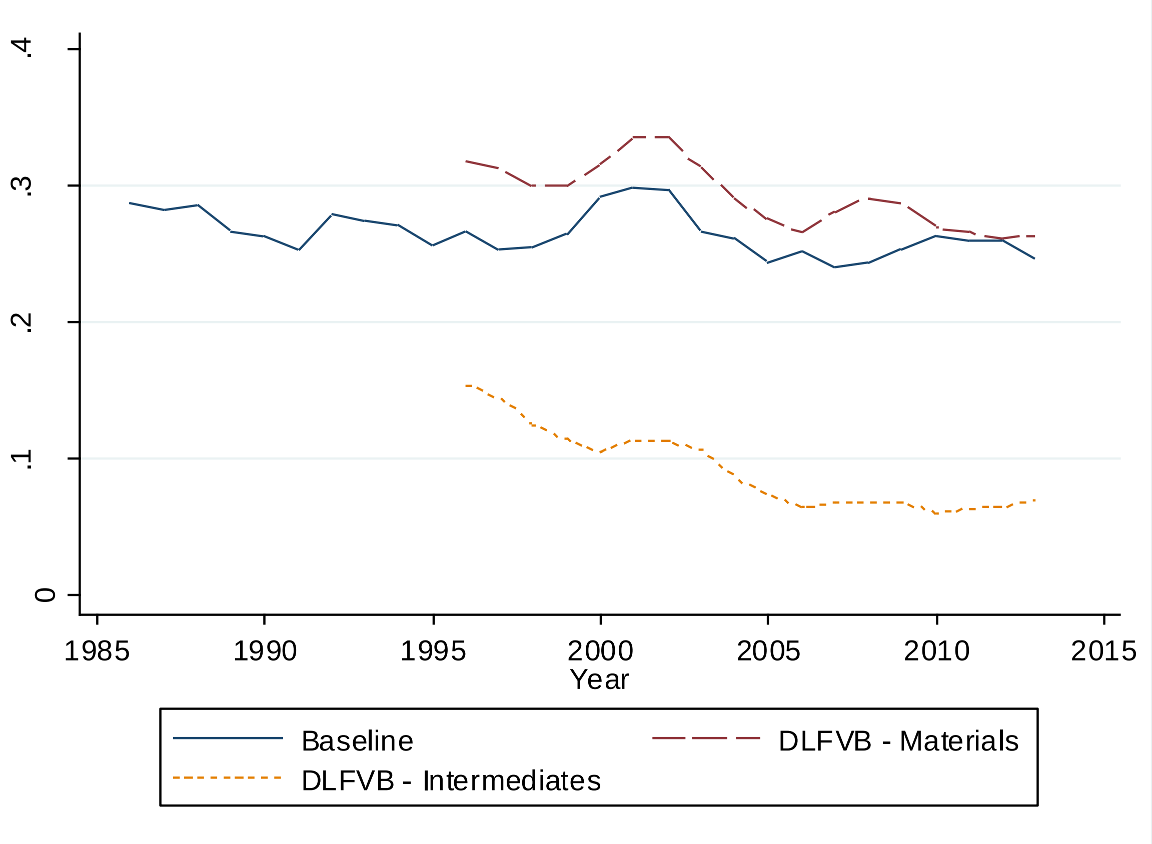
We observe that our baseline price-cost margins fall from 26.6% in 1996 to 24.1% in 2014 while the DLFVB price-cost margins based on materials fall from 31.8% in 1996 to 26.3% in 2014. The DLFVB price-cost margins based on intermediate inputs fall from 15.5% in 1996 to 7.0% in 2014. Hence, we find that our baseline price-cost margins correspond reasonably well to the DLFVB price-cost margins

[30] Intermediate inputs, material inputs and services inputs are respectively classified as category 60/61, 60 and 61 in the financial statement. The sum of material and services inputs is equal to intermediate inputs.

[31] We compute a normalized aggregate markup in which we normalize the output elasticity such that the median firm markup equals 1.1 over the sample.

based on materials, in level as well as in (secular and cyclical) trend. However, our baseline results appear to differ from the DLFVB price-cost margins based on intermediate inputs. This makes sense as the former DLFVB estimates are based on a quasi-variable input unlike the latter DLFVB estimates.

Figure 5 Evolution of price-cost margins: Baseline and DLFVB estimates



Notes: *This figure shows the evolution of our baseline price-cost margins, and the price-cost margins based on DLFVB estimates (once based on materials as variable input and once based on intermediate inputs as variable input) at the yearly level. The evolution of variables has been smoothed. Each observation is the simple average of its current observations and one observation before and after its current observation. DLFVB refers to the estimation procedure applied by De Loecker et al. (2018).*

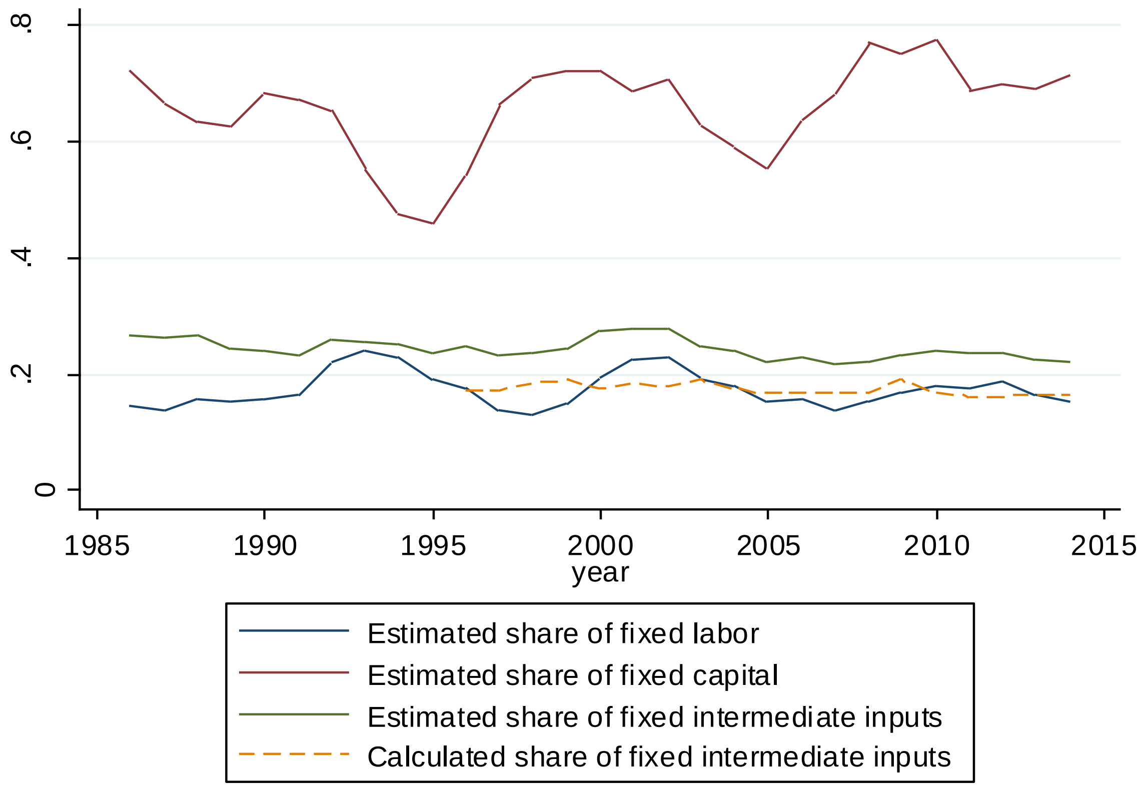
5.3 Share of fixed intermediate inputs

As already mentioned, De Loecker et al. (2018) suggest that service inputs are quasi-fixed whereas materials are quasi-variable. If this holds, then we should find that the estimated share of fixed intermediate inputs is reasonably similar to its proxy, namely the calculated share of fixed intermediate inputs. The calculated share of fixed intermediate inputs is defined as service inputs over the sum of material and services inputs.

Figure 6 shows the evolution of the estimated share of fixed inputs and the calculated share of fixed intermediate inputs. The estimated share of fixed intermediate inputs equals 24.5% in 1996 and moves to 22.0% in 2014, whereas the calculated share of fixed intermediate components equals 17.1% in

1996 and 16.4% in 2014. The calculated share is in the same order of magnitude, but is lower than the estimated share of fixed intermediate inputs.

Figure 6 Estimated and calculated share of fixed intermediate inputs



***Notes:** This figure shows the evolution of the estimated share of fixed intermediate inputs (equation 23) and the calculated share of fixed intermediate inputs for the Belgian economy.*

Note that the calculated share of fixed intermediate inputs assumes that materials and services are respectively entirely variable and fixed. This might hold for the vast majority of these categories, however, one can argue that some of the underlying components are respectively fixed and variable. This might shift the calculated share of fixed intermediate inputs.[32] Our estimated share of fixed intermediate inputs does not require us to specify whether a specific cost is fixed or variable.

5.4 (Un)weighted aggregate price-cost margins

This section looks into the difference between the unweighted and the weighted aggregate price-cost margin. Hall (1988) and Roeger (1995) estimate an unweighted aggregate price-cost margin. Their

[32] It is likely that this will increase the calculated share of fixed intermediate inputs as this measure assumes that materials, by far the largest component of intermediate inputs, are entirely variable. Even if a small fraction of materials is quasi-fixed, then, this might dominate the possibility that a fraction of services is quasi-variable. However, the data does not allow us to verify this claim.

empirical analysis uses industry level data. The approach basically links the growth rate of inputs to the growth rate of output, thereby implicitly assuming equal weight for all the industries.

Table 6 Price-cost margins: Weighted and Unweighted

	(1)	(2)	(3)	(3)
Weighted	**Yes**	**No**	**Yes**	**No**
Price-Cost Margins	0.080^{***}	0.116^{***}	0.259^{***}	0.416^{***}
	(0.012)	(0.016)	(0.016)	(0.045)
Share of Fixed Capital			0.679^{***}	0.924^{***}
			(0.036)	(0.050)
Share of Fixed Labor			0.169^{***}	0.331^{***}
			(0.028)	(0.040)
Share of Fixed Intermediates			0.236^{***}	0.419^{***}
			(0.017)	(0.053)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
N	280,252	280,252	280252	280252
r2	0.349	0.327	0.510	0.534

Notes: *Standard errors are clustered by NACE 2 digits. Standard errors in parentheses (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Odd (even) columns are (not) weighted by operating revenue at the firm-year level.*

In order to estimate a weighted aggregate price-cost margin, we deviate on two aspects. First, we use firm level data rather than industry level data. This allows to exploit variation between industries as well as between firms within an industry. Second, we weigh our regressions. We take into account that larger firms have a stronger impact on the aggregate price-cost margin. In the absence of fixed factors, we weigh equation (22) by operating revenue at the firm-year level. The weights are allowed to vary over time. This allows to capture potential reallocation effects. In particular, assume that a large firm with a high price-cost margins is growing, then this would push the aggregate price-cost margin upwards. In the presence of fixed factors, firm-year specific weights are introduced as we go from equation (11) and (17) to respectively equation (18) and (19). The former equations are multiplied by firm-year operating revenue or firm-year total costs. Assume now that we divide equation (20) again by operating revenue at the firm-year level. This eliminates the firm size dimension as all firms have a 'rescaled' operating revenue of one, while the growth rates remain the same. Doing so, all firms have an equal weight and regression results are no longer driven by firm size but only by the growth rates of the (variable) inputs and output.

Table 6 displays a comparison of weighted and unweighted aggregate price-cost margins based on firm level data. Columns (1) and (3) display the weighted aggregate price-cost margin while columns (2) and (4) display the unweighted aggregate price-cost margin. We find that weighted price-cost margins are smaller than unweighted price-cost margins. This suggests that large firms are characterized by lower price-cost margins. This is at odds with the bulk of the literature which finds that large firms also have large markups (e.g. Autor et al., 2020; De Loecker et al., 2019). However, the literature typically assumes that price-cost margins can be interpreted as profitability and vice versa. As we already showed, this is no longer necessarily the case once fixed costs are present. Therefore, we decompose the price-cost margin into the fixed costs ratio and the excess profits ratio. We find that the estimated weighted share of factor inputs in column (3) is smaller than the estimated unweighted share of factor inputs in column (4) for each input. Therefore, large firms have lower price-cost margins as well as a lower fixed costs ratio. Ex-ante, it is not clear whether large firms have a higher profitability or not.

Table 7 Decomposition of price-cost margins: Weighted and unweighted

		(1)	**(2)**
Weighted		**Yes**	**No**
Panel A	*Without Fixed Costs*		
(1)	Price-cost Margins	.080*** (0.012)	0.116*** (0.016)
(2)	Fixed Costs Ratio	-	-
(3)	Excess Profits Ratio	.080*** (0.012)	0.116*** (0.016)
Panel B	*With Fixed Costs*		
(4)	Price-cost Margins	.259*** (0.016)	.416*** (0.045)
(5) = |(7)| + |(8)|	Fixed Costs Ratio	.234*** (0.016)	.407*** (0.048)
(6)	Excess Profits Ratio	.025*** (0.002)	.009*** (0.003)
(7) = (1) – (4)	**Bias PCM**	-.179*** (0.020)	-.300*** (0.048)
(8) = (3) – (6)	**Bias EPR**	.052*** (0.012)	.107*** (0.016)

Notes *This table repeats the price-cost margins from Table 3. All components are weighted by operating revenue at the firm-year level. Odd (even) columns refer to weighted (unweighted) results.*

In Table 7, we decompose the price-cost margin into a fixed costs ratio and an excess profits ratio. Considering Panel B, we find that the unweighted excess profits ratio equals 0.9% whereas the weighted excess profits ratio equals 2.5%. Therefore, we can conclude that large firms have a lower price-cost margin and a lower fixed costs ratio, however, they are able to generate a higher excess profits ratio than smaller firms. Again, this shows that fixed costs create a wedge between price-cost margins and the excess profits ratio and both concepts cannot be used interchangeably. The literature typically finds that large firms possess more market power which is in line with our finding that large firms have a higher profitability level (e.g. Autor et al., 2020; De Loecker et al., 2019).

5.5 Measurement error: cost of capital

Pinning down the cost of capital remains challenging. There might be measurement error in the nominal cost of capital. We provide three alternative definitions: the first one considers the firms' loan rate instead of the Belgian government long-term interest rate. The second one uses an adjusted formula for the capital allowance by including a capital allowance for patents as well. The third adjustment considers a risk premium for the Belgian market.

5.5.1 Loan rate

First, we replace the Belgian long-term interest rate by the cost of borrowing for firms, which we call the loan rate. This loan rate is closer related to the real borrowing cost for corporations than the Belgian long-term interest rate, however, data are only available from 2003 onwards. The loan rate is made available by the Statistical Data Warehouse of the European Central Bank. (Appendix) table 9 displays the values for the nominal interest rate and the loan rate. During the Financial crisis, the loan rate is above the Belgian long-term interest rate. During the European debt crisis, the loan rate is lower than the Belgian long-term interest rate.

We compare our new results (in yellow) with our baseline results (in blue) in Figure 7.[33] The new results are consistent with our main findings. The excess profits ratio remains basically unchanged while the fixed costs ratio and the price-cost margins are close to the baseline results, i.e. they are slightly higher, especially during the Financial Crisis.

5.5.2 Capital allowances

The second robustness test considers an adjustment of the cost of capital. Our baseline cost of capital measure considers capital allowances for machines and buildings. Additionally, we also take patents into account, made available by the OECD. Note that these data are only available from 1994 onwards. We add these values to (appendix) table 9 as well.

We show the results (in red) in Figure 6 and demonstrate that our main findings still hold. [34] The price-cost margins, fixed costs ratio and excess profits ratio are very similar to our baseline results.

5.5.3 Risk premium

Next, we include a market risk premium in the calculation of our cost of capital. We source the values for this risk premium from www.market-risk-premia.com (owned by Fenebris, a corporate finance company). Data is available from 2000 onwards and included in (appendix) table 9. Figure 7 visualizes the new results in green, and shows that the excess profits ratio follows the same trend but at a lower

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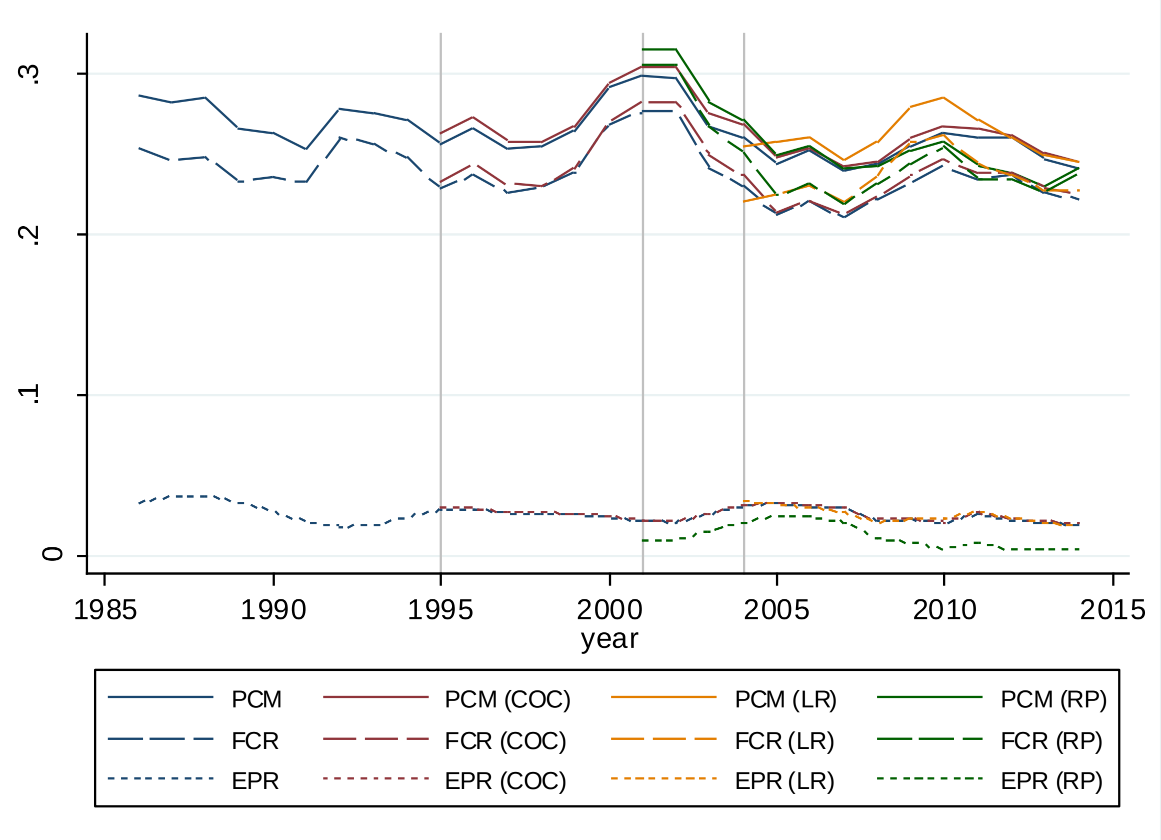
[33] (Appendix) Table 14 displays the corresponding actual (not smoothed) values for the price-cost margin, fixed-cost ratio and excess profits ratio. We also include standard errors and significance stars.

[34] (Appendix) Table 15 displays the corresponding actual (not smoothed) values for the price-cost margin, fixed-cost ratio and excess profits ratio. We also include standard errors and significance stars.

level.[35] The aggregate risk premium increases the cost of capital, which decreases the excess profits ratio. The price-cost margin and the fixed cost ratio follow a similar pattern as the baseline results.

Figure 7 Evolution of excess profits ratio: cost of capital & loan rate



Notes: *This figure shows the evolution the excess profits ratio (equation 24) under various robustness tests for the Belgian economy. The evolution of Belgian variables has been smoothed. Each observation is the simple average of its current observations and one observation before and after its current observation.*

5.6 Specification error

This section looks into a possible specification error. We allow the price-cost margin and the shares of fixed factor inputs to vary by firm size. We start from equation (23) and allow the price-cost margin and shares of fixed factor inputs to depend on firm size. We introduce the impact of firm size as follows,

$$B_{it} = B + \beta_1 * [PQ_{it} - mean(PQ_{it})]$$

$$sf_{it}^{k} = sf^{k} + \beta_2 * [PQ_{it} - mean(PQ_{it})_t]$$

$$sf_{it}^{l} = sf^{l} + \beta_3 * [PQ_{it} - mean(PQ_{it})_t]$$

[35] (Appendix) Table 16 displays the corresponding actual (not smoothed) values for the price-cost margin, fixed-cost ratio and excess profits ratio. We also include standard errors and significance stars.

$$sf_{it}^{m} = sf^{m} + \beta_4 * [PQ_{it} - mean(PQ_{it})_t]$$

and introduce this into equation (23) such that we obtain,

$$\left(SRQ_{it}^{C} - SRP_{it}^{C}\right)C_{it} - \left(SRQ_{it}^{R} - SRP_{it}^{R}\right)PQ_{it} = B * PQ_{it} * [(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}] + sf^{k} * RK_{it} * [(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}] + sf^{l} * WL_{it} * [(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}] + sf^{m} * P^{M}M_{it} * [(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}] + \beta_1 * PQ_{it}[PQ_{it} - mean(PQ_{it})_t] * X_{1it} + \beta_2 * RK_{it} * [PQ_{it} - mean(PQ_{it})_t] * X_{2it} + \beta_3 * WL_{it} * [PQ_{it} - mean(PQ_{it})_t] * X_{3it} + \beta_4 * P^{M}M_{it} * [PQ_{it} - mean(PQ_{it})_t] * X_{4it} + FE + \varepsilon_{it}. \quad (24)$$

Assuming that fixed costs are not present and dividing again by PQ_{it}, this formula collapses to equation (25),

$$SRQ_{it}^{R} - SRP_{it}^{R} = B[(\Delta q + \Delta p)_{it} - (\Delta k + \Delta r)_{it}] + \beta_1 * [PQ_{it} - mean(PQ_{it})_t][(\Delta q + \Delta p)_{it} - (\Delta k + \Delta r)_{it}] + FE + \varepsilon_{it} \quad (25)$$

We divide equation (24) again by PQ_{it} and show the results in Table 8. This repeats the unweighted results for Belgium between 1985 and 2014 in columns (1) and (3). Columns (2) and (4) extend these estimation results by taking the components linked to firm size into account as in equation (25) and (24) respectively.

Table 8 Price-cost margins and shares of fixed input factors: Control for firm size

	(1)	**(2)**	**(3)**	**(4)**
Price-cost Margins	0.116***	0.116***	0.416***	0.416***
	(0.0156)	(0.0157)	(0.045)	(0.045)
Share of Fixed Capital			0.924***	0.920***
			(0.050)	(0.050)
Share of Fixed Labor			0.331***	0.328***
			(0.040)	(0.040)
Share of Fixed Intermediates			0.419***	0.418***
			(0.053)	(0.053)
β_1		-0.0135**		-0.041**
		(0.00399)		(0.013)
β_2				-0.218*
				(0.102)
β_3				-0.154*
				(0.063)
β_4				-0.043**
				(0.015)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year-Industry FE	Yes	Yes	Yes	Yes
N	280252	280252	280252	280252
r2	0.327	0.327	0.534	0.535

Notes: *Standard errors in parentheses (+ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001). Standard errors are clustered by NACE 2 digits.*

Looking at columns (1) and (2), we find that, evaluated at the mean, price-cost margins are approximately the same. As firm size increases, the estimated price-cost margin decreases. This implies that large firms are estimated to have lower price-cost margins. The estimated coefficient is significant, however, the economic magnitude is very small as firms need to have an operating revenue of one billion euros above the mean value to lower the price-cost margins by 1.35 percentage points in Belgium.[36] Next, column (4) shows that β_1 is significant and negative. Firms with an operating revenue of one billion euros above the mean value have a price-cost margin which is 4.1 percentage points lower. Larger firms also have a lower share of fixed capital, fixed labor and intermediate input. So, large firms tend to have lower price-cost margins and a lower fixed cost ratio. These results confirm our earlier findings. Nevertheless, they have a higher excess profits ratio. We conclude that firm size has a very modest impact as the aggregate price-cost margins do not differ substantially across the specifications.

5.7 Proxy for consolidated accounts

The unit of analysis is the unconsolidated firm level account, as this is how firms report their annual income statement at the NBB. However, firms with a different legal VAT number might be controlled by the same parent company. Goutsmet, Lecocq & Volckaert (2017) use the concept of a 'domestic ultimate owner' to indicate whether a firm is owned by another firm within Belgium. This is the case if a firm has more than 50% of the shares of another firm. We refer to their paper for more technical details. We exploit these linkages and aggregate the Belgian annual income statements of firms which are owned by the same parent company. We use this as a proxy for consolidated firm level accounts at the Belgian level.[37]

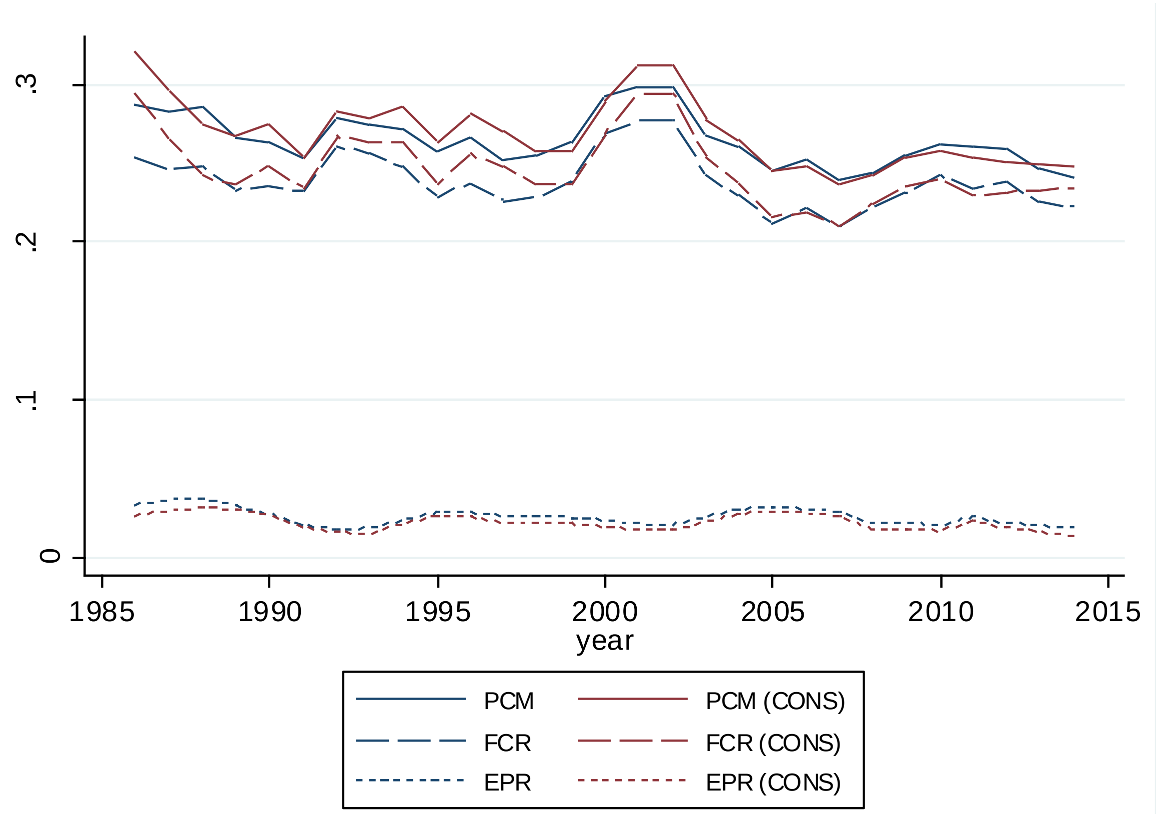
We show the evolution of the price-cost margins, fixed costs ratio and excess profits ratio for both unconsolidated accounts and our proxy for consolidated accounts in Figure 8.[38] Our results are robust to this alternative boundary definition of a firm. We find that price-cost margins and the fixed costs ratio are a bit higher in some years whereas in other periods, they are a bit lower. Overall, they fluctuate around the baseline results. The new excess profits ratio displays the same evolution over time albeit being slightly smaller.

[36] Firm-specific operating revenue is divided by one billion in order to be able to interpret the estimated coefficients.

[37] Note that this alternative definition of the frontier of a firm is a technical one and does not exist in reality.

[38] (Appendix) Table 17 displays the corresponding actual (not smoothed) values for the price-cost margin, fixed-cost ratio and excess profits ratio. We also include standard errors and significance stars.

Figure 8 Evolution of excess profits ratio: consolidated accounts



Notes: *This figure shows the evolution the excess profits ratio (equation 24) under various robustness tests for the Belgian economy. The evolution of Belgian variables has been smoothed. Each observation is the simple average of its current observations and one observation before and after its current observation.*

6 Conclusion

In this paper, we introduce and illustrate a new method which allows to estimate aggregate price-cost margins in the presence of fixed factors of production. Our method exploits properties of the primal and dual (revenue- and cost-based) Solow residuals. It allows a flexible treatment of the input factors: labor, capital and intermediate inputs. Each input can be variable, fixed or a combination of both. Based on empirical data, the model jointly estimates price-cost margins and the share of fixity for each input. The estimated price-cost margin can be decomposed into two components: one part is needed to cover fixed costs while the other part represents firms' profitability.

We apply our method to Belgian firm level data from 1985 until 2014. Given the rich time dimension of this data set, we are able to distinguish cyclical variation from the secular trend. Our main findings can be summarized as follows. First, allowing input factors to be variable, fixed or a mix of both has a profound impact on the estimation of price-cost margins. Once fixed factors of production are taken into account, Belgian price-cost margins rise from 8.0% to 25.9%. However, this does not necessarily imply that firms' profitability has risen as well. Price-cost margins are predominantly needed to cover fixed costs (23.4%) whereas only a small fraction remains left as excess profits (2.5%). Ignoring fixed costs underestimates price-cost margins while it overestimates firms' profitability. Second, the evolution of price-cost margins consists of the evolution of the fixed costs ratio and the evolution of the excess profits ratio. These components can reinforce or offset each other. Looking at the Belgian economy, we find that both the fixed costs ratio (-4.8%) and the excess profits ratio (-0.8%) have fallen between 1985 and 2014 such that price-cost margins decreased by 5.6%. Finally, heterogeneity across time and among sectors matters. For example, price-cost margins exhibit an increase in Industry but this evolution is dominated by an even larger increase in the fixed costs ratio in this sector, hence, firms' profitability falls.

Understanding the decomposition and evolution of price-cost margins is an important tool to assess firms' market power and its evolution. The presence of fixed costs implies that price-cost margins might change not only due to a change in firms' profitability, but also due to changes in the production process (i.e., the mix between variable and fixed costs) or even due to a combination of both. Our novel methodology is able to distinguish these underlying mechanisms, thereby providing an additional layer of insight to the ongoing academic and policy debate on firms' market power.

7 Appendix

Data appendix

Our application uses Belgian unconsolidated firm level accounts from the National Bank of Belgium (1985-2014).[39] Firms are identified as a legal entity by their unique VAT number. NACE rev. 2 codes are used to assign a firm to an industry (NACE 2-digit).[40] The dataset includes all for-profit firms which file an annual income statement, however, 'small firms' do not have to report this information.[41] They can choose to do this at a voluntary basis. The dataset does not include data on self-employed people.

We obtain the following balance sheet variables: operating revenue, wage costs, intermediate inputs, depreciation and tangible fixed assets. We have 358,143 firm-year observations. From 1996 onwards, firms report employment in terms of full-time equivalents (FTE).[42] Our dataset covers an increasing

[39] Belgian annual accounts are freely accessible through the NBB. The past ten years can be downloaded online. Older firm accounts can be requested at a cost.
[40] NACE is the industry standard classification system used in the European Union. It is the acronym of the French translation of the Statistical Classification of Economic activities in the European Community. The first four digits are common across all European countries.
[41] We refer to Bijnens & Konings (2018) for more detailed information on the filing requirements. Small firms are firms that do not exceed the following criteria: average number of employees above 50 FTE, €7.3 million for turnover and €3.65 for balance sheet total (2014 levels).
[42] Before 1996, firms report the number of jobs instead of full-time equivalents.

number of employees over time: total employment in FTE equals 1,042,861.8 in 1996. This increases to 1,298,381.4 in 2014.

Before running our regressions, we need to make some data adjustments. First, we only keep firms which belong to NACE rev. 2 categories 10/82. Next, we solely keep firms which have no missing values for operating revenue, wage costs, intermediate inputs, tangible fixed assets, depreciation and their NACE two digits code. We drop firms with a negative or zero value for operating revenue, wage costs, intermediate inputs, tangible fixed assets or depreciation. We drop firms which have a labor or intermediate input share above one and winsorize the labor and intermediate input share at the 95th percentile.[43] Finally, we winsorize the components for the regressions at the 1st and 99th percentiles to account for outliers in terms of growth rates.

In order to calculate the nominal rental cost of capital $R_{it} = P_{I_t}(r_t - \pi_t + \delta_{it})$ for firm i in year t, we start from Hall & Jorgenson (1967). We calculate the depreciation rate δ_{it} as the ratio of depreciation in year t-1 and tangible fixed assets in year t for firm i, thereby following Konings, Van Cayseele and Warzynski (2005).[44] The price index of investment goods P_I is obtained from the World Bank. Inflation π and the nominal interest rate r are sourced from the OECD.[45] The three latter variables are at the Belgian country-year level.

Further, we extend the calculation of the cost of capital by accounting for capital allowances (Asen & Bunn, 2019) and the statutory tax rate as follows: $R^{ADJ} = R_{it} * \frac{(1-(CA_t)*\tau_t)}{(1-\tau_t)}$ with CA[46] and τ representing respectively the Belgian capital allowance and the statutory tax rate. Both measures are made available by the OECD. In most countries, like in Belgium, depreciation schedules do not allow to take the time value of money into account. The time value of money consists of inflation and a normal return. Assume that a firm invests €1000 in a machine and it uses the straight-line depreciation method over a time horizon of five years. Further, assume an inflation rate of 2% and a normal return of 5%. In the first year, the firm depreciates €200. In the second year, again, the firm depreciates €200, however, the present value of this amount equals only €187. After five years, the firm is able to deduct only €877. The capital allowance, defined as the percentage of the initial investment which can be fully deducted, equals 87.7% in this case. The capital allowance becomes lower as the time horizon

[43] Under the assumption of constant returns to scale, a labor (intermediate input) share larger than one implies that the capital share would be negative. We only retain observations which have a labor (intermediate input) share smaller or equal to one. We replace negative capital shares by a value of zero.

[44] We limit the depreciation rate at 100%.

[45] Inflation refers to the yearly growth rate of the consumer price index. The nominal interest rate refers to the long-term (10 years) government bond yield. The OECD reports these indices in a consistent manner since 1985.

[46] We calculate the capital allowance as the weighed sum of the capital allowance of each component, divided by tangible fixed assets. The weights are the corresponding shares of the component in tangible fixed assets.

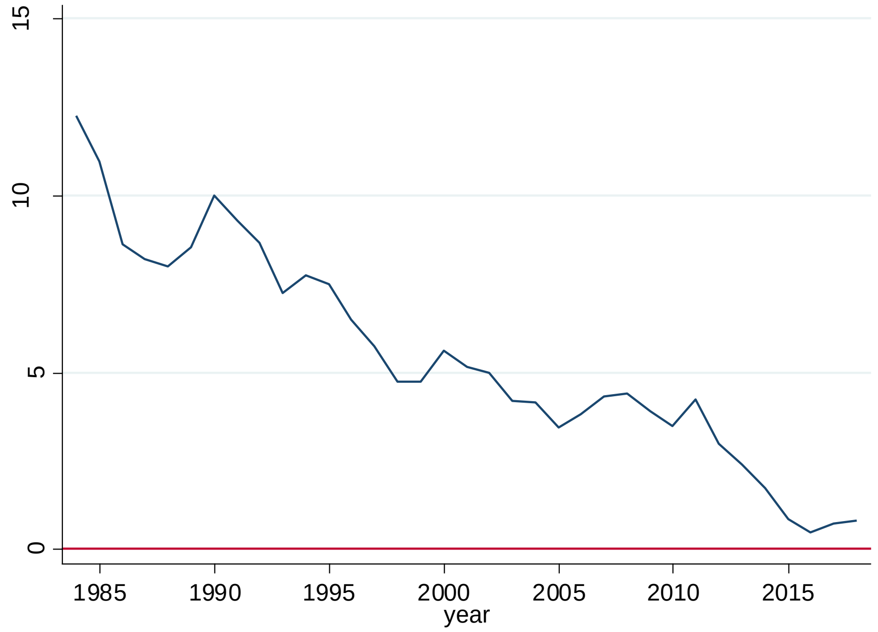
increases and/or the time value of money rises. A lower (than 100%) capital allowance increases the cost of capital. We use the adjusted cost of capital as our measure of cost of capital in the main text.

We plot the evolution of the nominal interest rate r in Figure 9, the evolution of inflation π in Figure 10, the evolution of the weighted depreciation rate δ in Figure 11, the evolution of the (adjusted) real rental cost of capital $(r_t - \pi_t + \delta_{it}) * \frac{(1-(CA)*\tau)}{(1-\tau)}$ in Figure 12, the evolution of the price index of investment goods P_I in Figure 13 and the evolution of the (adjusted) nominal rental cost of capital R^{ADJ} in Figure 14. Appendix Table 9 displays the values for the nominal interest rate, statutory tax rate and capital allowances.

A limitation of our Belgian data is that depreciation is only reported from 1996 onwards while we observe all other variables from 1985 onwards. Therefore, we assume that the depreciation rate in and before 1995 equals the depreciation rate in 1996 at the firm level.

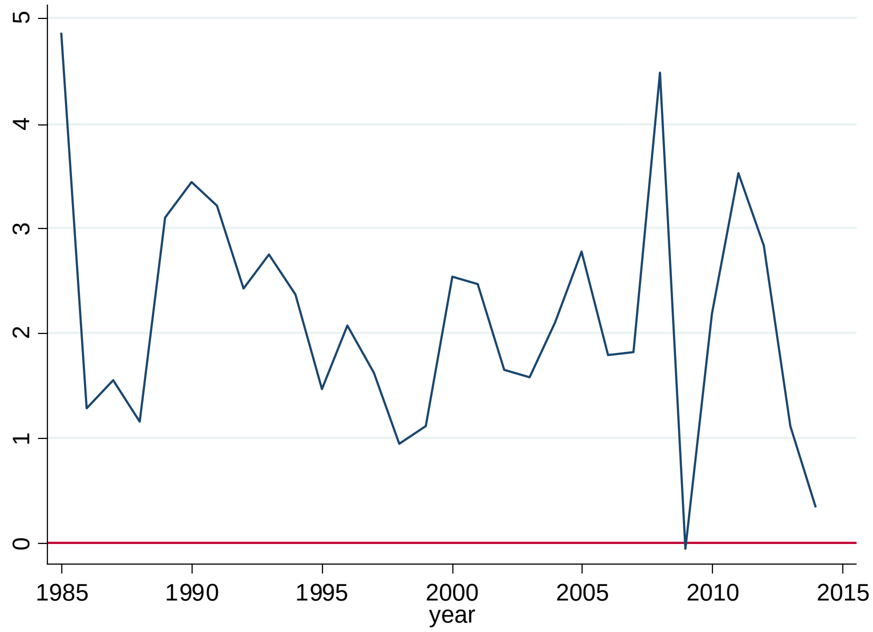
Figures appendix

Figure 9 Evolution of the nominal long-term interest rate



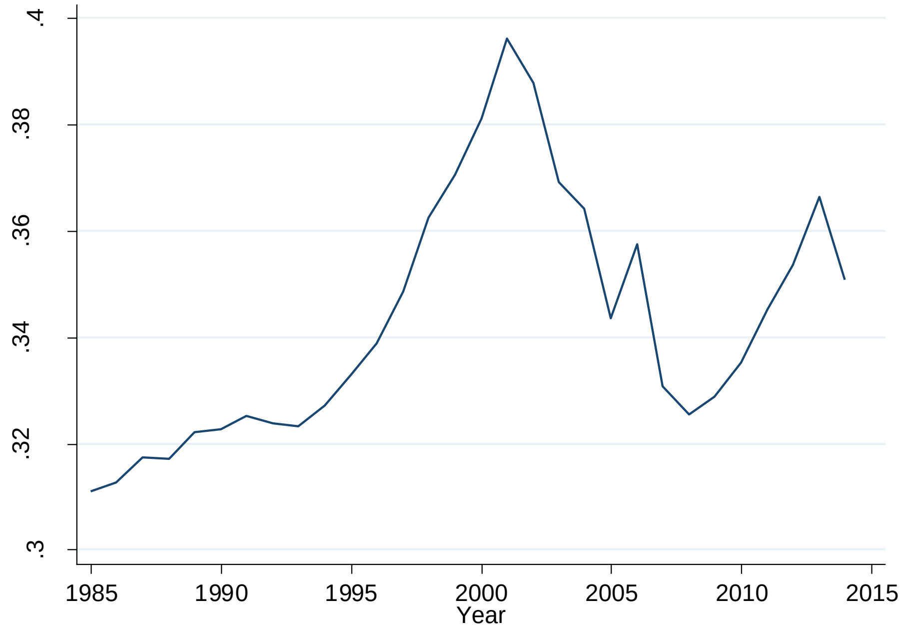
Notes: *This figure plots the long-term government bond yield (10 years). Data is obtained from the OECD and is consistently calculated throughout the sample period.*

Figure 10 Evolution of the consumer price index



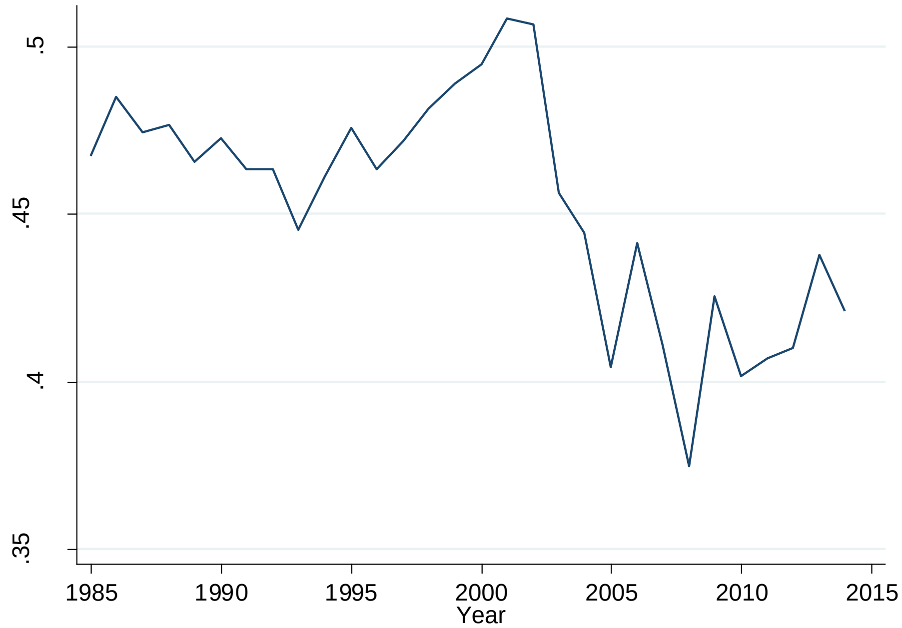
Notes: *This figure plots the yearly Belgian consumer price index (CPI) change. Data is obtained from the OECD and is consistently calculated throughout the sample period.*

Figure 11 Evolution of the weighted depreciation rate



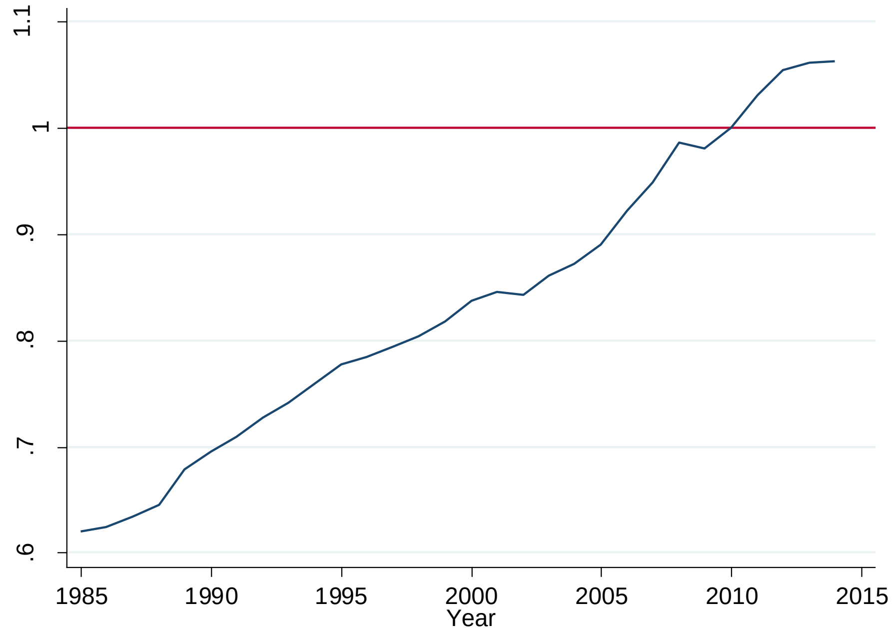
Notes: *This figure shows the weighted depreciation rate. We weigh the depreciation rate by operating revenue at the firm-year level.*

Figure 12 Evolution of the weighted real rental price of capital



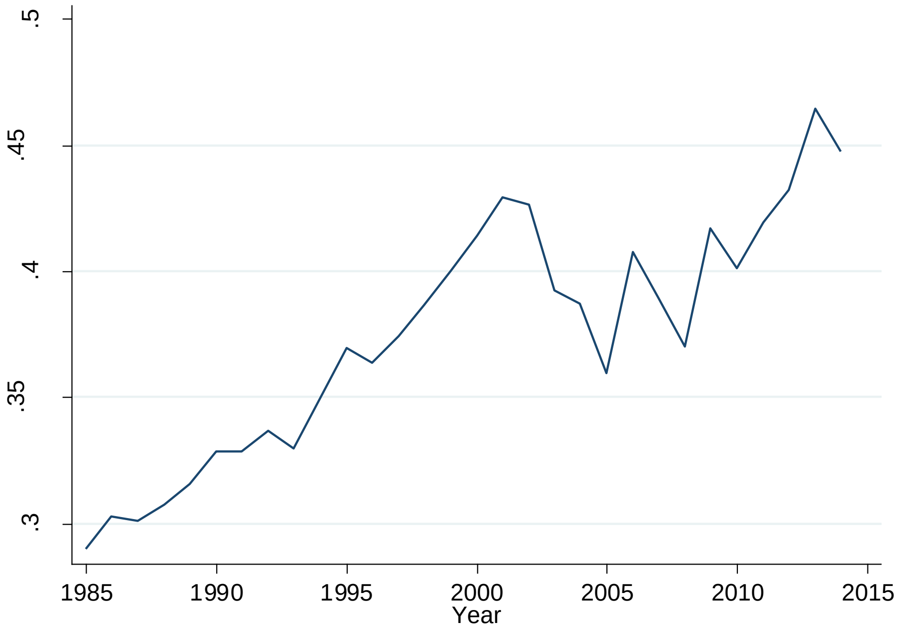
Notes: *This figure shows the weighted real rental price of capital. Depreciation is only available since 1996 for Belgian firms. We weigh the depreciation rate by operating revenue at the firm-year level.*

Figure 13 Evolution of the price index of investment goods



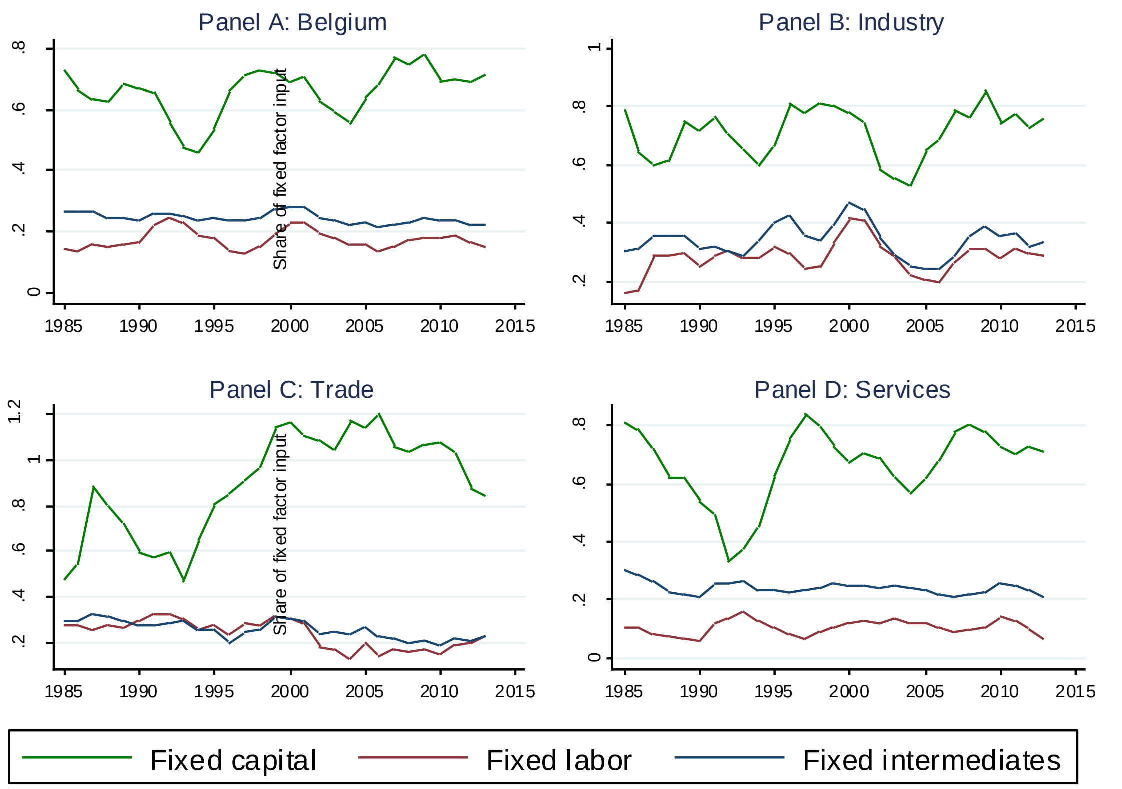
Notes: *This figure shows the Belgian price index of investment goods with 2010 as reference year. We source this data from the World Bank.*

Figure 14 Evolution of the weighted nominal rental price of capital



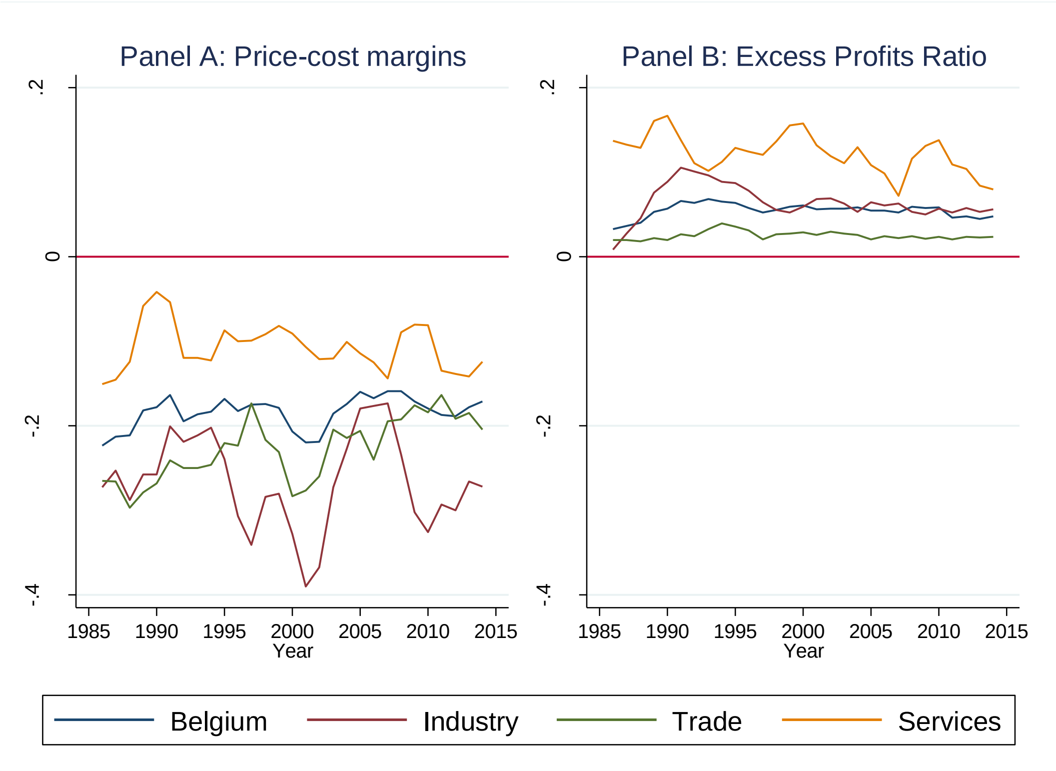
Notes: *This figure shows the weighted nominal rental price of capital. Depreciation is only available since 1996 for Belgian firms. We weigh the depreciation rate by operating revenue at the firm-year level.*

Figure 15 Evolution of estimated share of fixed inputs



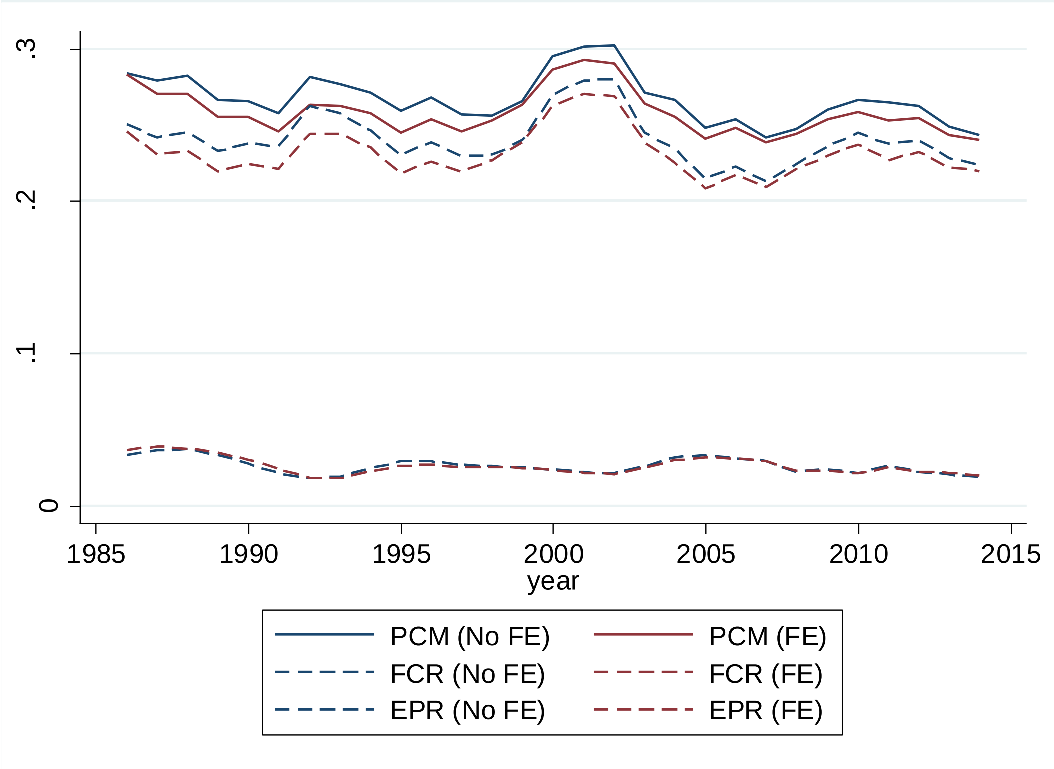
***Notes** Each panel plots the evolution of the estimated share of fixed capital (green), the estimated share of fixed labor (red) and the estimated share of fixed intermediates (green). These evolutions have been smoothed. Each observation is the simple average of its current observations and two observations before and after its current observation.*

Figure 16 Evolution of PCM and EPR bias



Notes *This figure shows the price-cost margins and excess profits ratio, at the aggregate and sectoral level.*

Figure 17 Evolution of PCM, FCR and EPR: With and Without Firm FE



Notes *This figure shows the price-cost margin, fixed costs ratio and excess profits ratio for estimation results without any fixed effects (blue) and for estimation results with only firm fixed effects (red). Each observation is the simple average of its current observations and one observation before and after its current observation.*

Table appendix

Table 9 Raw data for robustness tests for the cost of capital

Year	Nominal Interest Rate	Tax Rate	Loan Rate	CA (Machines)	CA (Buildings)	CA (Patents)	Market Risk Premium
1985	10.97	45	-	83.8	62.2	-	-
1986	8.63	45	-	83.8	62.2	-	-
1987	8.18	43	-	83.8	62.2	-	-
1988	8.01	43	-	83.8	62.2	-	-
1989	8.54	43	-	83.8	62.2	-	-
1990	10.01	41	-	83.8	62.2	-	-
1991	9.29	39	-	83.8	62.2	-	-
1992	8.65	39	-	83.8	62.2	-	-
1993	7.23	40.2	-	83.8	62.2	-	-
1994	7.75	40.2	-	83.8	62.2	87	-
1995	7.48	40.2	-	83.8	62.2	87	-
1996	6.49	40.2	-	83.8	62.2	87	-
1997	5.75	40.2	-	83.8	62.2	87	-
1998	4.75	40.2	-	88.2	62.2	87	-
1999	4.75	40.2	-	88.2	62.2	87	-
2000	5.59	40.17	-	88.2	62.2	87	4.29
2001	5.13	40.17	-	88.2	62.2	87	5.63
2002	4.99	40.17	-	88.2	62.2	87	4.72
2003	4.18	33.99	3.78	88.2	62.2	87	6.87
2004	4.15	33.99	3.58	88.2	62.2	87	5.16
2005	3.43	33.99	3.43	88.2	62.2	87	5.27
2006	3.82	35.97	4.04	88.2	62.2	87	5.46
2007	4.33	33.99	5.15	88.2	62.2	87	4.72
2008	4.42	33.99	5.44	88.2	62.2	87	6.09
2009	3.90	33.99	2.62	88.2	62.2	87	6.97
2010	3.46	33.99	2.27	88.2	62.2	87	6.84
2011	4.23	33.99	2.83	88.2	62.2	87	7.26
2012	3.00	33.99	2.40	88.2	62.2	87	9.57
2013	2.41	33.99	2.28	88.2	62.2	86	7.33
2014	1.71	33.99	2.26	88.2	62.2	85	6.30

Notes: *All values in this table are denoted in percentages.*

Table 10 Yearly estimates: Belgium

Year	PCM	PCM (SE)		FCR	FCR (SE)		EPR	EPR (SE)	
1986	0.280	0.033	***	0.247	0.032	***	0.033	0.003	***
1987	0.294	0.040	***	0.260	0.039	***	0.034	0.004	***
1988	0.274	0.033	***	0.230	0.031	***	0.044	0.004	***
1989	0.289	0.044	***	0.255	0.044	***	0.034	0.003	***
1990	0.237	0.025	***	0.214	0.026	***	0.023	0.003	***
1991	0.263	0.025	***	0.237	0.025	***	0.026	0.003	***
1992	0.261	0.030	***	0.246	0.032	***	0.015	0.005	**
1993	0.313	0.041	***	0.300	0.041	***	0.013	0.005	*
1994	0.251	0.028	***	0.223	0.028	***	0.028	0.003	***
1995	0.251	0.035	***	0.220	0.036	***	0.031	0.004	***
1996	0.269	0.030	***	0.243	0.030	***	0.026	0.004	***
1997	0.277	0.027	***	0.249	0.027	***	0.029	0.004	***
1998	0.212	0.031	***	0.188	0.031	***	0.025	0.004	***
1999	0.276	0.027	***	0.251	0.028	***	0.025	0.003	***
2000	0.304	0.030	***	0.277	0.030	***	0.027	0.003	***
2001	0.297	0.023	***	0.278	0.023	***	0.020	0.002	***
2002	0.295	0.026	***	0.276	0.026	***	0.019	0.003	***
2003	0.301	0.024	***	0.277	0.024	***	0.024	0.002	***
2004	0.206	0.031	***	0.172	0.031	***	0.034	0.002	***
2005	0.276	0.030	***	0.242	0.030	***	0.034	0.002	***
2006	0.252	0.023	***	0.222	0.024	***	0.030	0.002	***
2007	0.228	0.026	***	0.200	0.027	***	0.029	0.002	***
2008	0.240	0.020	***	0.211	0.021	***	0.029	0.002	***
2009	0.264	0.028	***	0.256	0.028	***	0.008	0.002	***
2010	0.260	0.026	***	0.229	0.027	***	0.031	0.002	***
2011	0.264	0.019	***	0.242	0.020	***	0.023	0.002	***
2012	0.257	0.023	***	0.233	0.024	***	0.024	0.002	***
2013	0.259	0.017	***	0.239	0.017	***	0.020	0.002	***
2014	0.224	0.017	***	0.205	0.018	***	0.018	0.002	***

Notes: *This table shows the estimated Belgian price-cost margins, fixed costs ratio and excess profits ratio, with corresponding standard errors and significance level. Standard errors ($^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Standard errors are clustered by NACE 2 digits.*

Table 11 Yearly estimates: Industry

Year	PCM	PCM (SE)		FCR	FCR (SE)		EPR	EPR (SE)	
1986	0.316	0.063	***	0.268	0.062	***	0.047	0.004	***
1987	0.334	0.082	***	0.290	0.079	***	0.044	0.006	***
1988	0.333	0.074	***	0.276	0.069	***	0.058	0.006	***
1989	0.464	0.051	***	0.423	0.050	***	0.040	0.004	***
1990	0.315	0.047	***	0.294	0.048	***	0.021	0.004	***
1991	0.345	0.078	***	0.320	0.079	***	0.025	0.004	***
1992	0.313	0.055	***	0.312	0.056	***	0.001	0.007	.
1993	0.346	0.163	*	0.347	0.163	*	-0.001	0.008	.
1994	0.308	0.084	***	0.283	0.082	***	0.026	0.004	***
1995	0.292	0.087	***	0.256	0.086	**	0.035	0.005	***
1996	0.468	0.103	***	0.435	0.102	***	0.033	0.005	***
1997	0.493	0.078	***	0.453	0.077	***	0.040	0.005	***
1998	0.353	0.100	***	0.321	0.099	**	0.033	0.006	***
1999	0.273	0.050	***	0.241	0.050	***	0.032	0.004	***
2000	0.472	0.064	***	0.438	0.064	***	0.034	0.004	***
2001	0.497	0.057	***	0.480	0.058	***	0.017	0.004	***
2002	0.472	0.042	***	0.446	0.043	***	0.025	0.003	***
2003	0.397	0.043	***	0.369	0.043	***	0.028	0.004	***
2004	0.217	0.063	***	0.181	0.063	**	0.036	0.003	***
2005	0.326	0.048	***	0.287	0.047	***	0.039	0.004	***
2006	0.297	0.047	***	0.258	0.047	***	0.039	0.003	***
2007	0.203	0.049	***	0.169	0.048	***	0.034	0.003	***
2008	0.313	0.033	***	0.287	0.034	***	0.026	0.004	***
2009	0.425	0.044	***	0.420	0.043	***	0.005	0.004	.
2010	0.386	0.055	***	0.351	0.056	***	0.035	0.004	***
2011	0.390	0.046	***	0.371	0.048	***	0.019	0.004	***
2012	0.332	0.062	***	0.306	0.065	***	0.026	0.005	***
2013	0.411	0.037	***	0.391	0.037	***	0.020	0.002	***
2014	0.284	0.071	***	0.265	0.072	***	0.019	0.004	***

Notes: *This table shows the estimated Belgian price-cost margins, fixed costs ratio and excess profits ratio, with corresponding standard errors and significance level. Standard errors ($^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Standard errors are clustered by NACE 2 digits.*

Table 12 Yearly estimates: Trade

Year	PCM	PCM (SE)		FCR	FCR (SE)		EPR	EPR (SE)	
1986	0.288	0.027	***	0.257	0.034	***	0.032	0.007	***
1987	0.335	0.014	***	0.302	0.014	***	0.033	0.001	***
1988	0.316	0.023	***	0.282	0.025	***	0.035	0.002	***
1989	0.377	0.051	***	0.345	0.048	***	0.032	0.004	***
1990	0.293	0.020	***	0.262	0.020	***	0.031	0.001	***
1991	0.275	0.017	***	0.244	0.015	***	0.031	0.002	***
1992	0.312	0.026	***	0.287	0.023	***	0.025	0.004	***
1993	0.310	0.034	***	0.281	0.033	***	0.029	0.001	***
1994	0.297	0.005	***	0.269	0.002	***	0.028	0.004	***
1995	0.317	0.033	***	0.289	0.035	***	0.028	0.002	***
1996	0.226	0.019	***	0.201	0.020	***	0.026	0.001	***
1997	0.291	0.029	***	0.269	0.032	***	0.022	0.003	***
1998	0.143	0.029	***	0.117	0.031	***	0.026	0.002	***
1999	0.369	0.047	***	0.344	0.047	***	0.025	0.001	***
2000	0.337	0.019	***	0.311	0.019	***	0.026	0.001	***
2001	0.300	0.033	***	0.277	0.033	***	0.024	0.000	***
2002	0.338	0.058	***	0.316	0.060	***	0.021	0.003	***
2003	0.300	0.011	***	0.273	0.010	***	0.027	0.001	***
2004	0.135	0.017	***	0.102	0.017	***	0.033	0.001	***
2005	0.368	0.020	***	0.335	0.022	***	0.033	0.002	***
2006	0.264	0.031	***	0.236	0.031	***	0.028	0.000	***
2007	0.246	0.030	***	0.216	0.030	***	0.030	0.001	***
2008	0.229	0.019	***	0.199	0.020	***	0.030	0.002	***
2009	0.260	0.023	***	0.235	0.023	***	0.025	0.002	***
2010	0.190	0.019	***	0.160	0.021	***	0.030	0.001	***
2011	0.257	0.003	***	0.228	0.004	***	0.029	0.002	***
2012	0.197	0.026	***	0.169	0.028	***	0.028	0.002	***
2013	0.276	0.024	***	0.251	0.027	***	0.025	0.003	***
2014	0.230	0.023	***	0.204	0.025	***	0.026	0.002	***

Notes: *This table shows the estimated Belgian price-cost margins, fixed costs ratio and excess profits ratio, with corresponding standard errors and significance level. Standard errors ($^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Standard errors are clustered by NACE 2 digits.*

Table 13 Yearly estimates: Services

Year	PCM	PCM (SE)		FCR	FCR (SE)		EPR	EPR (SE)	
1986	0.269	0.054	***	0.289	0.062	***	-0.021	0.023	.
1987	0.279	0.071	***	0.266	0.080	***	0.013	0.022	.
1988	0.262	0.045	***	0.242	0.042	***	0.019	0.017	.
1989	0.225	0.047	***	0.207	0.052	***	0.019	0.015	.
1990	0.187	0.029	***	0.167	0.030	***	0.020	0.010	*
1991	0.234	0.031	***	0.219	0.035	***	0.015	0.013	.
1992	0.204	0.033	***	0.169	0.042	***	0.035	0.012	**
1993	0.304	0.040	***	0.284	0.037	***	0.020	0.017	.
1994	0.222	0.031	***	0.187	0.039	***	0.036	0.018	*
1995	0.224	0.048	***	0.211	0.053	***	0.013	0.014	.
1996	0.249	0.036	***	0.237	0.043	***	0.012	0.013	.
1997	0.231	0.030	***	0.223	0.031	***	0.007	0.010	.
1998	0.206	0.032	***	0.202	0.035	***	0.004	0.010	.
1999	0.261	0.037	***	0.255	0.039	***	0.006	0.010	.
2000	0.256	0.037	***	0.244	0.038	***	0.012	0.007	+
2001	0.245	0.021	***	0.226	0.024	***	0.019	0.008	*
2002	0.234	0.024	***	0.236	0.028	***	-0.003	0.010	.
2003	0.270	0.035	***	0.254	0.038	***	0.016	0.008	*
2004	0.236	0.051	***	0.203	0.054	***	0.033	0.008	***
2005	0.258	0.045	***	0.227	0.047	***	0.031	0.010	**
2006	0.240	0.038	***	0.223	0.043	***	0.017	0.007	*
2007	0.233	0.040	***	0.209	0.044	***	0.024	0.007	***
2008	0.230	0.030	***	0.204	0.033	***	0.026	0.007	***
2009	0.207	0.029	***	0.219	0.033	***	-0.011	0.009	.
2010	0.253	0.031	***	0.233	0.034	***	0.021	0.008	**
2011	0.244	0.031	***	0.231	0.036	***	0.013	0.009	.
2012	0.276	0.035	***	0.269	0.038	***	0.007	0.006	.
2013	0.227	0.025	***	0.223	0.030	***	0.004	0.009	.
2014	0.196	0.019	***	0.189	0.020	9.251	***	0.007	0.814

Notes: *This table shows the estimated Belgian price-cost margins, fixed costs ratio and excess profits ratio, with corresponding standard errors and significance level. Standard errors (+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Standard errors are clustered by NACE 2 digits.*

Table 14 Yearly estimates (Robustness: Loan Rate)

Year	PCM	PCM (SE)		FCR	FCR (SE)		EPR	EPR (SE)	
2004	0.218	0.032	***	0.184	0.032	***	0.034	0.002	***
2005	0.291	0.029	***	0.257	0.029	***	0.034	0.002	***
2006	0.263	0.025	***	0.234	0.026	***	0.029	0.002	***
2007	0.226	0.029	***	0.200	0.029	***	0.027	0.002	***
2008	0.252	0.018	***	0.227	0.019	***	0.025	0.002	***
2009	0.296	0.022	***	0.285	0.022	***	0.011	0.003	***
2010	0.293	0.025	***	0.261	0.024	***	0.032	0.002	***
2011	0.265	0.020	***	0.239	0.021	***	0.026	0.003	***
2012	0.256	0.022	***	0.230	0.022	***	0.025	0.002	***
2013	0.262	0.020	***	0.242	0.021	***	0.020	0.003	***
2014	0.230	0.018	***	0.213	0.018	***	0.017	0.003	***

Notes: *This table shows the estimated Belgian price-cost margins, fixed costs ratio and excess profits ratio, with corresponding standard errors and significance level. Standard errors ($^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Standard errors are clustered by NACE 2 digits.*

Table 15 Yearly estimates (Robustness: Capital Allowances)

Year	PCM	PCM (SE)		FCR	FCR (SE)		EPR	EPR (SE)	
1995	0.255	0.031	***	0.223	0.032	***	0.031	0.004	***
1996	0.271	0.030	***	0.244	0.031	***	0.027	0.004	***
1997	0.295	0.030	***	0.265	0.030	***	0.030	0.004	***
1998	0.210	0.032	***	0.185	0.032	***	0.025	0.004	***
1999	0.268	0.031	***	0.242	0.031	***	0.026	0.004	***
2000	0.323	0.035	***	0.295	0.035	***	0.028	0.003	***
2001	0.295	0.024	***	0.275	0.025	***	0.020	0.002	***
2002	0.297	0.026	***	0.277	0.026	***	0.019	0.003	***
2003	0.320	0.027	***	0.295	0.028	***	0.025	0.002	***
2004	0.210	0.033	***	0.175	0.033	***	0.034	0.002	***
2005	0.276	0.030	***	0.240	0.030	***	0.035	0.002	***
2006	0.258	0.024	***	0.227	0.025	***	0.031	0.002	***
2007	0.226	0.029	***	0.196	0.029	***	0.030	0.002	***
2008	0.244	0.019	***	0.214	0.020	***	0.030	0.002	***
2009	0.268	0.028	***	0.260	0.028	***	0.008	0.003	***
2010	0.270	0.026	***	0.239	0.026	***	0.032	0.002	***
2011	0.264	0.020	***	0.241	0.020	***	0.024	0.002	***
2012	0.261	0.023	***	0.236	0.024	***	0.025	0.002	***
2013	0.261	0.019	***	0.240	0.019	***	0.020	0.002	***
2014	0.231	0.018	***	0.212	0.018	***	0.020	0.002	***

Notes: *This table shows the estimated Belgian price-cost margins, fixed costs ratio and excess profits ratio, with corresponding standard errors and significance level. Standard errors ($^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Standard errors are clustered by NACE 2 digits.*

Table 16 Yearly estimates (Robustness: Risk Premium)

Year	PCM	PCM (SE)		FCR	FCR (SE)		EPR	EPR (SE)	
2001	0.310	0.026	***	0.302	0.027	***	0.008	0.002	***
2002	0.320	0.030	***	0.309	0.030	***	0.012	0.003	***
2003	0.316	0.031	***	0.306	0.031	***	0.009	0.003	***
2004	0.212	0.033	***	0.187	0.032	***	0.025	0.003	***
2005	0.285	0.030	***	0.258	0.031	***	0.027	0.003	***
2006	0.250	0.025	***	0.229	0.026	***	0.021	0.002	***
2007	0.230	0.030	***	0.206	0.030	***	0.024	0.002	***
2008	0.243	0.025	***	0.224	0.025	***	0.019	0.002	***
2009	0.254	0.022	***	0.264	0.022	***	-0.010	0.003	***
2010	0.260	0.024	***	0.244	0.024	***	0.016	0.003	***
2011	0.262	0.023	***	0.256	0.023	***	0.007	0.002	***
2012	0.207	0.027	***	0.206	0.026	***	0.002	0.002	.
2013	0.245	0.022	***	0.242	0.023	***	0.003	0.002	.
2014	0.238	0.023	***	0.234	0.023	***	0.005	0.002	*

Notes: *This table shows the estimated Belgian price-cost margins, fixed costs ratio and excess profits ratio, with corresponding standard errors and significance level. Standard errors (+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Standard errors are clustered by NACE 2 digits.*

Table 17 Yearly estimates (Robustness: Consolidated accounts)

Year	PCM	PCM (SE)		FCR	FCR (SE)		EPR	EPR (SE)	
1986	0.364	0.051	***	0.336	0.052	***	0.028	0.004	***
1987	0.277	0.038	***	0.252	0.039	***	0.025	0.004	***
1988	0.245	0.053	***	0.209	0.052	***	0.036	0.003	***
1989	0.301	0.051	***	0.267	0.050	***	0.035	0.004	***
1990	0.254	0.032	***	0.233	0.033	***	0.021	0.003	***
1991	0.269	0.049	***	0.243	0.049	***	0.026	0.004	***
1992	0.236	0.030	***	0.226	0.031	***	0.010	0.005	+
1993	0.345	0.069	***	0.333	0.070	***	0.012	0.006	+
1994	0.254	0.035	***	0.229	0.037	***	0.025	0.004	***
1995	0.258	0.040	***	0.228	0.040	***	0.029	0.004	***
1996	0.279	0.033	***	0.254	0.034	***	0.025	0.004	***
1997	0.309	0.045	***	0.285	0.045	***	0.024	0.004	***
1998	0.224	0.036	***	0.205	0.036	***	0.019	0.004	***
1999	0.241	0.039	***	0.219	0.039	***	0.023	0.004	***
2000	0.308	0.028	***	0.285	0.029	***	0.024	0.003	***
2001	0.319	0.035	***	0.305	0.036	***	0.014	0.003	***
2002	0.310	0.028	***	0.295	0.029	***	0.015	0.004	***
2003	0.308	0.028	***	0.285	0.029	***	0.023	0.003	***
2004	0.212	0.028	***	0.182	0.029	***	0.030	0.002	***
2005	0.273	0.032	***	0.243	0.032	***	0.031	0.002	***
2006	0.251	0.031	***	0.223	0.032	***	0.027	0.003	***
2007	0.218	0.041	***	0.190	0.040	***	0.027	0.002	***
2008	0.244	0.023	***	0.220	0.024	***	0.024	0.003	***
2009	0.265	0.025	***	0.263	0.025	***	0.002	0.003	.
2010	0.251	0.023	***	0.224	0.023	***	0.027	0.003	***
2011	0.256	0.024	***	0.235	0.024	***	0.022	0.002	***
2012	0.253	0.033	***	0.232	0.034	***	0.021	0.003	***
2013	0.244	0.027	***	0.229	0.028	***	0.014	0.003	***
2014	0.252	0.022	***	0.238	0.023	***	0.013	0.003	***

Notes: *This table shows the estimated Belgian price-cost margins, fixed costs ratio and excess profits ratio, with corresponding standard errors and significance level. Standard errors ($^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). Standard errors are clustered by NACE 2 digits.*

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