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Targeting government aid during COVID-19: The issue of fixed costs.

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Abstract

Many governments implement policies to support generally healthy firms to survive the COVID-19 crisis in a targeted way. For such policies, it is crucial to understand how profitability changes during the crisis and in which industries inefficient exit is most likely. Earlier research produced ambiguous results about the relationship between crises and firm-level price-cost margins. This paper argues that this mainly results from the fact that the two components of price-cost margins, the part needed to cover fixed cost and the excess profit margin, move in different directions during an economic crisis. We illustrate this by relying on Belgian firm level accounts from 1985 until 2014 and applying a novel methodology (Abraham, Bormans, Konings & Roeger, 2020), which takes into account fixed costs when estimating the price-cost margins. We show that, indeed, the fixed cost share is countercyclical while excess profitability is procyclical. These insights allow to identify and target industries, in which the case for support is strong, based on three criteria: high operating revenue losses, high fixed costs (as a % of revenue) and a low profitability as inefficient exit is more likely in these industries.

Keywords: COVID-19, government aid, price-cost margin, fixed cost, cyclicality, profitability

JEL codes: D22, E32, H12, L16

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1. Introduction

The ongoing COVID-19 pandemic leads to an unprecedented drop in economic activity around the world. GDP losses are estimated at 11.5% in the Euro Area and 8.5% in the United States (OECD, 2020). Many firms, as well as households and governments, have experienced a sharp decrease in income even though they still have to pay fixed expenses, i.e., costs which by definition do not change as production changes. Governments reacted almost instantly and implemented measures like furlough schemes or moratory on rent or interest payments (see Bennedsen, Larsen, Schmutte & Scuret, 2020 for an overview). Meanwhile, government budgets are very tight as budget deficits are widening and public debts are rising, which makes the effective targeting and design of the different policy instruments crucial. Regarding subsidizing firms, a common idea is that firms do not need to be compensated for their entire operating revenue loss during and after the lockdown, because - unlike fixed costs - variable costs related to the foregone production can be avoided. Relatedly, a fall in demand is more likely to lead to inefficient bankruptcy and exit in industries, where fixed costs are high. Motivated by such ideas, several governments are targeting firms or industries in which not only operating revenue losses are high but fixed costs are also considered to be substantial. For example, the Danish government covers 25% to 80% of the fixed costs if turnover falls by 35% to 100% (Bennedsen et al., 2020). Other examples are the Norwegian or the Flemish government which implemented a policy change (Alstadsæter, Bjørkheim, Kopczuk & Øklanet al., 2020; De Tijd, 2020). They move from a lump-sum subsidy to a targeted program in which they compensate (partly) for fixed, unavoidable costs if firms experience substantial losses.

Although the conceptual difference between variable and fixed costs is straightforward, they are harder to quantify in practice. Firms are not required to report this distinction and even if they have to do so, accounting concepts differ from economic categories. This paper exploits a novel methodology (Abraham et al., 2020) which disentangles variable and fixed costs at the industry level based on firm level accounts by relying on identities derived from profit maximization under very weak assumptions. This approach allows one to estimate and decompose the industry-level *price-cost margin (PCM)* into two components: the part required to cover fixed costs, the *fixed cost ratio (FCR)* and the remaining *excess profits ratio (EPR)*. Importantly, these two components depend on different economic forces: the FCR is mainly determined by technology and demand, while the EPR depends mainly on the strength of competition. Therefore, even if two industries have very similar price-cost margins, they may differ substantially in terms of competition or technology. Importantly, the two components respond very differently to economic shocks, and therefore, two industries with the similar price-cost margin can behave very differently under a crisis.

From a policy side of view, this paper provides a methodology and implements it to identify industries which should be targeted by policy support during large demand shocks. To this end, we identify the industries which are characterized by high fixed costs (as a % of operating revenue). Furthermore, we are able to estimate price-cost margins and excess profitability alongside these fixed cost shares at the industry level. Price-cost margins are needed to cover fixed costs as well as to generate profits. Industries in which almost all of the price-cost margin is needed to pay for fixed costs have a low profitability, even if their price-cost margin is high. A negative economic shock might push this low profitability into losses and potentially exit of otherwise healthy firms. Consequently, government aid should be targeted based on both the share of fixed costs and profitability: the case for such support is strong where fixed costs share is high and the excess profit margin is low.

From an academic point of view, this paper fits into a long-standing empirical literature on price-cost margin cyclicality. This strand explores how price-cost margins evolve over the business cycle. A countercyclical price-cost margin is a theoretical key feature in macroeconomic models (see Rotemberg & Woodford, 1992; Smets & Wouters, 2003, 2007). Most empirical papers find evidence for this relationship (Rotemberg & Woodford, 1992; Bils, Klenow & Malin, 2018) although other scholars disagree and show evidence for a positive link (Nekarda & Ramey, 2013; Kim, 2015). Empirical evidence, therefore, is still ambiguous. Our paper contributes to this debate by emphasizing that price-cost margins are the sum of the fixed cost ratio and excess profitability, which are likely to have different cyclicality patterns. In particular, with falling demand the share of fixed cost will increase while stronger competitive pressure will push down profits. As price-cost margin cyclicality is the sum of the cyclicality of the fixed cost ratio and the cyclicality of the excess profitability, the different cyclicality of the two components can lead to ambiguous patterns of price-cost margin cyclicality.

This paper also relates to literature on the cleansing effect during recessions, i.e., recession periods push the least productive firms out of the market and reallocate resources towards more productive firms (see Foster, Grim & Haltiwanger, 2015; Van den bosch & Vanormelingen, 2017 for evidence from US and Belgium, respectively). There is a trade-off between saving efficient firms facing only temporary financial issues on the one hand and allowing for efficient reallocation on the other hand. Saving all firms would be both expensive and disruptive for efficient reallocation while withdrawing all support would lead to inefficient liquidation of healthy firms. Hence, government aid measures should be well-designed and targeted.

Making use of exceptionally long Belgian firm level accounts from 1985 until 2014, we show that the fixed cost ratio is indeed negatively linked to the business cycle (countercyclical) while the excess profitability is positively linked to the business cycle (procyclical). If fixed costs are high relative to profits, then the price-cost margin should be countercyclical. Vice versa, if excess profits are high relative to fixed costs, then the price-cost margin should be procyclical. Empirically, we find that fixed costs are high relative to excess profits such that price-cost margins are countercyclical in Belgium.

Moving the focus from business cycle evolutions to investigating a specific crisis, we find that fixed cost ratios rose significantly during the Great Recession of 2008/2009 while the excess profitability decreased. The ongoing COVID-19 pandemic is likely to have even stronger effects such that industries with high operating revenue losses, high fixed costs and high fixed costs relative to their price-cost margin run into financial trouble. Government aid should be targeted to these industries to make sure that they survive the pandemic. After all, the pandemic should be temporary rather than structural.

This paper contains six remaining parts. Section 2 discusses the methodology. The baseline idea is presented in the main text. More technical details are available in the Appendix methodology. The third part discusses the data while the fourth section presents the results. The fifth section contains a discussion which makes the bridge from the academic insights towards policy recommendations. Section 6 presents a robustness test and section 7 concludes.

2. Methodology

2.1 Estimating price-cost margins, fixed costs and excess profits

Our estimation strategy builds on Abraham et al. (2020), which estimates price-cost margins in the presence of fixed costs. The model exploits characteristics of profit maximizing behaviour and relies on very mild assumptions. A key advantage is that one does not have to make assumptions about which input is fixed or to what extent, rather, it estimates the proportion of fixed costs for the three key types of inputs capital, labor and intermediate inputs alongside the price-cost margin. For example, the *share of fixed cost for capital* shows the share of capital stock that is fixed. Assume that fixed and variable capital equal respectively €40 and €60, then the share of fixed capital equals .40.

The price-cost margin (PCM) captures the difference between the price and the marginal cost as a fraction of the price: $PCM = \frac{P-MC}{P}$. One can always convert a price-cost margin into a mark-up through $\mu = \frac{1}{1-PCM}$. For example, a price-cost margin of 0.20 corresponds to a mark-up of 1.25.

The method contrasts different ways of representing the relationship between the growth rate of the output and growth rate of the three types of inputs at the firm level. The starting point is the Solow residual, which is a measure of total factor productivity (TFP) growth. It subtracts a weighted average of the growth in input use from output growth. Importantly, the Solow residual can be written up in four different ways which differ in two main respect. First, the weights used for the inputs can come from the shares of inputs either in costs or revenues. Second, one can model the production (primal) or the cost functions (dual).

The logic of the method builds on two principles derived from profit maximizing behaviour. First, comparing the output changes relative to a change in inputs will inform us about how different prices are from costs, or, equivalently, how large is the margin. Second, when expanding output, only variable inputs increase, therefore total input use will increase more if the share of fixed inputs is lower. Capturing the relationship between input and output growth allow us to quantify the share of fixed costs. The method combines these two principles and, by contrasting the four types of Solow residuals, it allows one to decompose price-cost margins into a part needed to cover fixed costs and another part which remains left as excess profits at the same time.

This section presents the main equations and their interpretation. A technical derivation and a detailed definition of the components can be found in the Appendix methodology. We refer to Abraham et al. (2020) for an in-depth technical discussion.

Our main equation to estimate price-cost margins looks as follows:

$$\Delta y_{it} = -PCM_{st} * \Delta {x_1}_{it} + sf_{st}^{k} * \Delta {x_2}_{it} + sf_{st}^{l} * \Delta {x_3}_{it} + sf_{st}^{m} * \Delta {x_4}_{it} + \epsilon_{it} \qquad (1)$$

where all components in Δy and Δx (see appendix methodology) are readily available in firm-level accounts for each firm-year combination. Δy represents a combination of the four Solow residuals while the various Δx components are linked to changes in output (operating revenue) and changes in the various input factors capital, labor and intermediate inputs for firm *i* in year *t,* respectively. The coefficients from estimating equation (1) are direct estimates of the price-cost margins PCM_{st}, the *share of fixed capital* sf_{st}^{k}, the *share of fixed labor* sf_{st}^{l} and the *share of fixed intermediate inputs* sf_{st}^{m} for industry *s* in year *t*. [4]

Having estimated these coefficients, this method allows one to decompose the price-cost margins into a *fixed costs ratio* and the *excess profits ratio*. The first component part of the PCM is necessary to cover fixed costs while the second component represents the excess profitability.[5] Price-cost

[4] We assume that ϵ_{it} represents an i.i.d. error term which is not subject to any specification nor measurement error. For a detailed discussion about misspecification errors, see Abraham et al. (2020).

[5] The fixed cost ratio is calculated from the share of the different inputs in production and the fixed cost shares. For example, if the share of materials, labour and capital are 70, 20 and 10 percent in production, respectively, and sf_t^m=0.3, sf_t^l=0.3 and $sf_t^k = 0.8$, $\widehat{FCR} = 0.7 * 0.3 + 0.2 * 0.3 + 0.1 * 0.8 = 0.35$. In other words, 35% percentage points from the PCM are needed to cover the fixed costs.

margins are defined as the sum of the fixed costs ratio and the excess profits ratio as shown in equation (2):

$$\widehat{PCM}_{st} \equiv \widehat{FCR}_{st} + \widehat{EPR}_{st} \qquad (2)$$

Consider, for example, an industry which needs 60% of their operating revenue to pay their variable cost such that their price-cost margin equals 40%. Assume further that 35% is needed to cover the fixed costs, then, 5% remains as excess profitability. As a result of this procedure, we can estimate the price-cost margin, the fixed cost shares for every input and the two ratios for each industry-year combinations. Importantly, this method allow to estimate these parameters at the industry level, but does not allow estimating at the firm level.

2.2 Cyclicality framework

As we have already discussed briefly, the two main components of the price-cost margins are likely to have different cyclicality. It seems reasonable to expect that the excess profits ratio is positively linked to the business cycle, i.e. firms or industries become more (less) profitable as the economy is growing (shrinking). In contrast, fixed costs become relatively more (less) dominant in bad (good) economic times. Firms produce less, but they can only cut their variable costs, hence, fixed costs represent a larger share of the total costs.

The price-cost margin cyclicality combines how the fixed cost share and the profitability move over the business cycle and, *a priori*, it is not clear which of the two effects dominates. The price-cost margin cyclicality may be negative, insignificant or positive depending on the relative importance of the fixed costs ratio cyclicality and the excess profits ratio cyclicality. This might explain why ambiguous results are still found in the literature. For example, in an industry with high fixed costs and almost no excess profits, the price-cost margin cyclicality will be close to the fixed costs cyclicality and thus countercyclical. On the other hand, consider an industry with almost no fixed costs and a high profitability. In this case, the price-cost margin cyclicality should be close to the excess profits ratio cyclicality for which our maintained hypothesis is procyclical.

We answer this question empirically by investigating how the estimated price cost margins and ratios co-move with the state of the economy in the long run. In particular, we proxy the business cycle by the growth rate of aggregate GDP.[6] Writing this more formally,

$$Y_{st} = \beta * X_t + \delta_s + \varepsilon_{st}, \qquad (3)$$

[6] We follow Bils et al. (2018) and apply the Hodrick-Prescott (HP) for all the variables in the regression filter in order to capture the cyclical component.

where Y_{st} represents the objects of interest (the price-cost margin, the fixed cost ratio or the excess profit ratio) for industry s in year t, X_t is GDP growth and δ_s represents industry fixed effects, while ε_{st} is the error term.

The slope of the regression, β shows the sign and magnitude of the cyclicality of the different components, with $\beta > 0$ showing procyclicality and $\beta < 0$ suggesting countercyclicality.

3. Data

We make use of Belgian unconsolidated firm level data, obtained from the National Bank of Belgium. This unique data set covers all for-profit firms and is particularly rich in terms of the time dimension between 1985 and 2014, thereby making it an ideal data set to study business cycle movements. We rely on the following balance sheet variables: operating revenue, wage bill, intermediate inputs, tangible fixed assets and depreciation.[7]

Table 1 shows the firm-level summary statistics. Our sample contains 305,404 firm-year observations. The 'average' Belgian firm between 1985 and 2014 has an operating revenue of 38.4 million EUR, pays 5.2 million EUR in wage costs and 29.9 million EUR in intermediate input costs. Its tangible fixed assets are worth 7.6 million EUR and the firm depreciates 1.5 million EUR on a yearly basis.

Table 1 Summary statistics: Firm-level

Variable	Mean	SD	P25	Median	P75	N
PQ	38.4	304.9	4.1	8.9	21.2	305,404
WL	5.2	32.2	0.6	1.4	3.1	305,404
$P^M M$	29.9	278.9	2.3	6.1	15.6	305,404
TFA	7.6	87.3	0.2	0.7	0.2	305,404
Depreciation	1.5	15.0	0.1	0.2	0.1	305,404
ΔPQ	6.8%	23.5%	-2.5%	4.7%	13.6%	269,789
ΔWL	4.7%	19.3%	-1.9%	3.7%	9.9%	269,789
$\Delta P^M M$	7.1%	25.4%	-3.1%	4.9%	15.2%	269,789
ΔTFA	1.7%	33.3%	-11.4%	-1.5%	10.4%	269,789
LS	0.13	0.14	0.03	0.09	0.19	305,404
MS	0.77	0.19	0.68	0.83	0.93	305,404
CS	0.10	0.11	0.04	0.06	0.11	305,404

Notes: *The top panel shows the descriptive statistics in nominal million EUR. The middle and bottom panel show the descriptive statistics in units. The number of observations is always shown in units. Summary statistics for the growth rates and the input share are weighted by operating revenue at the firm-year level. Note that price deflators are not used as we do not need this in the empirical analysis.*

This typical Belgian firm is able to increase its yearly nominal operating revenue by 6.8%. Meanwhile, labor costs, intermediate input costs and tangible fixed assets rise by 4.7%, 7.1% and 1.7%,

[7] We follow Hall and Jorgenson (1967) in order to compute the cost of capital. More details about the data can be found in the data appendix.

respectively. The intermediate input share is by far the most dominant input factor (77%), followed by the labor share (13%) and capital share (10%).

Finally, we exploit two indicators for the business cycle in equation (3). First, we make use of the real Belgian aggregate GDP growth sourced from Eurostat. Second, we calculate yearly industry value added growth rates, based on our final sample and use this as a robustness test.

4. Results

This section consists of three main parts. The first part provides a picture about the importance of fixed costs in production in Belgium. The second part takes the long term perspective and investigates how these quantities co-move with the business cycle based on three decades of firm-level data. Finally, we take a closer look on the most recent crisis on which we have data, the Great Recession of 2008/2009.

4.1 Fixed costs and margins in Belgium

Table 2 shows the distribution of the price-cost margin, the fixed cost ratio and the excess profit ratio across Belgian industries and years. We find that an 'average' Belgian industry in our sample period has a price-cost margin of .388, i.e., for every €100 in operating revenue, it pays €61.2 in variable costs and retains €38.8 in price-cost margin.[8] Almost all of it is needed to cover the fixed costs (€38.6) such that the excess profitability (€0.2) remains rather low indicating that 'on average', competition pushes down these profits to low levels.[9] Clearly, considering the strength of competition based on price-cost margins would paint a very different picture compared to the excess profit ratios.

Table 2 Summary statistics: Industry-level estimates

Variable	Mean	SD	P10	P25	Median	P75	P90	N
PCM	0.388	0.228	0.161	0.216	0.307	0.554	0.743	1,285
FCR	0.386	0.232	0.153	0.212	0.297	0.554	0.753	1,285
EPR	0.002	0.040	-0.033	-0.017	-0.002	0.013	0.040	1,285

Notes: *This table shows the mean, standard deviation, quartiles and number of observations in units for the price-cost margin (PCM), the fixed costs ratio (FCR) and the excess profits ratio (EPR). Summary statistics are weighted by operating revenue at the industry-year level. The mean share of fixed capital, labor and intermediate inputs equals 0.86, 0.35 and 0.34, respectively. This is in line with the idea that capital is quasi-fixed in the short run whereas other inputs display less fixity.*

[8] The average share of fixed capital, labor and intermediate inputs is 0.857, 0.347 and 0.341 respectively. This confirms the intuition that capital displays the largest fixity among all inputs, however, the fixed costs ratio is remarkably closer to the estimated share of intermediate inputs due to the fact the intermediate input share dominates the other input shares.

[9] Note that the profitability is 0.2% of operating revenue. Given that intermediate inputs comprises roughly three quarters of the revenues, profitability is roughly four times as large, and thus around 0.8%, in terms of value of added.

Two additional things are noteworthy. First, the average hides substantial heterogeneity at the industry level. For example, price-cost margins represent less than a quarter of revenues in more than 25 percent of the industries while the margins constitute more than 55% of revenue in the top 25 percent of industries. This heterogeneity in PCM is largely a result of the variation in the fixed cost shares, which span a similar range. The excess profit ratio varies on a smaller range, but that range spans around that critical number, zero. It turns out that it is close to zero in most industries but it exceeds 1% of the revenue for the top quartile and even 4% in the top decile. When interpreting these numbers, it is important to recall they represent industry averages and might hide substantial differences among firms. Some firms might be able to extract a lot of the economic rents while others are barely surviving and even making losses.

4.2 Cyclicality in the long term

Figure 1 sets the stage for investigating how these numbers vary with the business cycle. This figure has three panels which show how the price-cost margin, excess profits ratio and the fixed costs ratio evolve along the business cycle, respectively.

Figure 1 Cyclicality: Price-cost margins, fixed costs ratio and excess profits ratio

Notes: *This figure has three panels which show the evolution of the estimated price-cost margin, the excess profits ratio and the fixed costs ratio respectively, as well as the evolution of GDP growth. All evolutions are filtered with the Hodrick-Prescott* *filter. Grey areas indicate recession times, defined as years in which the real Belgian GDP decreased. The y-axis for GDP growth is reversed in the third panel.*

Looking at the first panel of Figure 1, there is no clear correlation between the price-cost margin and GDP growth but it seems to be the case that price-cost margin tends to be high whenever GDP growth is low, e.g. during the Great Recession, and vice versa. Decomposing the price-cost margin into the excess profits ratio and the fixed costs ratio in the second and third panel, respectively, suggests that the excess profits ratio evolves procyclical with the GDP growth. Visually, we infer that the profitability rises whenever GDP growth is increasing (e.g. from the early '90s until 2000) and vice versa (e.g. during the Great Recession).

In the third panel, we reverse the axis of GDP growth and observe that fixed costs ratio seems to rise whenever GDP growth is decreasing. In particular, firms pay more fixed costs (as a % of operating revenues) during the Great Recession. The opposite happened between 1993 and 2000, i.e., as GDP growth increases, firms use a smaller part of their operating revenues to cover the fixed costs. While these correlations are suggestive, we build on this and use a regression framework to identify these conditional correlations while controlling for industry fixed effects.

Appendix Figure A1 shows cross-country evidence for Belgium, Hungary and the United Kingdom based on firm-level accounts. Panel B shows that the excess profitability drops notably in all three countries during the Great Recession while panel C reveals that the fixed cost share is increasing. Albeit descriptive, it seems likely that the Belgian cyclicality patterns extend to other countries as well. In the remainder of the paper, we proceed with the Belgian data due to its exceptionally long time dimension, which is key in studying business cycle movements.

Table 3 shows the regression results based on equation (3). The business cycle indicator $X_t$is proxied by GDP growth while price-cost margins, the fixed costs ratio and the excess profits ratio are used as Y_{st} respectively. The former three columns show results weighted by operating revenue at the industry-year level while the latter three columns show the unweighted results. Weighted regression results take into account that larger industries drive the aggregate results while unweighted regressions give equal importance to each industry.

Table 3 Cyclicality: Aggregate results

	Weighted			**Unweighted**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	PCM	FCR	EPR	PCM	FCR	EPR
ΔGDP	-.013***	-.017***	.0038***	-.011***	-.013***	.0031**
	(.0027)	(.0028)	(.00065)	(.0032)	(.0032)	(.00100)
Industry FE	YES	YES	YES	YES	YES	YES
N	1763	1763	1763	1763	1763	1763

Notes: *This table shows the estimation results from equation (3). Columns (1)-(3) show the weighted results. Columns (4)-(6)*

show the unweighted results. Standard errors in parentheses ($^{+}$ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001). All coefficients remain significant when clustering stander errors at the year-level.

Table 1 confirms our hypotheses. In particular, as expected, the fixed costs ratio and excess profits ratio are counter- and procyclical, respectively. This means that industries experience a decrease in their fixed costs ratio as aggregate GDP is growing. Vice versa, an industry encounters an increasing fixed costs ratio whenever the economy is shrinking. Furthermore, industries enjoy increased profitability as the economy is booming while they suffer whenever the economy is going through recession times. Second, given that the price-cost margin is the sum of the fixed costs ratio and the excess profits ratio, the price-cost margin cyclicality in column (1) equals the sum of the cyclicality of the fixed costs ratio and the excess profits ratio. Empirically, we find that the price-cost margin is countercyclical due to the fact that the fixed costs ratio is by far the largest component of the price-cost margin in Belgium, i.e. the price-cost margin cyclicality is very close to the fixed cost ratio cyclicality.[10] On a smaller note, we find that the weighted and the unweighted regression results point to the same results.

Table 4 Cyclicality: Sectoral results

	Manufacturing			**Trade**			**Services**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
	PCM	FCR	EPR	PCM	FCR	EPR	PCM	FCR	EPR
ΔGDP	-.012*	-.024***	.0052***	-.0083	-.0098	.0019^{+}	-.013***	-.013**	.0023^{+}
	(.0054)	(.0055)	(.0012)	(.0081)	(.0084)	(.0010)	(.0038)	(.0042)	(.0012)
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	676	676	676	87	87	87	800	800	800

Notes: *This table shows the estimation results from equation (3). Columns (1)-(3), (4)-(6) and (7)-(9) show results for Manufacturing (10/33), Trade (45/47) and Services (49/82), respectively. Standard errors in parentheses ($^{+}$ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001). Coefficients in columns (1) until (3) remain significant when clustering at the year-level. Other coefficients lose significance.*

Table 4 investigates whether these patterns persist in the different large sectors of the economy. In particular, the regression is run separately for Manufacturing, Trade and Services. We confirm the countercyclical fixed cost share and the procyclical excess profits ratio in all sectors although the fixed cost share in Trade is insignificant. We find countercyclical price-cost margins in Manufacturing, Trade and Services albeit nog significant in Trade.

4.3 Event Study: the effects of the Great Recession

While the long term results are relevant for macroeconomic or competition policy in general, crisis times, such as the COVID-19 crisis, may be different. While no data is yet available from this recent

[10] El Gallaa (2018) finds procyclical markups for the Belgian Manufacturing industry while implicitly assuming away fixed costs. These results might be in line with our positive coefficient on the excess profits ratio. Additionally, we find countercyclicality for the fixed cost share such that the price-cost margins are countercyclical.

episode, we can investigate what happened during the most recent crisis, the Great Recession of 2008/2009 with a focused 'event study' type approach. The next section discusses these insights in light of the ongoing COVID-19 pandemic.

We proceed by focusing explicitly on the impact of the Great Recession, which we proxy by a dummy variable. The dummy equals 0 in the years 2006-2007 ('before the Great Recession') and 1 in the years 2008-2009 ('Great Recession'). Note that the Great Recession was already affecting the Belgian economy at the end of 2007 although the full impact displayed itself mainly in 2008 and 2009. Consequently, if anything, we would underestimate the impact of the episode. Table 3 shows the estimation results of equation (3) in which the business cycle indicator is replaced by the dummy variable while focusing only on the years 2006-2009.[11]

Table 5 Cyclicality: Great Recession

	Weighted			**Unweighted**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Great Recession=1	.0075 (.021)	.047* (.020)	-.010^{+} (.0057)	.038 (.024)	.055* (.023)	-.0028 (.0076)
Industry FE	YES	YES	YES	YES	YES	YES
Observations	256	256	256	256	256	256

Notes: *This table shows the estimation results from equation (3) during the period 2006-2009. The business cycle indicator is a dummy variable which equals zero in 2006 and 2007 ; and 1 in 2008 and 2009. Columns (1)-(3) show the weighted results. Columns (4)-(6) show the unweighted results. Standard errors in parentheses ($^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). All coefficients become insignificant when clustering standard errors at the year-level.*

Table 3 shows that the patterns during the Great Recession did not differ from the overall results in the long-run analysis. The fall in output leads to an insignificant increase in price-cost margins, caused by two effects. First, the fixed costs ratio has risen significantly during the Great Recession, because, as we have seen, industries need a larger share of their operating revenue to cover for the fixed costs which, by definition, do not change as the economy is being hit by this severe shock. Second, industries observe a fall in their excess profitability during the Great Recession because of increased competition. Note that the excess profitability decreases both when using weighted or unweighted results, however, the fall is only significant in the former case.

The Great Recession has mainly affected the price-cost margins through the fixed costs ratio mechanism. In particular, industries and firms experience a sharp increase in their fixed costs ratio once this crisis hit the economy while generating less profits. This might cause many industries or firms to get into financial trouble, even if they were otherwise operating efficiently. This suggests that the fixed cost channel is quite strong during crisis times, and, as a consequence, it may lead to

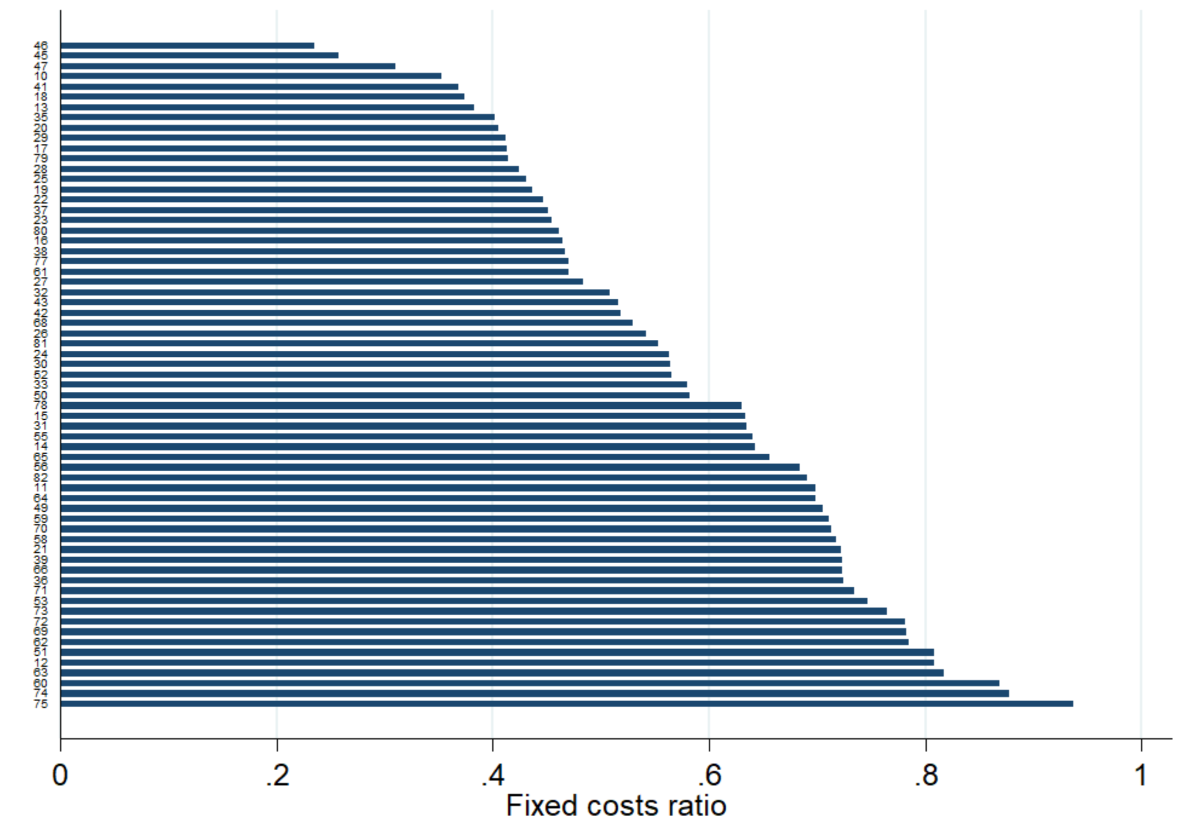
[11] Appendix Figure A2 shows the change in HP filtered price-cost margin, fixed costs ratio and excess profits ratio between 2006 and 2009 by industry. Most industries experience an increase in the fixed cost share and a decrease in the excess profits ratio.

serious adverse effects during the current COVID-19 pandemic, where the fall in demand is even more pronounced.

5. Discussion

The ongoing COVID-19 pandemic led many governments around the world to implement a lockdown to contain the spread of the virus, among which the Belgian government. This lockdown has inflicted an unprecedented blow for the economy, estimated at a decrease of 12.2% for the Belgian economy (NBB, 2020). The various governments (federal, regional and municipalities) reacted instantly and tried to control the damage to the economy through a system of temporarily economic unemployment and subsidies. The fall in output and the high cost of some of these measures make effective targeting and credible exit strategies fundamental. This involves a delicate trade-off: saving all firms would be both expensive and hinder efficient reallocation, while withdrawing support for all firms would lead to inefficient liquidation of healthy firms.

Figure 2 Fixed costs ratio by industry

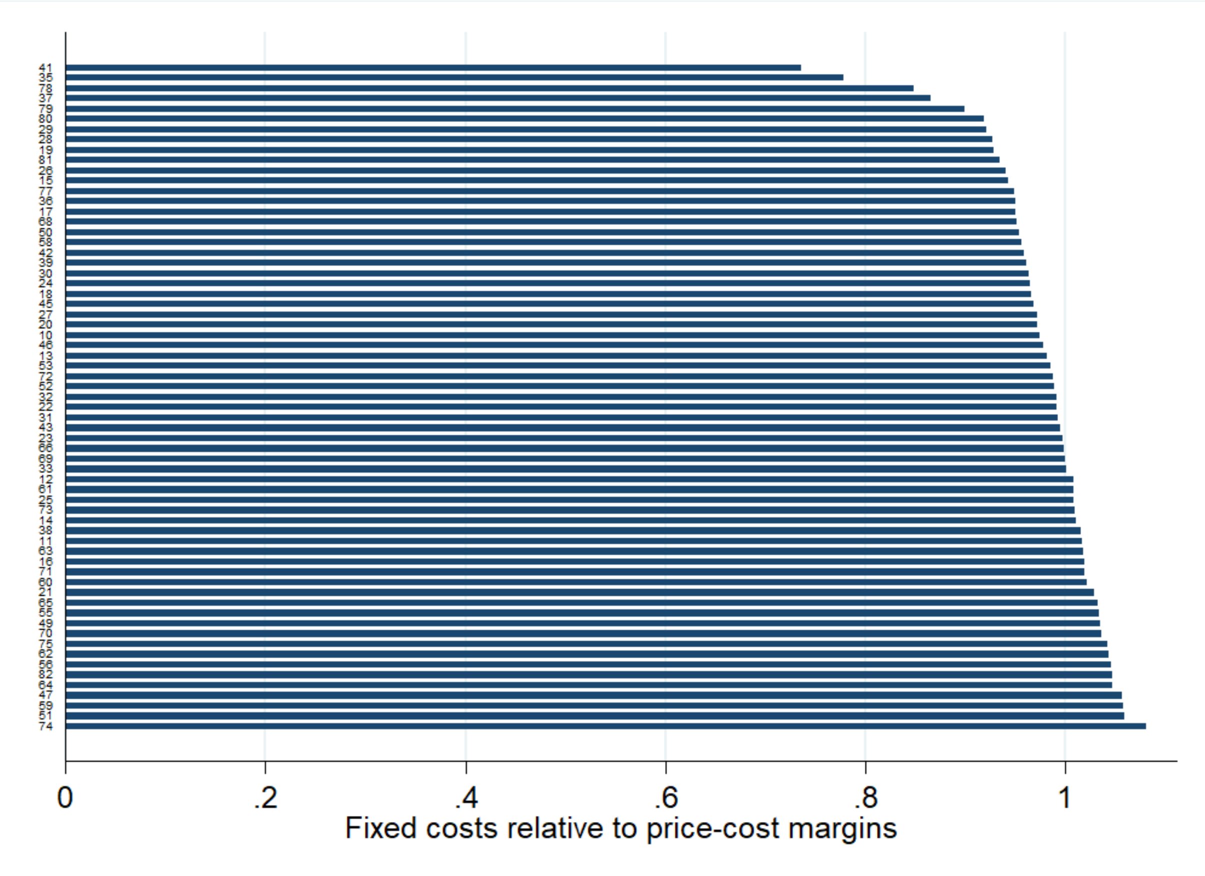


Notes: *This figure shows the estimated fixed costs ratio by two digit industry, averaged over the period 1985-2014. Values are sorted from low to high.*

The approach in this paper provides a simple guide for governments when deciding which industries and firms to target. The probability of inefficient exit is higher when both fixed costs and the fall in demand are high.[12] Fixed costs used to be hard to observe as firms do not have to classify their expenses as variable or fixed and accounting conventions do not follow the economic distinction in this respect. However, the framework used in this article allows one to estimate the fixed costs ratio based on firms' balance sheet information, which is publicly available. Identifying industries with high fixed cost shares is therefore a critical input into efficient targeted policies.

Figure 1 shows the fixed costs ratio, averaged over the sample period, for the Belgian industries. Appendix Table 1 includes the full description of the corresponding NACE two digits industry.

Figure 3 Crisis vulnerability index



Notes: *This figure shows the ratio of the estimated fixed costs ratio and the estimated price-cost margin by two digit industry, averaged over the period 1985-2014. Values are sorted from low to high. We only keep ratios below 1.1.*

Some industries with high fixed costs are air transport[13] (FCR: 0.80 ; NACE: 51), scientific research and development (FCR: 0.78 ; NACE: 72) and advertising and market research (FCR: 0.78 ; NACE: 73). On the lower side of the estimates, we find Wholesale trade, except of motor vehicles and

[12] Statistics Belgium (2020) provides (provisional) industry-specific data on operating revenue loss. The largest decline in operating revenues between 2019 and 2020 is observed in NACE industries 79 (Travel agency, tour operator and other reservation service and related activities), 55 (Accomodation), 56 (Food and beverage service activities), 51 (Air transport) and 19 (Manufacture of coke and refined petroleum products).

[13] The Belgian government provided a loan of 290 million EUR for Brussels Airlines such that this company is able to survive the current crisis (VRT News, 2020).

motorcycles (FCR: 0.23 ; NACE: 46), Wholesale and retail trade and repair of motor vehicles and motorcycles (FCR: 0.25 ; NACE: 45) and Retail trade, except of motor vehicles and motorcycles (FCR: 0.30 ; NACE: 47).

The fact that specific industries have low fixed costs does not necessarily mean that inefficient liquidation cannot happen in those industries. Policy measures should also consider the extent to which excess profitability is able to provide a buffer for falling revenues. In highly competitive industries with low excess profit ratios, inefficient liquidation can happen even if the fixed cost share is not very high. This insight can be operationalized by a measure which takes into account both components of the price cost margins. One such measure is the ratio of the fixed costs ratio and the price-cost margin, which we call the *Crisis vulnerability index*. High values indicate that industries or firms need their price-cost margins almost exclusively to cover remaining fixed costs, therefore even a small fall in demand may generate inefficient liquidation of healthy firms. Likewise, low values show that industries or firms are able to retain a large part of their price-cost margin as excess profits due to the fact that fixed costs constitute only a smaller fraction of the price-cost margin. Figure 3 visualizes the values of these fixed costs to price-cost margins ratios.

This figure shows that many industries need large parts of their price-cost margin to cover their fixed costs. In particular, almost all industries need more than 80% of their price-cost margin to pay for the fixed costs and more than half needs 90% to do so. Likewise, most industries can retain less than 10% of their price-cost margin as excess profits. Moreover, some industries are operating around the break-even point. This might explain why governments have taken measures to support, for example, the retail sector (NACE: 47) despite the fact their estimated fixed costs ratio is amongst the lowest. Low excess profit margins make this highly competitive industry vulnerable for a fall in demand even though the fixed costs ratio is not especially high.[14]

We consider these industry-level measures as one of the criteria governments can use when designing targeted policies. Obviously, notable differences remain to exist between firms even within the same industry and governments can and probably should take these firm-level differences into account. Moreover, specific industries are more affected by the lockdown measures than others, which requires special treatment. We provide guidelines on how policy makers can implement targeted measures rather than broad-based, and expensive, policy measures. It is essential to provide support for industries or firms which are characterized by high fixed cost and low profitability. These industries are competitive in normal times, but become unprofitable as demand

[14] There other reasons, beyond the fixed cost share dimension, why a government would like to support an industry. For example, the retail sector (47) can be considered as an essential industry during the pandemic. Moreover, costs went up significantly due to social distance rules and prevention measures.

collapses in this pandemic. An economic recovery plan should target these firms in order to preserve the economic fabric of our society.

6. Robustness test

We consider one robustness test to validate our main result. In particular, we use GDP growth at the industry-year level as business cycle indicator. This allows to explore the price-cost margin cyclicality at an industry-level rather than at the aggregate level, thereby inducing more variation to exploit in subsequent research. More specifically, we use equation (3) with the industry-level GDP growth as measure of the business cycle. We show the general regression results in Table 6.

Table 6 Cyclicality: Industry results

	(1) PCM	(2) FCR	(3) EPR
Industry GDP growth	-.046	-.086*	.027***
	(.034)	(.035)	(.0082)
Observations	1699	1699	1699

Notes: *This table shows the estimation results from equation (3). The business cycle indicator is the industry-level GDP growth. Standard errors in parentheses (+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). All coefficients become insignificant when clustering standard errors at the year-level.*

Table 6 shows that our main results are robust to this alternative business cycle indicator, i.e., we find countercyclicality for the fixed costs ratio and procyclicality for the excess profits ratio. Combining these two effects, we observe that price-cost margins are countercyclical albeit insignificantly.

7. Conclusion

The current COVID-19 pandemic leads to a sharp decrease in operating revenue for many industries and firms. Although variable costs related to the foregone production can be avoided, fixed expenses still have to be paid. Firms which are no longer able to do so might run rapidly into liquidity problems leading to inefficient exit. Governments reacted instantly and initiated various aid programs to guide healthy firms through the crisis, however, budget deficits are widening and public debt is increasing. Therefore, it is essential that policy measures are targeted rather than broad-based.

This paper argues that the case for support is high in industries which are characterized by the following criteria: 1) a substantial loss of operating revenue, 2) a high fixed cost share and 3) a low profitability relative to the price-cost margin. The first component is readily available from accounting information, however, the latter two components cannot easily be identified. Firms are not required to report the distinction between variable and fixed costs in their accounts. Based on a novel methodology (Abraham et al., 2020), we estimate industry-level price-cost margins and decompose them into a part needed to pay for fixed costs and a part which remains left as excess profitability.

We illustrate this methodology with Belgian firm-level data from 1985 until 2014 and identify the industries which should be targeted based on these three criteria. Further, we show that the fixed costs ratio and the excess profits ratio evolve differently during crisis times. The fixed cost share is countercyclical while the excess profitability is procyclical, i.e., fixed cost shares rise in crisis times while profitability decreases. The ongoing COVID-19 pandemic is likely to amplify this channel even more such that fixed costs might become hard, if not impossible, to carry as profits and buffers vanish. One key dimension of an economic exit strategy is to target government aid towards industries which are prone to high liquidity losses, high fixed cost shares and low profitability.

Appendix: Methodology

We start from a standard short run production function which is homogeneous of degree one in variable capital K^v, variable labor L^v and variable intermediate inputs M^v such that the returns to scale are constant for variable inputs for firm *i* in year *t*,

$$Q_{it} = F(K_{it}^v, L_{it}^v, M_{it}^v)\Theta_{it} \qquad \text{(A1)}$$

where production function F(.) uses inputs capital, labor and intermediate inputs to produce physical output Q. Θ represents an index of Hicks-neutral technological change.

A variable input is defined is defined as an input which adjusts within one time period without frictions. Likewise, a fixed input is defined as an input which does not adjust within one time period and/or experiences frictions. The share of variable (fixed) capital sv^k (sf^k), the share of variable (fixed) labor sv^l (sf^l) and the share of variable (fixed) intermediate inputs sv^m (sf^m) are defined as the share of the input which is variable (fixed). For example, a firm has €100 in total capital costs of which €30 (€70) is needed to pay variable (fixed) capital costs, then, the share of variable (fixed) capital is 30% (70%). In the remainder of the derivation, we omit the subscripts for firms and time after which we add them again in the final main equation.

Allowing for the presence of fixed costs and imperfect competition in the product market, output growth is defined is a weighted sum of the variable input growth augmented by the mark-up and the growth rate of productivity as,

$$\Delta q = \frac{P}{MC}\left(\frac{sv^k RK}{PQ}\Delta k^v + \frac{sv^l WL}{PQ}\Delta l^v + \frac{sv^m P^M M}{PQ}\Delta m^v\right) + \Delta\theta \qquad \text{(A2)}$$

where $\frac{sv^k RK}{PQ}$, $\frac{sv^l WL}{PQ}$ and $\frac{sv^m P^M M}{PQ}$ are defined as the share of variable capital cost, variable labor cost and variable intermediate input cost in revenue, respectively. Growth rates are shown by Δ and are defined as the difference between the value in year *t* and year *t-1* divided by the sum of the values in year *t* and year *t-1*. The primal revenue-based Solow residual is defined as,

$$SRQ^R \equiv \Delta q - \frac{WL}{PQ}\Delta l - \frac{P^M M}{PQ}\Delta m - \left(1 - \frac{WL}{PQ} - \frac{P^M M}{PQ}\right)\Delta k \qquad \text{(A3)}$$

with $\Delta q, \Delta l, \Delta m \; and \; \Delta k$ defined as the growth rate of physical output *q*, number of employees *l*, units of intermediate inputs *m* and capital units *k*. This Solow residual is positive if the growth rate of the output exceeds the weighted growth rate of the inputs. For example, the growth rate of output equals 5% while all inputs increase by 3%, then the Solow residual equals 2%. Hence, the firm or the industry becomes more productive.

Substituting equation (A2) in the primal revenue-based Solow residual defined in equation (A3), allows to rewrite the primal revenue-based Solow residual as follows:

$$SRQ^R = PCM(\Delta q - \Delta k) + \frac{(1-\mathrm{sv^l})WL}{PQ}(\Delta k - \Delta l) + \frac{(1-\mathrm{sv^m})P^M M}{PQ}(\Delta k - \Delta m) + \frac{\mathrm{sv^k}RK}{PQ}(\Delta \mathrm{k^v} - \Delta k) + \frac{\mathrm{sv}^l WL}{PQ}(\Delta l^{\mathrm{v}} - \Delta l) + \frac{\mathrm{sv^m}P^M M}{PQ}(\Delta \mathrm{m^v} - \Delta m) + (1-B)\Delta\theta \qquad \text{(A4)}$$

Equation (A4) shows that the primal revenue-based Solow residual captures the growth rate of productivity as well as additional wedges introduced by the presence of price-cost margins on the one hand and fixed factors of production on the other hand. Under the simplifying assumptions that fixed cost and price-cost margin do not exist, i.e. these components equal zero, all components except the final one in equation (A4) drop out such the primal revenue-based Solow residual only captures the growth rate of technology.

Following Roeger (1995), we exploit the dual revenue-based Solow residual to eliminate the unobservable productivity growth. Define the cost function $C(W, R, P^M, Q, \theta) = \frac{G(W,R,P^M)Q}{\theta}$ with G(.) homogeneous of degree one. The growth rate of product price Δp is defined as,

$$\Delta p = \frac{P}{MC}\left(\frac{\mathrm{sv^k RK}}{\mathrm{PQ}}\Delta r + \frac{\mathrm{sv^l WL}}{\mathrm{PQ}}\Delta w + \frac{\mathrm{sv}^m P^M M}{\mathrm{PQ}}\Delta p^M\right) - \Delta\theta \qquad \text{(A5)}$$

with $\Delta r, \Delta w\ and\ \Delta p^M$ defined as the growth rate of the cost of capital, the average firm-level wage and the price of the intermediate input. Define the dual revenue-based Solow residual as,

$$SRP^R \equiv \frac{WL}{PQ}\Delta w + \frac{P^M M}{PQ}\Delta p^M + \left(1 - \frac{WL}{PQ} - \frac{P^M M}{PQ}\right)\Delta r - \Delta p \qquad \text{(A6)}$$

The dual revenue-based Solow residual is negative (positive) if the growth rate of the product price exceeds (is less than) the weighted growth rate of the inputs. Substituting equation (A5) into equation (A6) leads to,

$$SRP^R = -PCM(\Delta p - \Delta r) + \frac{(1-\mathrm{sv^l})WL}{PQ}(\Delta w - \Delta r) + \frac{(1-\mathrm{sv^m})P^M M}{PQ}(\Delta p^M - \Delta r) + (1-B)\Delta\theta \qquad \text{(A7)}$$

Taking the difference of equations (A3) and (A7) gives,

$$SRQ^R - SRP^R = PCM[(\Delta p + \Delta q) - (\Delta k + \Delta r)] + \frac{(1-\mathrm{sv^l})WL}{PQ}(\Delta k + \Delta r) + \frac{(1-\mathrm{sv^m})P^M M}{PQ}(\Delta k + \Delta r) + \frac{(\mathrm{sv^l}-1)WL}{PQ}(\Delta w + \Delta l) + \frac{(\mathrm{sv^m}-1)P^M M}{PQ}(\Delta p^M + \Delta m) + \frac{\mathrm{sv^k RK}}{\mathrm{PQ}}(\Delta \mathrm{k^v} - \Delta \mathrm{k}) + \frac{\mathrm{sv^l WL}}{\mathrm{PQ}}(\Delta \mathrm{l^v} - \Delta \mathrm{l}) + \frac{\mathrm{sv^m}P^M M}{\mathrm{PQ}}(\Delta m^v - \Delta \mathrm{m}) \qquad \text{(A8)}$$

and allows to eliminate the unobservable growth rate of productivity $\Delta\theta$. The difference of the primal and dual revenue-based Solow residual can be explained by a price-cost margin component and the presence of fixed factors of production. There is still more than one unobservable in the latter three components. In order to resolve this issue, we exploit the primal and dual cost-based Solow residuals as well. We follow the same roadmap to obtain the difference between the primal and dual cost-based Solow residual after which we exploit the difference between the four Solow residuals.

Using cost shares and the assumption of constant returns to scale for variable inputs, we obtain $MC * Q = C^v$ with MC and C^v defined as the marginal cost and the total variable costs respectively, we can rewrite equation (A2) as,

$$\Delta q = \frac{sv^k RK}{C^v}\Delta k^v + \frac{sv^l WL}{C^v}\Delta l^v + \frac{sv^m P^M M}{C^v}\Delta m^v + \Delta\theta \qquad \text{(A9)}$$

which we then substitute in the primal cost-based Solow residual

$$SRQ^C \equiv \Delta q - \frac{WL}{C}\Delta l - \frac{P^M M}{C}\Delta m - \frac{RK}{C}\Delta k \qquad \text{(A10)}$$

to obtain the alternative primal cost-based Solow residual,

$$SRQ^C = \left(1 - sv^k\right)\frac{RK}{C}(\Delta q - \Delta k) + \left(1 - sv^l\right)\frac{WL}{C}(\Delta q - \Delta l) + (1 - sv^m)\frac{P^M M}{C}(\Delta q - \Delta m) +$$
$$sv^k\frac{RK}{C}(\Delta k^v - \Delta k) + sv^l\frac{WL}{C}(\Delta l^v - \Delta l) + sv^m\frac{P^M M}{C}(\Delta m^v - \Delta m) + \frac{C^v}{C}\Delta\theta \qquad \text{(A11)}$$

We exploit the dual cost-based Solow residual and define the growth rate of the product price as,

$$\Delta p = \frac{sv^k RK}{C^v}\Delta r + \frac{sv^l WL}{C^v}\Delta w + \frac{sv^m P^M M}{C^v}\Delta p^M - \Delta\theta \qquad \text{(A12)}$$

and substitute it in the dual cost-based Solow residual defined in equation (A13),

$$SRP^C \equiv \frac{RK}{C}\Delta r + \frac{WL}{C}\Delta w + \frac{P^M M}{C}\Delta p^M - \Delta p \qquad \text{(A13)}$$

to get,

$$SRP^C = -\left(1 - sv^k\right)\frac{RK}{C}(\Delta p - \Delta r) - (1 - sv^l)\frac{WL}{C}(\Delta p - \Delta w) - (1 - sv^m)\frac{P^M M}{C}(\Delta p - \Delta p^M) + \frac{C^v}{C}\Delta\theta$$
(A14)

Combining the primal and dual cost-based Solow residual from equations (A11) and (A14) gives,

$SRQ^C - SRP^C = \left(1 - \mathrm{sv}^k\right)\frac{RK}{C}[(\Delta p + \Delta q) - (\Delta k + \Delta r)] + \left(1 - \mathrm{sv}^\mathrm{l}\right)\frac{WL}{C}[(\Delta p + \Delta q) - (\Delta w + \Delta l)] + (1 - \mathrm{sv}^\mathrm{m})\frac{P^M M}{C}[(\Delta p + \Delta q) - (\Delta m + \Delta p^M)] + \frac{\mathrm{sv}^k RK}{C}(\Delta k^v - \Delta k) + \frac{\mathrm{sv}^l WL}{C}(\Delta l^v - \Delta l) + \frac{\mathrm{sv}^m P^M M}{C}(\Delta m^v - \Delta m)$ (A15)

which shows that the difference of the two cost-based Solow residuals is not subject to the growth rate of productivity nor to the price-cost margin. Nevertheless, the fourth, fifth and sixth still have more than one unobservable such that we cannot uniquely identify all unobserved components.

We resolve this by exploiting the difference between the difference between the primal and dual cost-based Solow residual on the one hand and the difference between the primal and dual revenue-based Solow residual on the other hand, which looks like a “difference-in-difference” (DID) approach. Note that we deviate from Abraham et al. (2020) as we multiply both sides of equation (A15) by $\frac{C}{PQ}$ to get the same denominator. This avoids some of the winsorizing steps done in Abraham et al. (2020).

Finally, we obtain our main equation (1) as introduced in the main text.

$\Delta y_{it} = -PCM_{st} * \Delta x_{1_{it}} + sf_{st}^k * \Delta x_{2_{it}} + sf_{st}^l * \Delta x_{3_{it}} + sf_{st}^m * \Delta x_{4_{it}} + \epsilon_{it}$ (1)

with $\Delta y_{it} = \left(SRQ_{it}^C - SRP_{it}^C\right)\frac{C_{it}}{PQ_{it}} - \left(SRQ_{it}^R - SRP_{it}^R\right)$, $\Delta x_{1_{it}} = [(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}]$, $\Delta x_{2_{it}} = \frac{RK_{it}}{PQ_{it}}[(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}]$, $\Delta x_{3_{it}} = \frac{WL_{it}}{PQ_{it}}[(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}]$ and $\Delta x_{4_{it}} = \frac{P^M M_{it}}{PQ_{it}}[(\Delta p + \Delta q)_{it} - (\Delta k + \Delta r)_{it}]$. $(\Delta p + \Delta q)_{it}$ and $(\Delta k + \Delta r)_{it}$ are defined as the growth rate of operating revenue and the growth rate of total cost of capital, respectively. SRQ(C), SRP(C), SRQ(R) and SRP(R) are defined as in equations A10, A13, A3 and A6 respectively. We weigh equation (1) by operating revenue at the firm-year level.

Having estimated both the price-cost margin and the shares of fixity for each input factor, we can now decompose the price-cost margins into a fixed costs ratio and an excess profits ratio. The former component is needed to cover fixed costs while the latter component represents the profitability. Price-cost margins are defined as the sum of the fixed costs ratio and the excess profits ratio as shown in equation (2):

$\widehat{PCM}_{st} \equiv \widehat{FCR}_{st} + \widehat{EPR}_{st}$ (2)

with $\widehat{FCR}_{st} \equiv \frac{\left(\widehat{sf_{st}^k} * RK_{st} + \widehat{sf_{st}^l} * WL_{st} + \widehat{sf_{st}^m} * P^M M_{st}\right)}{PQ_{st}}$; $\widehat{EPR}_{st} = \widehat{PCM}_{st} - \frac{\left(\widehat{sf_{st}^k} * RK_{st} + \widehat{sf_{st}^l} * WL_{st} + \widehat{sf_{st}^m} * P^M M_{st}\right)}{PQ_{st}}$

where RK_{st}, WL_{st}, $P^M M_{st}$ and PQ_{st} represent respectively total capital costs, total labor costs, total intermediate input costs and operating revenue at the industry-year level.

Appendix: Data

This paper uses balance sheet information from Belgian unconsolidated firms. The sample period goes from 1985 until 2014. Firms are identified by their unique VAT number and are assigned to a NACE rev. 2 two-digit industry.[15] The data set covers all for-profit firms which are legally required to report an annual income statement. Small firms are not obliged to report however some of them still choose to do so voluntarily. Small firms are firms that do not exceed one of the following criteria (2014 levels): average number of employees above 50 FTE, €7.3 million turnover and €3.65 million balance sheet total (Bijnens & Konings, 2018). Self-employed people are not included. The data set covers an increasing number of employees: employment is 881,701 in 1985 and 1,496,192 in 2014.

Variable definition – We follow Hall & Jorgenson (1967) and define the nominal rental cost of capital as $R_{it} = P_{I_t}(r_t - \pi_t + \delta_{it})$ for firm i in year t. We follow Konings, Van Cayseele and Warzynski (2005) in order to calculate the depreciation rate δ_{it}, defined as the ratio of depreciation in year t-1 and tangible fixed assets in year t for firm i. We limit the depreciation rate at 100%. Note that Belgian firms report depreciation only since 1996, therefore, we assume that the depreciation rate before 1996 equals the depreciation rate in 1996. Furthermore, we obtain the price index of investment goods P_I from the World Bank. Inflation π and the nominal interest rate r are sourced from the OECD. The three latter variables are at the Belgian country-year level.

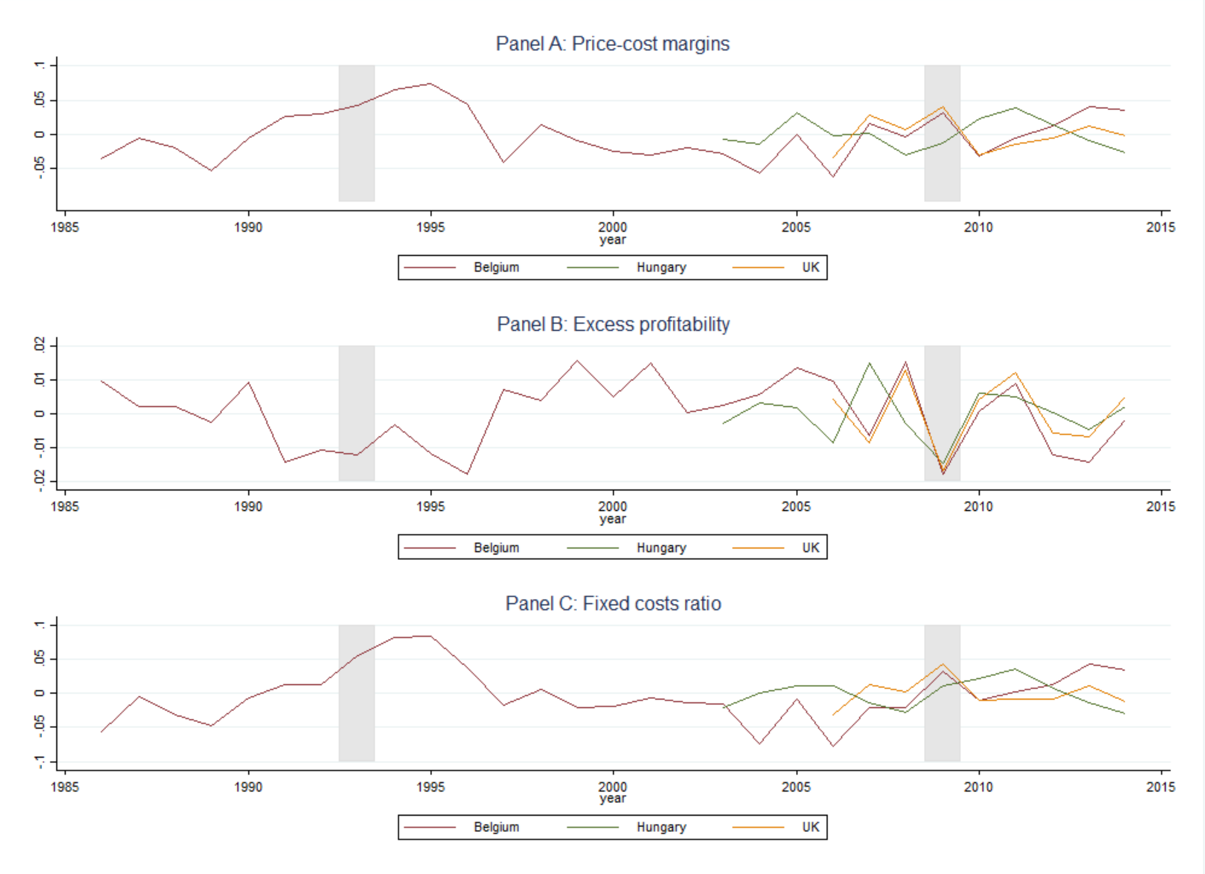
Data cleaning (firm-level) – As part of the data cleaning process, we focus on firms which belong to the private sector (NACE codes: 10/82). We keep firms which have a nonnegative value for operating revenue, wage costs, intermediate input costs, tangible fixed assets and which report their NACE rev. 2 two-digit code. We drop firms with a negative or zero value for depreciation. We drop firms with a labor share or an intermediate input share larger than one. We replace negative capital shares by a value of zero. Finally, we winsorize the variables in equation (1) at the 1st and 99th percentile at the sector level to account for outliers. We define four sectors: Industry (10/33), Trade (45/47), Services (49/82) and Other. The numbers in parentheses refer to the NACE rev. 2 two-digit codes.

Data cleaning (industry-level) – We estimate equation (1) and (2) at the industry-year level. We remove industries-years which have an estimated price-cost margin or fixed costs ratio below 0% or above 100% as well as industries with an excess profits ratio below -10% or above 100%. We interpolate the price-cost margin, fixed costs ratio and the excess profits ratio after which we obtain the HP filtered deviations, by industry.

[15] NACE is the industry standard classification system used in the European Union.

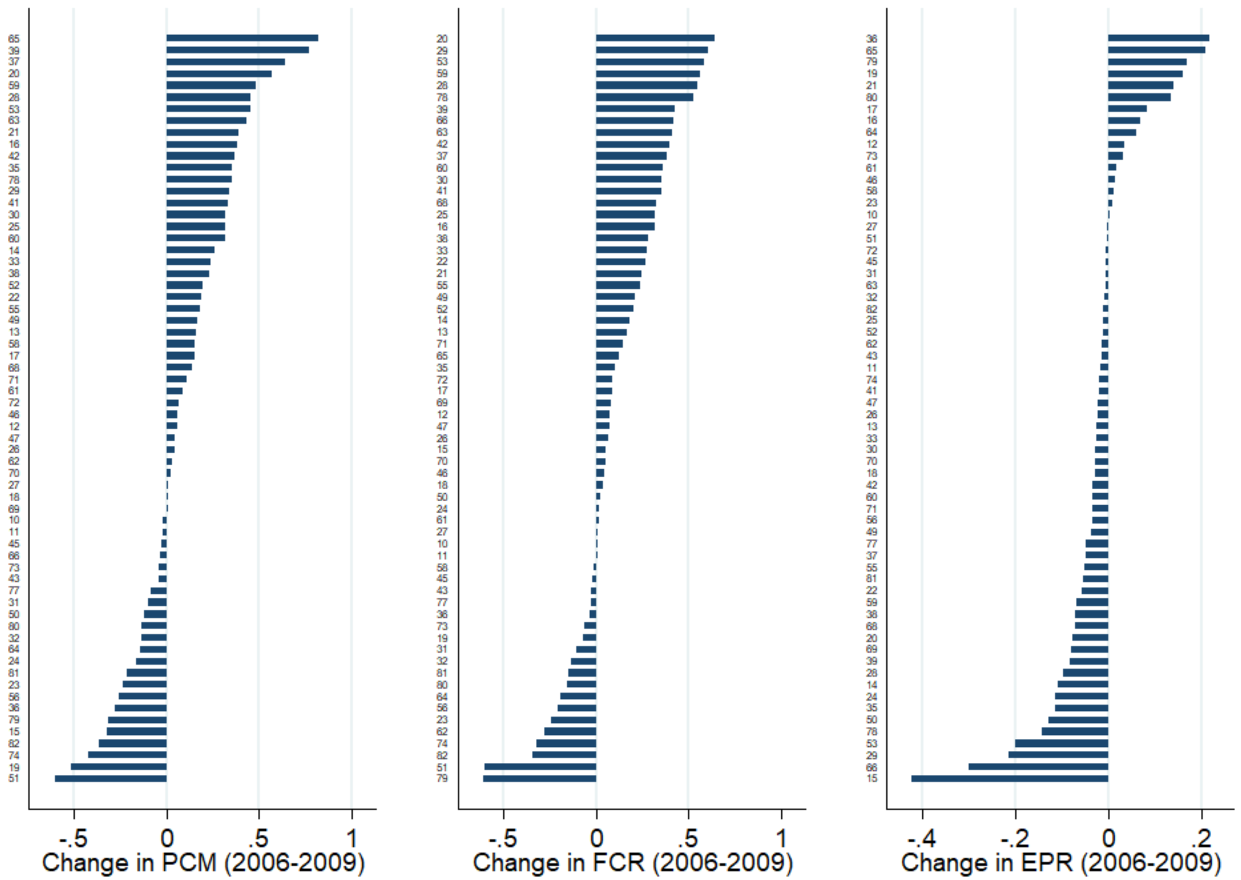
Appendix: Figures

Figure A1 Evolution of price-cost margin, excess profitability and fixed costs ratio for various countries



Notes: *This figure has three panels which show the evolution of the estimated price-cost margin, the excess profits ratio and the fixed costs ratio respectively for Belgium, Hungary and the United Kingdom. All evolutions are filtered with the Hodrick-Prescott filter. Grey areas indicate recession times, defined as years in which real GDP decreased in Belgium. Source: Authors' own calculations based on the methodology explained in this paper. We use firm-level data from the National Bank of Belgium (Belgium), ??? (Hungary) and Orbis Global (United Kingdom).*

Figure A2 Change in PCM, FCR and EPR (2006-2009)



***Notes:** This figure shows the change in, HP filtered, price-cost margin, fixed costs ratio and excess profits ratio between 2006 and 2009 by NACE revision 2 two digits industry based on equation (1) and (2).*

Appendix: Table

Table A1 Industry description

Sector	NACE	Fixed costs ratio	P-value (FCR)	Ratio (FCR/PCM)	Industry description
G	46	.23	<.001	1.01	Wholesale trade, except of motor vehicles and motorcycles
G	45	.25	<.001	.968	Wholesale and retail trade and repair of motor vehicles and motorcycles
G	47	.30	<.001	1.08	Retail trade, except of motor vehicles and motorcycles
C	10	.35	<.001	.967	Manufacture of food products
F	41	.36	<.001	.739	Construction of buildings
C	18	.37	<.001	.999	Printing and reproduction of recorded media
C	13	.38	<.001	1.01	Manufacture of textiles
C	20	.40	<.001	.984	Manufacture of chemicals and chemical products
D	35	.40	<.001	.767	Electricity, gas, steam and air conditioning supply
N	79	.41	<.001	.832	Travel agency, tour operator and other reservation service and related activities
C	17	.41	<.001	2.12	Manufacture of paper and paper products
C	29	.41	<.001	.985	Manufacture of motor vehicles, trailers and semi-trailers
C	28	.42	<.001	.959	Manufacture of machinery and equipment n.e.c.
C	19	.43	<.001	.895	Manufacture of coke and refined petroleum products
C	25	.43	<.001	1.05	Manufacture of fabricated metal products, except machinery and equipment
C	22	.44	<.001	.984	Manufacture of rubber and plastic products
C	23	.45	<.001	1.15	Manufacture of other non-metallic mineral products
E	37	.45	<.001	.716	Sewerage
J	61	.46	<.001	1.43	Telecommunications
N	77	.46	<.001	.956	Rental and leasing activities
E	38	.46	<.001	1.04	Waste collection, treatment and disposal activities; materials recovery
C	16	.46	<.001	1.12	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
N	80	.46	<.001	.935	Security and investigation activities
C	27	.48	<.001	.966	Manufacture of electrical equipment
C	32	.50	<.001	1.01	Other manufacturing
F	42	.51	<.001	.999	Civil engineering

F	43	.51	<.001	.988	Specialised construction activities
L	68	.52	<.001	1.08	Real estate activities
C	26	.54	<.001	.935	Manufacture of computer, electronic and optical products
N	81	.55	<.001	.920	Services to buildings and landscape activities
H	52	.56	<.001	.985	Warehousing and support activities for transportation
C	30	.56	<.001	.990	Manufacture of other transport equipment
C	24	.56	<.001	.947	Manufacture of basic metals
C	33	.57	<.001	.991	Repair and installation of machinery and equipment
H	50	.58	<.001	.951	Water transport
N	78	.62	<.001	.933	Employment activities
C	31	.63	<.001	.997	Manufacture of furniture
C	15	.63	<.001	.940	Manufacture of leather and related products
C	14	.64	<.001	1.08	Manufacture of wearing apparel
I	55	.64	<.001	1.23	Accommodation
K	65	.65	<.001	1.02	Insurance, reinsurance and pension funding, except compulsory social security
I	56	.68	<.001	1.05	Food and beverage service activities
K	64	.69	<.001	1.06	Financial service activities, except insurance and pension funding
C	11	.69	<.001	1.00	Manufacture of beverages
N	82	.69	<.001	1.04	Office administrative, office support and other business support activities
H	49	.70	<.001	1.03	Land transport and transport via pipelines
J	58	.71	<.001	.993	Publishing activities
M	70	.71	<.001	1.03	Activities of head offices; management consultancy activities
J	59	.71	<.001	1.06	Motion picture, video and television programme production, sound recording and music publishing activities
E	36	.72	<.001	.896	Water collection, treatment and supply
K	66	.72	<.001	1.00	Activities auxiliary to financial services and insurance activities
E	39	.72	<.001	.915	Remediation activities and other waste management services
C	21	.72	<.001	1.07	Manufacture of basic pharmaceutical products and pharmaceutical preparations
M	71	.73	<.001	1.05	Architectural and engineering activities; technical testing and analysis
H	53	.74	<.001	1.02	Postal and courier activities
M	73	.76	<.001	1.00	Advertising and market research

J	62	.78	<.001	1.05	Computer programming, consultancy and related activities
M	69	.78	<.001	1.04	Legal and accounting activities
M	72	.78	<.001	.999	Scientific research and development
C	12	.80	<.001	.868	Manufacture of tobacco products
H	51	.80	<.001	1.09	Air transport
J	63	.81	<.001	1.10	Information service activities
J	60	.86	<.001	1.12	Programming and broadcasting activities
M	74	.87	<.001	1.09	Other professional, scientific and technical activities
M	75	.93	<.001	1.00	Veterinary activities

Notes: *This table contains the sector code in column (1), the NACE two digit code in column (2), the estimated fixed costs ratio averaged over the sample period in column (3), the ratio of the estimated fixed costs ratio and the price-cost margin averaged over the sample period in column (4) and the industry description name. The table is sorted by estimated fixed costs ratio.*

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