Steunpunt Economie en Ondernemen
Waaistraat 6, bus 3550
3000 Leuven
Belgium
www.steunpunt-economie-ondernemen.be

Beleidsrapport STORE-17-015

Marktmacht

Voorlopige versie (niet voor verspreiding)

Asmae El Gallaa[b,*] en Jo Reynaerts[a,b,+]

[a] Steunpunt Economie en Ondernemen

[b] VIVES, Faculteit Economie en Bedrijfswetenschappen, KU Leuven

*asmae.elgallaa@kuleuven.be
+jo.reynaerts@kuleuven.be

22 december 2017

De resultaten in dit rapport geven de mening van de auteurs weer en niet die van de Vlaamse overheid. De Vlaamse Gemeenschap/het Vlaams Gewest is niet aansprakelijk voor het gebruik dat kan worden gemaakt van de in deze mededeling of bekendmaking opgenomen gegevens.

Inhoudsopgave

KTO Markmacht – Nederlandstalige samenvatting ii
Motivering en doel van het onderzoek ii
Methodologie iii
Beschrijving van de gegevens v
Bevindingen v
1. Introduction 1
2. From data-based to a model-based measure of markups 2
3. Data description 4
3.1 Data sources and limitations 4
3.2. Descriptive statistics 4
4. Empirical Results 8
4.1 The distribution of the markup estimates 8
4.1.1. The distribution of markups: at the aggregate level 8
4.1.2. The distribution of markups: by region 10
4.2. The markup estimates by sector and by region 11
4.3. Regression results 15
5. Conclusion 18
6. References 19
Appendices 21
A.1 Estimates of the output elasticities, returns to scale, and markups 21
A.2 Robustness check: removing outliers of the markup estimates 26

KTO Markmacht – Nederlandstalige samenvatting

Motivering en doel van het onderzoek

In een omgeving van perfecte concurrentie rekenen bedrijven de consument een prijs aan die gelijk is aan de (marginale) productiekost. Het resultaat is dat bedrijven geen (economische) winst maken en dat de uitkomst op de markt, m.n. de evenwichtsprijs en –hoeveelheid bepaald door het snijpunt van vraag en aanbod, de grootste mogelijke welvaart genereert voor de maatschappij in haar geheel.[1] De realiteit wijkt echter doorgaans af van dit perfect competitieve vergelijkingspunt waar zeer veel bedrijven elkaar beconcurreren en noch consumenten, noch producenten op individuele basis een invloed kunnen uitoefenen op de marktprijs: veel sectoren worden gekenmerkt door een beperkt aantal spelers die van deze situatie gebruik maken om de prijs boven de marginale kost te zetten, en zo winst te maken. Dit is wat verstaan wordt onder het begrip "marktmacht." Een teveel aan marktmacht gaat echter ten koste van de maatschappelijke welvaart en vormt de bestaansreden voor de nationale en supranationale mededingingsautoriteiten waken over het welzijn van de consument.

Het bestaan van marktmacht op zich vormt geen probleem; marktmacht is immers het natuurlijke resultaat in omgevingen waar een beperkt aantal ondernemingen elkaar beconcurreren, m.n. in *oligopolistische* markten. Problematisch is wel wanneer deze marktmacht *excessief* is en sterk afwijkt van de theoretische voorspellingen, gegenereerd bijvoorbeeld op basis van een *Cournot* model (waar de strategische interactie tussen ondernemingen plaatsvindt via hoeveelheden) of een *Bertrand* model (waar de strategische interactie tussen ondernemingen plaatsvindt via prijzen). Zo zijn er wel degelijk indicaties dat marktmacht zich aan de excessieve kant bevindt: een kenmerkend feit van de Belgische economie is bijvoorbeeld dat in vergelijking met buurlanden zoals Nederland, Frankrijk en Duitsland, producten lokaal duurder zijn dan hun internationale varianten.[2] De vraagt stelt zich waarom deze prijsverschillen optreden. Experts en beleidsmakers verwijzen in dit verband doorgaans naar het Belgische indexeringsmechanisme, onder meer omdat de Belgische inflatie (uitgedrukt op basis van de prijzen van goederen in een representatieve korf van goederen en diensten) hoger is dan in naburige landen of de Eurozone waar nochtans hetzelfde monetaire beleid wordt gevoerd. Ook de relatief hogere Belgische BTW

[1] Dit is in essentie het resultaat van het *Eerste Fundamentele Welvaartstheorema*; de resulterende toestand is Pareto optimaal waarbij niemand beter af kan gemaakt worden zonder een andere partij slechter af te maken.

[2] Meest zichtbaar is het prijsverschil van consumptiegoederen in Belgische supermarkten ten opzichte van Nederlandse en Duitse ketens: met uitzondering van de categorie "groenten en fruit" zijn alle producten namelijk duurder dan in het buitenland (De Standaard, 2017b,c).

tarieven komen in aanmerking. Het kan ook zijn dat bedrijven in België meer marktmacht kennen en daardoor hogere prijzen kunnen zetten, wat inflatie in de hand werkt.[3] Excessieve marktmacht treedt doorgaans op via prijsafspraken,[4] een illegale praktijk waartegen de Belgische Mededingingsautoriteit (BMA) steeds strenger optreedt (De Standaard, 2017a). In een recente stand van zaken van de Belgische economie wijst de Europese Commissie naar de dienstensectoren als één van de redenen waarom de Belgische inflatie zoveel hoger is dan de omringende landen. Belgische (diensten)sectoren zijn méér dan elders onderworpen aan regulering en reglementering (o.m. productmarktregulering, vestiging, ...) wat een nefaste impact heeft op de prijzen.[5] Vermits diensten niet alleen door consumenten maar ook door andere sectoren worden aangewend in de productie, leidt dit indirect ook tot hogere prijzen in de rest van de economie (Europese Commissie, 2017). Verder wordt ook expliciet verwezen naar de geringe mate van concurrentie in deze sectoren omdat de regulering een barrière vormt tot toetreding van nieuwe bedrijven, waardoor zittende ondernemingen te weinig gedisciplineerd worden.

Naar aanleiding van de voorgaande vaststellingen van de Europese Commissie en de vraag om de regionale verschillen in marktmacht te becijferen (vermeld tijdens de Stuurgroep van 07/06/2017), berekent deze studie de markmacht op het niveau van de individuele onderneming (gegroepeerd op NACE 2-cijfer niveau) en brengt deze via een regressieanalyse in verband met de geografische locatie van de onderneming, dit controlerend voor bedrijfsspecifieke, sectorspecifieke en tijdsafhankelijke factoren. Deze tweede stap formuleert aldus een antwoord op de vraag of en in welke mate marktmacht verschilt tussen de verschillende gewesten.

Methodologie

De mate waarin bedrijven prijzen boven de marginale kost zetten, kan empirisch nagegaan worden aan de hand van de zgn. *Lerner* index (of *markup*). Deze index is een maatstaf van individuele marktmacht en wordt gedefinieerd als

$$L_i = \frac{p_i - c_i}{p_i},$$

[3] De mate waarin het mededingingsbeleid wordt toegepast, speelt in deze context dus ook een belangrijke rol, zie Konings *et al.* (2001, 2011) voor een vergelijking tussen België en Nederland.

[4] Een onderscheid wordt gemaakt tussen *horizontale* prijsafspraken (afspraken tussen spelers in dezelfde productmarkt, de zgn. kartels) en *verticale* prijsafspraken (afspraken tussen bedrijven binnen dezelfde waardeketen of bedrijfskolom, de zgn. kartels).

[5] Niet alleen dienstensectoren zoals de detailhandel maar ook nutsbedrijven (water, gas en elektriciteit) en netwerksectoren (o.m. telecom) zijn in België sterk gereguleerd.

waarbij p_i en c_i respectievelijk de prijs en (marginale) kost zijn van het product van onderneming i. Omdat gegevens over individuele prijzen doorgaans niet beschikbaar en (marginale) kosten niet waarneembaar zijn, moet de index op alternatieve wijze berekend worden.[6] De benadering die we hier volgen, laat toe om uitgaande van een individuele productiefunctie bedrijfsspecifieke markups te schatten zonder veronderstellingen te maken over de aard van de strategische interactie in de productmarkt, m.a.w. de wijze waarop bedrijven elkaar beconcurreren (Hall, 1986; De Loecker, 2011; De Loecker en Warzynski, 2012). In eerste instantie wordt de bedrijfsspecifieke markup berekend als

$$\theta_{it}^{X} = \mu_{it} \frac{P_{it}^{X} X_{it}}{P_{it} Q_{it}},$$

waarbij θ_{it}^{X} de elasticiteit van de productie ten opzichte van de input X_{it} voorstelt (de percentsgewijze toename in de geproduceerde hoeveelheid naar aanleiding van een toename van de input met 1%). Deze wordt bekomen aan de hand van de schatting van de coëfficiënten van de productiefunctie.[7] De teller aan de rechterkant stelt de overeenkomstige uitgaven weer van de inzet van een hoeveelheid X_{it} van de productiefactor (input) aan een factorprijs van P_{it}^{X} per eenheid. De noemer stelt de totale ontvangsten van de onderneming weer van de verkoop van een hoeveelheid Q_{it} aan een eenheidsprijs van P_{it} op de productmarkt. Teller en noemer kunnen berekend worden aan de hand van de cijfers vervat in de jaarrekening van de onderneming (ontvangsten en loonkosten of materiaalkosten, afhankelijk van de gekozen input). De resterende term, $\mu_{it} = \frac{P_{it}}{\lambda_{it}}$, is de verhouding van de prijs tot de marginale kost, de bedrijfsspecifieke maatstaf van marktmacht en wordt berekend als

$$\mu_{it} = \theta_{it}^{X} \frac{P_{it}^{X} X_{it}}{P_{it} Q_{it}}.$$

Gebruikmakend van de tweetrapsmethodologie van Amiti en Konings (2007) worden de aldus bekomen markups in tweede instantie in verband gebracht met de geografische locatie van de overeenkomstige ondernemingen. Daartoe worden de markups geregresseerd op binaire indicatoren d_{it}^{V}, $d_{it}^{W} \in \{0, 1\}$ die aangeven of het bedrijf respectievelijk in Vlaanderen dan wel Wallonië is gelokaliseerd, met Brussel als basiscategorie:

[6] De *econometrische* benadering van marktmacht schat op basis van een steekproef de parameters van de productiefunctie van een individuele onderneming en maakt gebruik van micro-economische gedragsrelaties om de markup af te leiden enkel via de outputelasticiteiten en de aandelen van uitgaven aan inputs ten opzichte van omzet, zie Konings *et al.* (2001) voor een inleiding.

[7] Voor de alom gekende Cobb-Douglas productiefunctie $Q_i = AL_i^{\alpha} K_i^{\beta}$ komen de outputelasticiteiten voor arbeid (L) en kapitaal (K) respectievelijk overeen met de parameters α en β.

$$\mu_{it} = \beta_0 + \beta_1 d_{it}^V + \beta_2 d_{it}^W + \boldsymbol{\delta}' \mathbf{z}_{it} + v_{it}.$$

Indien de coëfficiënten $\hat{\beta}_1$ en $\hat{\beta}_2$ statistisch significant verschillen van nul, dan geven ze aan in welke mate marktmacht geografisch varieert tussen Belgische ondernemingen. De voorgaande vergelijking houdt rekening met verschillen tussen bedrijven in het gebruik van inputs (arbeid en kapitaal, bv. de kapitaalintensiteit), de leeftijd van de onderneming en de invloed van sectorspecifieke trends in markups via sector-jaar controlevariabelen. Bedrijven worden in deze studie toegekend aan de regio (Vlaanderen, Wallonië en het Brussels Hoofdstedelijk Gewest) waar ze het grootste aandeel in de totale tewerkstelling kennen.

Beschrijving van de gegevens

De benodigde boekhoudkundige gegevens voor de uitvoering van deze studie werden gepuurd uit de Bel-first databank van Bureau van Dijk en vervolgens gekoppeld aan de gegevens van de Rijksdienst voor Sociale Zekerheid (RSZ) die informatie vervat over de tewerkstelling in de afzonderlijke vestigingen van de ondernemingen. Deze vestigingen, geïdentificeerd via het vestigingsnummer, werden aan de moederbedrijven gekoppeld via de informatie hernomen in de Kruispuntbank Ondernemingen (KBO), in het bijzonder via het KBO nummer. De resulterende niet-gebalanceerde longitudinale steekproef bevat 58.928 bedrijven waargenomen over de periode 2005-2015. De variabelen hernemen de omzet, toegevoegde waarde, aantal werknemers in voltijdse equivalenten (VTE), materiële vaste activa, kost van materialen en de loonmassa. De steekproef herneemt enkel waarnemingen die voor alle voorgaande variabelen waarden laten optekenen, dit om de schattingen van productiviteit op het ondernemingsniveau in de eerste stap van de hierboven beschreven methode te kunnen uitvoeren.

Bevindingen

De analyse is in eerste instantie beschrijvend en herneemt de beschrijvende statistieken van de geschatte markups en hun respectievelijke nationale en regionale verdelingen. Wat de globale verdeling betreft, registreren we een gemiddelde markup over alle ondernemingen en jaren heen van 1,41. Dit impliceert dat prijzen zich gemiddeld 40% boven de marginale kost bevinden. Omdat het gemiddelde echter gevoelig is voor extreme waarden, wordt ook de *mediane* markup berekend: deze komt neer op 1,09, wat op zijn beurt inhoudt dat bedrijven prijzen zo'n 9% boven de richtlijn van perfecte mededinging zetten. De regionale mediane waarden voor Brussel, Vlaanderen en Wallonië komen neer op respectievelijk 1,08, 1,08 en 1,12. De waarde voor Wallonië wijkt dus af van deze van de overige regio's en geeft een eerste indicatie van regionale verschillen in marktmacht. Deze gegevens worden verder aangevuld met de mediane waarden

voor de markup per NACE 2-cijfer bedrijfstak en per regio en brengt zo regionale verschillen in de competitieve aard van de sectoren in kaart.

Omdat de voorgaande beschrijvende statistieken geen rekening houden met bedrijfsspecifieke kenmerken en andere sector- en tijdsgebonden factoren, wordt in tweede instantie overgegaan tot een regressie-analyse waarbij de individuele markups in verband worden gebracht met de regionale indicatoren zoals hierboven beschreven. De resultaten van de basisspecificatie geven aan dat er geen statistische indicaties zijn van hogere markups in Vlaanderen ten opzichte van Brussel. De geschatte coëfficiënt $\hat{\delta}_2$ is echter statistisch significant verschillend van nul en bedraagt in de meest uitgebreide regressiespecificatie 0,0659, zie kolom (8) in tabel 11. De interpretatie is dat gemiddeld genomen de markups van bedrijven in het Waalse gewest ongeveer 6,6% hoger zijn dan in Brussel. Dit resultaat houdt rekening met verschillen in bedrijfskenmerken (inzet van arbeid en kapitaal en de interactie tussen beide, leeftijd), productiviteit, sector- en tijdsgebonden factoren en daarnaast ook regio-tijdsgebonden invloeden op de marktmacht van individuele ondernemingen.

Het voorgaande resultaat kan te wijten zijn aan regionale verschillen in de productmarkt (hierbij denken we aan kenmerken van de vraag zoals de prijselasticiteit van de vraag, de aan- of afwezigheid van substituten en complementen, het inkomen, …), de arbeidsmarkt (m.n. de rigiditeit van lokale arbeidsmarkten), institutionele verschillen of regionale verschillen in de onderliggende sectoren. Een dergelijke analyse, net als een meer flexibele specificatie zoals de translog productiefunctie, valt buiten het tijdsbestek van deze kortermijnopdracht maar kan deel uitmaken van eventueel vervolgonderzoek binnen de langlopende opdracht van het Steunpunt Economie en Ondernemen.

1. Introduction

Markups depend on firms' relative market power. This in turn depends on firm-specific characteristics such as productivity, whether or not a firm is an exporter, and the market in which the firm operates. In this study, we analyze whether and to what extent firm location plays a role in explaining markups. We assume that location affects firm decisions on input use, and ask whether there exists regional differences in markups across firms located in regions in Brussels-capital, Flanders, and Wallonia.

Regions in Belgium are characterized by a high degree of heterogeneity in terms of per capita income, labor productivity, unemployment, the number of firms, etc., this is in addition to linguistic and cultural differences. All these factors affect the location choice of firms, and in turn the degree of competition in a region. The lower the degree of competition, the higher the ability of firms to set prices over marginal costs of production, the higher their corresponding markups.

The markup is defined as the ratio of the selling price of a product or service relative to its marginal cost of production and is a measure of the firm's degree of market power). However, data on prices are not always readily available and the marginal cost is typically unobserved. Therefore, we apply a recent development in empirical industrial organization methods to recover firm markups relying on firm-level accounting data. Based on an insight of Hall (1986), De Loecker and Warzynski(2012) propose a methodology to estimate markups that derives from a model of firm behavior, where firms minimize costs by adjusting the margins on their variable inputs.[8] The resulting model-based markup is the wedge between the output elasticity of a variable input and its expenditure share in revenues.

Markup estimates are recovered using accounting data obtained from the Belfirst dataset. The RSZ dataset provides us with data on the number of employees per plant, and the KBO dataset enables us to distinguish between multi-plant and single-plant firms. For each firm, we use input expenditures and revenues to estimate output elasticities, and rely on the number of employees per plant to decide in which region a multi-plant firm is located. Multi-plant firms separate various tasks and business functions and allocate them to different plants in different regions. The availability of the number of employees by plant allows us to avoid the mistake of assigning

[8] That is, firms choose the optimal input bundle of labor, capital and materials so as to minimize the costs of the use of those inputs subject to a production constraint.

multi-plant firms to the region where their headquarters are located and instead define the location of a multi-plant as the region with the largest share of firm employment.

We use the markup estimates to analyze whether firms in Flanders and Wallonia charge different markups relative to firms operating in the Brussels-Capital region. In a regression framework, we relate the firm-level markup to firm-specific characteristics such as size and productivity, and find that there is no statistically significant difference in markups of firms located in Flanders and the Brussels-Capital region. Firms in Wallonia on the other hand set, on average, higher markups compared to both Flanders and Brussels-Capital.

The remainder of this report is organized as follows. Section 2 briefly introduces the underlying model to obtain a firm's markup and the empirical procedure. Section 3 describes the data. Section 4, presents the results of the markup estimates and the regression framework. The final section concludes.

2. From data-based to a model-based measure of markups

A firm's markup is defined as the ratio of the selling price of a product or service relative to its marginal cost of production:

$$\mu_{it} = \frac{P_{it}}{c_{it}},$$

where μ_{it} denotes the markup of firm i at time t, P_{it} is the selling price and c_{it} is the marginal cost of production specific to the firm. However, data on prices are not readily available and the marginal cost is typically unobserved. Thus, researchers turned to a model of firm behavior to derive an alternative measure of a firm's markup.

The idea can be summarized as follows. Firms minimize costs by adjusting the margins on their variable inputs (materials, labor). When price equals marginal cost of production, the output elasticity of a variable input is equal to its expenditure share in revenues. However, in the presence of any form of noncompetitive behavior, the markup drives a wedge between the output elasticity of the variable input and its expenditure share in revenues, represented as

$$\mu_{it} = \frac{\theta^x}{\alpha_{it}^x},$$

where μ_{it} is the markup of firm *i* at time *t*, θ^x is the output elasticity of a variable input *x*, and α_{it}^x is its expenditure share in revenues. This requires us to specify and estimate firm-level production functions and perform the required simultaneity bias correction to obtain reliable estimates of θ^x. The choice of the variable input on which firms minimize costs depends on the degree of flexibility that firms have about their input demand. In the presence of adjustment costs, for example in the case of capital, investment decisions are typically dynamic (ahead of production period). Moreover, in a country like Belgium, where the labor market is rigid (high minimum wage; hiring and firing fees,…), we cannot assume labor to be a variable input. Energy and materials are the most variable production factors. In this study, we rely on materials to obtain the output elasticity of the variable input.

For each industry separately, we estimate a three-input Cobb-Douglas production function (labor, capital, and materials). The estimate of the coefficient on materials is the output elasticity of materials. It is common to firms operating in same industry and is constant over time. In this case, variations in markups are inverse to the variations of the materials share.[9]

We compute the markup estimate of firm i at time t ($\hat{\mu}_{it}^M$), as follows

$$\hat{\mu}_{it}^M = \frac{\hat{\theta}^M}{\alpha_{it}^M}$$

where $\hat{\theta}^M$ is the estimate of the output elasticity of materials and α_{it}^M is the expenditure share of materials in revenues obtained from accounting data.

We use the control function approach to production function estimation following Levinsohn and Petrin (2003). We assume that firms located in different regions face different input prices, hence dummies for Flanders, and Wallonia (relative to Brussels-Capital) are included in the proxy for productivity along with labor, capital, materials, the wage bill, and their interactions.

Finally, the markup estimate depends on the estimated output elasticity of the materials and therefore constitutes an (estimated) dependent variable in the regressions of Section 5. Hence we account for this additional source of variability in this variable by block bootstrapping over the entire procedure. The empirical procedure is as follows: (i) estimate the production function, (ii) recover the output elasticities, (iii) compute firm-level markups, and (iv) regress markups on regional dummies and a set of controls. We then replicate these steps 200 times using

[9] We refer the reader to De Loecker and Warzynski (2012) for a detailed description of the empirical procedure to estimate production function coefficients and markups.

bootstrapped (with replacement) samples whose size is equal to that of the original sample. This allows us to compute the bootstrapped standard errors on the regional dummies and the set of controls needed for the purposes of statistical inference.

3. Data description

3.1 Data sources and limitations

The dataset we use in this study is an unbalanced panel of 58928 firms (334,058 firm-year observations) spanning the years 2005-2015. The dataset is constructed by merging three sources of data on firms. Belfirst dataset provides information on firms' sales and inputs expenditures. The KBO dataset provides information on the number of plants owned by each firm while the RSZ dataset provides information on the number of employees in each plant. In turn, this enables us to distinguish between single-plant firms and multiplant firms.

To estimate markups, we need information on firms' sales and inputs expenditures. However, Belgian accounting rules grant exempt small and medium entreprises (SMEs) from reporting information on sales and materials costs. As a result, the sample of firms in this study not representative of the population of firms in the Belgian economy. In fact, looking at the descriptive statistics for employment, we see that the average number of employees in the dataset is equal to 40, which implies that the sample contains relatively large firms.

In this sample of firms, each firm has a unique identifier (KBO number) and reports information on turnover, value added, number of employees if full time equivalents (FTE), tangible fixed assets, materials costs, and the wage bill. Moreover, we can clearly see whether a firm is a single-plant firm or a multiplant firm as well as the number of employees in each plant. Also, we can track the location of the headquarters of firms and each of their plants. The location can be one of the main regions of Belgium, namely Brussels-capital, Flanders, and Wallonia. The following tables provide the number of firms, multiplant and single-plant, by year and geographical location.

3.2. Descriptive statistics

Table 1 presents of the number of firms in the dataset covered every year of the sample period 2005-2015. The number of firms is consistent through the period up to 2013, where it starts to

progressively decline. The Belgian economy seems to mainly contain single-plant firms who outnumber multiplant firms. The latter display a steady increase over the sample period.

Table 1: Number of single- and multi-firms per year

Year	N° of firms	N° of multiplant firms	N° of single-plant firms
2005	29,149	1,695	27,454
2006	32,732	2,015	30,717
2007	33,537	2,114	31,423
2008	32,726	2,143	30,583
2009	31,776	2,148	29,628
2010	31,466	2,192	29,274
2011	33,273	2,084	31,189
2012	32,481	2,221	30,260
2013	27,997	2,694	25,303
2014	26,227	3,277	22,950
2015	22,694	3,147	19,547
Total N° of obs	334,058	25,730	308,328

Table 2 presents the division of firms by region. The bulk of both single- and multiplant firms is located in Flanders; Wallonia and Brussels-Capital come in second and third position respectively. A couple of remarks on the location of firms are warranted.

Table 2: Number of firms in each region

Year	Number of firms			Multiplant firms			Single plant firms		
	Brussels	Flanders	Wallonia	Brussels	Flanders	Wallonia	Brussels	Flanders	Wallonia
2005	4,575	15,388	9,186	252	1,017	426	4,323	14,371	8,760
2006	5,037	17,224	10,471	282	1,189	544	4,755	16,035	9,927
2007	5,190	17,577	10,770	281	1,255	578	4,909	16,322	10,192
2008	5,087	17,139	10,500	285	1,273	585	4,802	15,866	9,915
2009	4,985	16,548	10,243	279	1,277	592	4,706	15,271	9,651
2010	4,914	16,498	10,054	288	1,303	601	4,626	15,195	9,453
2011	5,149	17,436	10,688	273	1,245	566	4,876	16,191	10,122
2012	5,050	17,017	10,414	271	1,356	594	4,779	15,661	9,820
2013	4,464	14,623	8,910	323	1,636	735	4,141	12,987	8,175
2014	4,076	13,939	8,212	387	2,006	884	3,689	11,933	7,328
2015	3,356	12,263	7,075	365	1,911	871	2,991	10,352	6,204
Total N° of obs	51,883	175,652	106,523	3,286	15,468	6,976	48,597	160,184	99,547

The location of a single-plant firm is typically the same as the location of its headquarters as it is hard to distinguish between the firm and its plant in this case; however, the location of a multiplant firm can differ from the location of its headquarters as these firms can have different

locations for their plants. Thus, we define the location of a mutliplant firm according to its employment level in every region. For example, a multiplant firm is located in Flanders if the plants present in Flanders have the highest employment share across regions.

Moreover, one common characteristic to both single- and multi-plant firms in this dataset is that their locations do not change over time. For example, if a multi-plant firm has the highest employment share in Flanders in 2005 this typically remains consistent over time. However, a small number of single-plant firms relocate (shut down business in one region to open in another region in subsequent years) and few multi-plant firms reallocate labor throughout the sample period (different regions have highest employment shares through time). Table 3 presents the number of single-plant firms who relocate over time and the number of multi-plant firms who reallocate labor across regions during the period of observation.

Table 3: The share of employment and the number of firms changing geographical locations

Year	Number of multiplant firms reallocating labor across regions	Number of single plant firms relocating to different regions
2005	14	12
2006	18	7
2007	17	10
2008	19	8
2009	19	9
2010	18	7
2011	15	12
2012	13	11
2013	16	8
2014	15	8
2015	16	6
Total N° of obs	180	98

In the data management process, single-plant firms who relocate and multi-plant firms who allocate labor across regions are assigned to the region of their headquarters and to the region with the highest, most recent, employment share respectively. Since the number of firms falling into these categories is very small relative to the total number of firms in the sample, we do not expect results to be qualitatively affected by this location rule.

Tables 4, 5, 6, and 7 present summary statistics of turnover, labor, and input expenditures of our sample of firms.

Table 4: Summary statistics of firms in the dataset

Variable	N° Obs	Mean	Std. Dev.
Turnover	334058	19972.44	270393.3
Value added	334045	4084.066	37409.66
Number of employees	334058	39.49577	364.9556
Tangible fixed assets	334058	3467.191	42128.78
Material costs	334058	16790.88	259740.2
Wage bill	334058	2509.502	21512.7

Note: All nominal variables are expressed in thousands of Euros

Table 4 shows that the average firm hires 40 employees in FTE. This implies that our sample covers mainly large firms. This is a consequence of under-reporting by SMEs. Looking at the regional differences, the average firm in Flanders is larger than the average firm in both Brussels-Capital and Wallonia, see tables 5, 6 and 7.

Table 5: Summary statistics of firms in Brussels-capital

Variable	N° Obs	Mean	Std. Dev.
Turnover	51883	23613.64	371810.9
Value added	51877	4859.596	54771.58
Number of employees	51883	37.89395	541.846
Tangible fixed assets	51883	4073.443	56999.32
Material costs	51883	19746.5	358868.5
Wage bill	51883	2735.407	33021.64

Note: All nominal variables are expressed in thousands of Euros

Table 6: Summary statistics of firms in Flanders

Variable	Obs	Mean	Std. Dev.
Turnover	175652	25754.16	307416.1
Value added	175648	5003.986	37483.74
Number of employees	175652	50.334	397.0563
Tangible fixed assets	175652	4046.529	42589.4
Material costs	175652	21839.61	295798.9
Wage bill	175652	3133.457	22166.77

Note: All nominal variables are expressed in thousands of Euros

Table 7: Summary statistics of firms in the Wallonia

Variable	N° Obs	Mean	Std. Dev.
Turnover	106523	8665.162	76989.56
Value added	106520	2189.452	24609.91
Number of employees	106523	22.40418	119.3601
Tangible fixed assets	106523	2216.605	31468.42
Material costs	106523	7026.165	66523.98
Wage bill	106523	1370.597	10394.21

Note: All nominal variables are expressed in thousands of Euros

4. Empirical Results

After the estimation of the production function coefficients, the sample period is reduced to the years 2006-2015, and we have 233107 firm-year observations. In this section, we first present descriptive statistics and the distribution of the estimated markups at the economy-wide level, and then move to analyze the distribution of markups by region, by sector, and by region-sector combined. Second, we present the results of the regression of firms' markups of regional dummies.

4.1 The distribution of the markup estimates

4.1.1. The distribution of markups: at the aggregate level

We estimate the production function at the sector level, we compute the firm-level markups; however, it might be informative to look at the economy-wide average/median markup. The markups vary by firm and over time; however, we report the statistics over all firm-year observations in the dataset. Table 8 presents the distribution of the markup estimates.

Table 8: Descriptive statistics of the markup estimates – Aggregate level

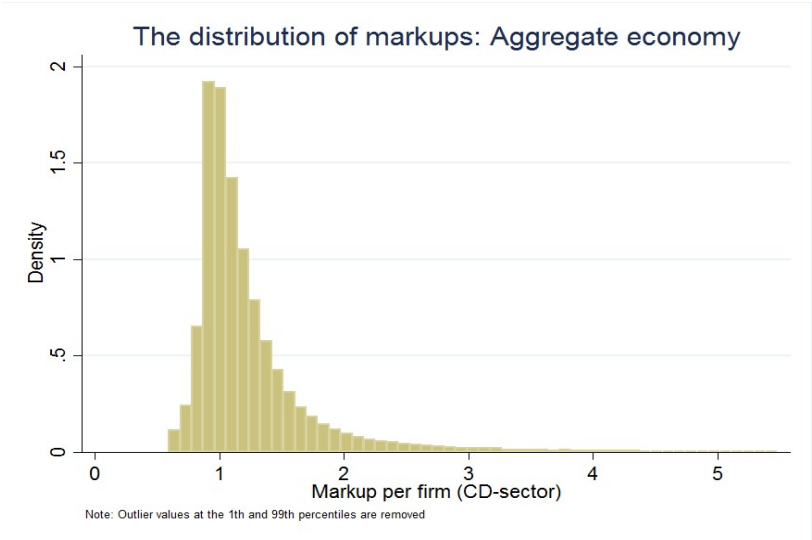
		Percentiles								
Mean	Std. Dev.	1%	5%	10%	25%	50%	75%	90%	95%	99%
1.41	7.09	0.59	0.80	0.87	0.95	**1.09**	1.35	1.82	2.40	5.48

Note: The markups are obtained using the estimate of the output elasticity of materials from a CD production function. We control for unobserved productivity shock using the Levinsohn and Petrin (2003) control function approach. We assume that demand for materials is affected by firm location; hence we add regional dummies (Wallonia and Flanders) to inputs and input prices in the control function. Firm-level productivity is proxied by a fourth-order polynomial in labor, capital, materials, wage bill, regional dummies, and their interactions.

The markup estimates range from 0.59 to 5.48 at the 1st and 99th percentiles respectively. The average markup is equal to 1.41, which implies that the average firm sets price 41% above marginal cost. The firm-level markups are below one for about 35 percent of the sample. The median markup is in the other hand equal to 1.09, which implies that the median firm charges prices 9% higher than marginal costs. Finally, the difference between the mean and the median markup points at a skewed markup distribution which makes the median a better estimates of the central tendency. We will rely on the median markup for sector comparisons both at the aggregate and regional levels.

Figure 1 presents the distribution of the markup estimates after removing outliers at the 1st and 99th percentiles. In this case, the average markup is equal to 1.25, while the median remains the same at 1.09. We clearly see that there is a concentration of markups around 1, with most markup estimates above 1, and very few are above 2.

Figure 1: Distribution of the markup estimates – Aggregate level



The dispersion of the markup estimates can be attributed to many factors, for example the structure of the industry in which a firm operates, its geographical location, its productivity

level, demand that firms face, etc. We further investigate the descriptive statistics of the markup estimates by region.

4.1.2. The distribution of markups: by region

The aim of this study is to investigate the presence of regional differences in markups. Table 9 presents the distribution of the markup estimates by region. The markups vary by firm and over time; however, we report the statistics over all firm-year observations in the dataset.

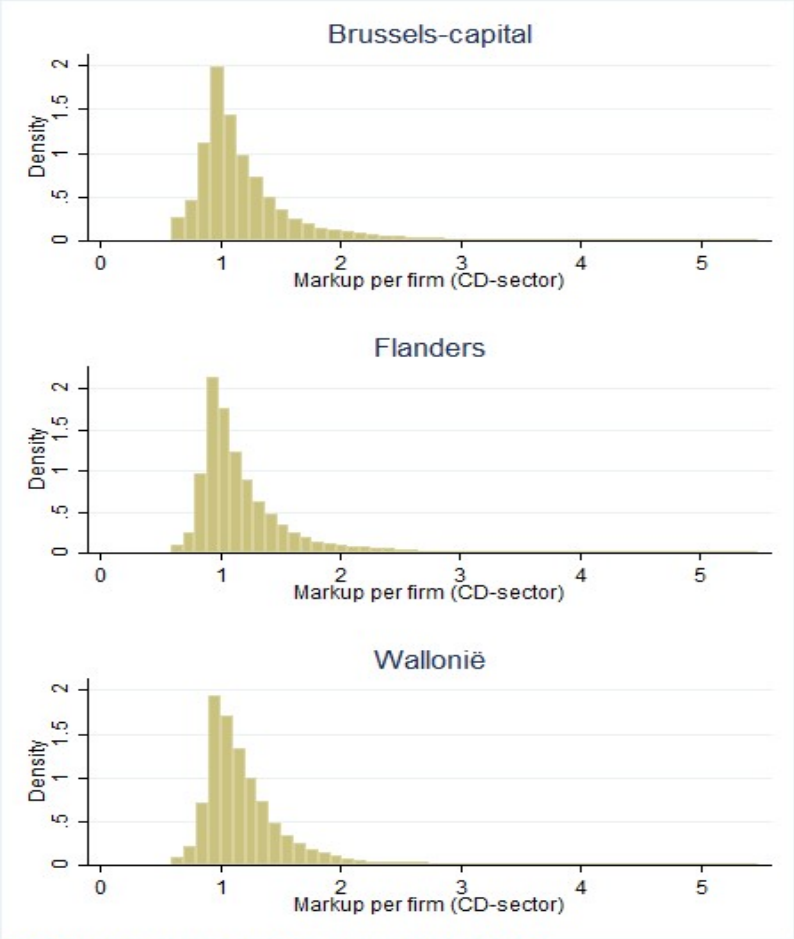
Table 9: Descriptive statistics of the markup estimates: Regional level

	Mean	Std. Dev.	Percentiles								
			1%	5%	10%	25%	50%	75%	90%	95%	99%
Brussels	1.36	3.81	0.43	0.70	0.81	0.94	1.08	1.35	1.88	2.46	5.56
Flanders	1.45	8.36	0.64	0.81	0.87	0.94	1.08	1.34	1.84	2.48	5.92
Wallonia	1.35	5.82	0.61	0.83	0.89	0.97	1.12	1.36	1.76	2.23	4.72

Note: 1 The markups are obtained using the estimate of the output elasticity of materials from a CD production function. We control for unobserved productivity shock using the Levinsohn and Petrin (2003) control function approach. We assume that demand for materials is affected by firms location, hence we add regional dummies (Wallonia and Flanders) to inputs and input prices in the control function. A firm's productivity is proxied with by a fourth order polynomial in labor, capital, materials, wage bill, regional dummies, and their interactions.

The average markup in Brussels, across firms and sectors, is equal to 1.36, while the median is equal to 1.08. Flanders has the same median markup as Brussels; however, the averages differ considerably (1.45 in Flanders). Wallonia displays an average markup similar to Brussels; however, the median markup is substantially higher than the one of the other regions.

Figure 2: Distribution of the markup estimates – by region



Note: Outlier values at the 1th and 99th percentiles are removed

Figure 2 displays the distributions of the markup estimates by region after removing outliers at the 1st and 99th percentiles of the markup distribution. Markups are concentrated around 1. Visually, it is hard to see substantial differences in firm markup between Brussels-Capital and Flanders. However, the distribution of markups of firms in the Walloon region highlights a higher density of markups above 1.

4.2. The markup estimates by sector and by region

We estimate the production function at the sector level. The datasets covers almost all sections of the economy. We use the estimates of markups to investigate differences across regions. Table 10 presents the median by NACE 2-digit sector and by region. With the exception of sectors 2 and 3 who are not present in the Brussels-Capital region, every region has its share of firms operating in all the different NACE 2-digit sectors. Since we do not have an official measure of

concentration of activities by region, we restrict ourselves into saying that all sections of the economy are spread over the three regions.

Table 10: the median markup by sector, and by region

Section	Sector	Median Markup			
		Aggregate	Brussels	Flanders	Wallonia
A — AGRICULTURE, FORESTRYAND FISHING	1 Crop and animal production, hunting and related service activities	1.16	1.15	1.14	1.18
	2 Forestry and logging	1.15	1.06	1.32	1.13
	3 Fishing and aquaculture	1.32		1.33	0.31
B — MINING AND QUARRYING	5 Mining of coal and lignite	1.16		1.22	0.86
	8&9 Other mining and quarrying & Mining support service activities	1.03	0.78	0.81	1.07
C — MANUFACTURING	10 Manufacture of food products	1.07	1.18	1.04	1.13
	11 Manufacture of beverages	1.41	1.48	1.40	1.42
	12 Manufacture of tobacco products	1.22	1.02	1.28	1.01
	13 Manufacture of textiles	1.02	0.92	1.01	1.11
	14 Manufacture of wearing apparel	0.99	1.09	0.96	1.22
	15 Manufacture of leather and related products	1.11	1.18	1.08	1.15
	16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1.10	1.06	1.09	1.11
	17 Manufacture of paper and paper products	1.00	1.18	0.98	1.05
	18 Printing and reproduction of recorded media	1.22	1.26	1.21	1.25
	19 Manufacture of coke and refined petroleum products	1.63	2.00	1.60	1.76
	20 Manufacture of chemicals and chemical products	1.00	0.94	0.99	1.05
	21 Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.96	0.94	0.95	0.99
	22 Manufacture of rubber and plastic products	1.20	1.20	1.19	1.24
	23 Manufacture of other non-metallic mineral products	1.05	0.95	1.07	1.01
	24 Manufacture of basic metals	0.92	0.88	0.91	0.92
	25 Manufacture of fabricated metal products, except machinery and equipment	1.13	1.18	1.11	1.15
	26 Manufacture of computer, electronic and optical products	1.12	1.08	1.13	1.11
	27 Manufacture of electrical equipment	0.98	0.98	0.97	0.99
	28 Manufacture of machineryand equipment n.e.c.	1.18	1.22	1.17	1.21
	29 Manufacture of motor vehicles, trailers and semi-trailers	1.05	1.05	1.03	1.08
	30 Manufacture of other transport	1.09	1.31	1.01	1.20

	equipment				
	31 Manufacture of furniture	1.14	1.13	1.14	1.13
	32 Other manufacturing	1.23	1.22	1.19	1.39
	33 Repair and installation of machinery and equipment	0.97	1.29	0.93	0.99
D — ELECTRICIT Y, GAS, STEAM AND AIR CONDITIONING SUPPLY	35 Electricity, gas, steam and air conditioning supply	1.18	1.67	1.16	1.13
	36 Water collection, treatment and supply	1.21	1.22	1.19	1.26
E — WATER SUPPLY;SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	37 Sewerage	1.24	1.76	1.22	1.21
	38 Waste collection, treatment and disposal activities; materials recovery	0.89	0.95	0.89	0.92
	41 Construction of buildings	1.09	1.02	1.05	1.15
	42 Civil engineering	1.08	1.02	1.06	1.14
F — CONSTRUCTION	43 Specialised construction activities	1.23	1.21	1.22	1.24
	45 Wholesale and retail trade and repair of motor vehicles and motorcycles	1.05	1.08	1.05	1.06
G — WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES AND MOTORCYCLES	46 Wholesale trade, except of motor vehicles and motorcycles	0.98	0.99	0.98	0.99
	47 Retail trade, except of motor vehicles and motorcycles	1.03	1.02	1.03	1.03
	49 Land transport and transport via pipelines	1.31	1.30	1.31	1.31
	50 Water transport	0.91	0.95	0.90	0.91
	51 Air transport	1.02	1.02	1.01	1.03
	52 Warehousing and support activities for transportation	0.95	0.95	0.95	0.94
H — TRANSPORTATION AND STORAGE	53 Postal and courier activities	1.08	1.04	1.08	1.14
	55 Accommodation	1.31	1.31	1.32	1.29
I — ACCOMMODATION AND FOOD SERVICE ACTIVITIES	56 Food and beverage service activities	1.20	1.19	1.21	1.20
	58 Publishing activities	1.17	1.10	1.20	1.19
	59 Motion picture, video and television programme production, sound recording and music publishing activities	1.22	1.23	1.17	1.32
	60 Programming and broadcasting activities	1.33	1.30	1.32	1.36
	61 Telecommunications	0.81	0.76	0.93	0.80
	62 Computer programming, consultancy and related activities	1.27	1.21	1.28	1.30
J — INFORMATION AND COMMUNICATION	63 Information service activities	0.92	0.92	0.92	0.98
	64 Financial service activities, except insurance and pension funding	1.00	0.81	1.19	0.78
	65 Insurance, reinsurance and pension funding, except compulsorysocial security	0.59	0.40	0.61	0.60
K — FINANCIAL AND INSURANCE ACTIVITIES	66 Activities auxiliary to financial services and insurance activities	1.51	1.50	1.60	1.47
L — REAL ESTATE ACTIVITIES	68 Real estate activities	1.69	1.58	1.78	1.65
M — PROFESSIONAL,	69 Legal and accounting activities	1.31	1.13	1.36	1.36

SCIENTIFIC AND TECHNICAL ACTIVITIES	70 Activities of head offices; management consultancy activities	1.15	1.02	1.23	1.15
	71 Architectural and engineering activities; technical testing and analysis	1.07	0.96	1.14	1.00
	72 Scientific research and development	1.14	1.12	1.13	1.17
	73 Advertising and market research	1.04	0.98	1.07	1.16
	74 Other professional, scientific and technical activities	1.10	0.96	1.15	1.15
	75 Veterinary activities	1.57	1.56	1.49	1.62
N — ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES	77 Rental and leasing activities	1.41	1.40	1.42	1.33
	78 Employment activities	2.10	1.13	3.49	5.09
	79 Travel agency, tour operator reservation service and related activities	0.94	0.93	0.94	0.96
	80 Security and investigation activities	1.20	1.16	1.30	1.02
	81 Services to buildings and landscape activities	1.05	1.04	1.09	1.01
	82 Office administrative, office support and other business support activities	1.09	0.99	1.11	1.17
O — PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY	84 Public administration and defence; compulsory social security	1.41	1.40	0.70	2.03
P — EDUCATION	85 Education	1.29	1.20	1.28	1.32
Q — HUMAN HEALTH AND SOCIAL WORK ACTIVITIES	86 Human health activities	1.00	0.94	1.04	0.99
	87 Residential care activities	1.19	1.10	1.09	1.27
	88 Social work activities without accommodation	2.11	1.23	3.06	2.18
R — ARTS, ENTERTAINMENT AND RECREATION	90 Creative, arts and entertainment activities	1.28	1.32	1.26	1.32
	91 Libraries, archives, museums and other cultural activities	1.12	0.84	0.94	1.23
	92 Gambling and betting activities	1.25	1.17	1.22	1.34
	93 Gambling and betting activities	1.38	1.38	1.37	1.39
S — OTHER SERVICE ACTIVITIES	94 Activities of membership organisations	1.60	1.64	1.38	1.47
	95 Repair of computers and personal and household goods	1.12	1.13	1.15	1.02
	96 Other personal service activities	1.27	1.20	1.29	1.29

Apart from a handful of NACE 2-digit sectors (3, 5, 12, 35, 55, 66, 77, 80 and 81), Wallonia displays the highest median markup by sector compared to the other two regions. Note that whenever the median markup is lower in Wallonia, it is typically either significantly lower or similar to the sector-wide (aggregate) median markup. These descriptive results of the markup estimates by region point at the presence of significant differences in markups between regions and call for a more detailed analysis that controls for the influence of a.o. sector- and year-specific factors and firm characteristics on markups. This is the subject of the next section.

4.3. Regression results

In this subsection, we focus on the main question of this work, whether firms in the different regions have different markups on average, and whether firm characteristics and the aggregate operating environment of the firm have an impact of this regional differences.

We regress the estimated firm-level markups obtained in the first stage of the analysis on firm-specific characteristics and the regional indicators. In this framework, we are not assessing differences in the level of markups per se but rather, we assess percentage differences between firms in Flanders and Wallonia relative to firms in Brussels-Capital region. The baseline regression specification is:

$$\ln \hat{\mu}_{it} = \delta_0 + \delta_1 \text{Flanders}_{it} + \delta_2 \text{Wallonia}_{it} + \delta_3 l_{it} + \delta_4 k_{it} + \delta_3 l_{it} k_{it} + \delta_4 age_{it} + \delta_5 \hat{\omega}_{it} + \nu_{it} \ ,$$

where $\ln\mu_{it}$ is the natural logarithm of the estimated firm-level markup, Flanders_{it} is a dummy equal to 1 if a firm is located in Flanders and 0 otherwise, Wallonia_{it} is a dummy equal to 1 if a firm is located in Wallonia and 0 otherwise. We control for a set of firm-level characteristics (expressed in logs) such as number of employees (l_{it}), tangible fixed assets (k_{it}), the interaction between the number of employees and tangible fixed assets ($l_{it}k_{it}$), the age of the firm, and the estimated firm-level productivity (TFP) from the first stage of the analysis ($\hat{\omega}_{it}$). The coefficients δ_1 and δ_2 measure the percentage difference in markups for firms in Flanders and Wallonia respectively relative to the Brussels-Capital region. We additionally control for full year-industry interactions to remove industry-specific aggregate trends in markups. We later run the same regression interacting the regional dummies with the year in order to assess whether the average difference in markups varies over time.

Table 11 presents regression results for various specifications depending on the control variables used. The parameter δ_1 is not statistically significant in all eight specifications, while δ_2 is precisely estimated in seven out of eight specifications. In Column (1), the coefficient on Flanders δ_1 is equal to 0.0222, and the coefficient on Wallonia δ_2 is equal to 0.0271 respectively; however, the parameters are not statistically significant. This implies, that based on firms locations only, we cannot make a distinction of firms in Flanders, Wallonia, and Brussels-capital regions in terms of their markups. In column(2), we control for the size of the firm via the log of the number of employees. In this case, the coefficient δ_1 goes down to 0.0104 and δ_2 goes up to 0.029 and is precisely estimated at the 10% significance level. However, in assessing the role of the firm size it is important to control for the age of the firm, as older firms are typically larger.

Column (3) shows that δ_1 goes up from 0.0104 to 0.0123, while δ_2 does not change. We further control for firm capacity in column (4). Firm capacity is proxied by the log of tangible fixed assets. δ_1 and δ_2 increase to 0.0150 and 0.0313 respectively. We expect that firm size and capacity have a positive effect on a firm's markup. To correct the negative, albeit, small coefficient on firm's capacity in column (4) we further control for the interaction between firm size and capacity. In this case, column(5) shows that firms in Flanders do not charge different markups on average than firms in Brussels (δ_1 is not statistically significant); while firms in Wallonia charge 2.9% higher markups than firms in Brussels.

Table 11: Regression results – Average markup differences across regions

	Log $\hat{\mu}_{it}$							
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Flanders-dummy	0.0222	0.0104	0.0123	0.0150	0.00833	0.00744	0.0112	0.0173
	(0.0192502)	(0.0093638)	(0.0093175)	(0.009436)	(0.0094167)	(0.0104815)	(0.0070523)	(0.0108513)
Wallonië-dummy	0.0271	0.0290*	0.0290*	0.0313*	0.0288*	0.0408***	0.0629***	0.0659***
	(0.0104688)	(0.0104299)	(0.0104142)	(0.0103794)	(0.0103827)	(0.0117673)	(0.0060637)	(0.0088941)
Log number of Employees		0.0205***	0.0239***	0.0266***	0.0832***	0.0598***	0.0646***	0.0674***
		(0.0026856)	(0.0027485)	(0.0035462)	(0.0057168)	(0.0082252)	(0.0054454)	(0.0055441)
Ln age			-0.0220***	-0.0207***	-0.0203***	-0.0183***	-0.0198***	-0.0207***
			(0.0040033)	(0.0037419)	(0.0037519)	(0.0051971)	(0.0027145)	(0.0027594)
Ln tangible fixed assets				-0.00358	0.0155***	0.0135***	0.00445***	0.00452***
				(0.0023775)	(0.0025139)	(0.0028853)	(0.0020956)	(0.0021394)
Log number of employees*tangible Fixed assets					-0.00957***	-0.00738***	-0.00612***	-0.00641***
					(0.0008379)	(0.001045)	(0.0006684)	(0.0006833)
Ln productivity						0.326***	1.440***	1.446***
						(0.0623557)	(0.170617)	(0.1681667)
Wallonië#2007.year								0.0132*
								(0.0064333)
Wallonië#2008.year								-0.0141
								(0.0346327)
Wallonië#2009.year								-0.00138
								(0.0090734)
Wallonië#2010.year								-0.00246
								(0.0092245)
Wallonië#2011.year								-0.00826
								(0.0099585)
Wallonië#2012.year								-0.0113
								(0.0097473)
Wallonië#2013.year								-0.0101
								(0.010187)
Wallonië#2014.year								-0.00320
								(0.0109613)
Wallonië#2015.year								-0.00771
								(0.0115677)
Flanders#2007.year								0.0144
								(0.0058407)
Flanders#2008.year								0.0107
								(0.0319829)
Flanders#2009.year								-0.00143
								(0.0098788)
Flanders#2010.year								-0.00350

								(0.0100283)
Flanders#2011.year								-0.0134
								(0.010359)
Flanders#2012.year								-0.0147*
								(0.0100936)
Flanders#2013.year								-0.0130
								(0.0107836)
Flanders#2014.year								-0.00993
								(0.0114697)
Flanders#2015.year								-0.00924
								(0.0122238)
Constant	0.153***	0.118***	0.171***	0.178***	0.0942***	0.0234***	-0.273***	-0.0960
	(0.0127381)	(0.0126667)	(0.0142445)	(0.0156999)	(0.0152123)	(0.0218879)	(0.0631048)	(0.2196359)
Observations	233,107	233,107	233,098	233,098	233,098	232,816	232,816	232,816
R-squared	0.000	0.008	0.010	0.010	0.022	0.102	0.475	0.459
Firm FE	NO	NO	NO	NO	NO	NO	NO	NO
Sector-Year FE	NO	NO	NO	NO	NO	NO	YES	
Sector FE								YES
Year FE								YES

*Note: the dependent variable in the log firm-level markup. Our regressors of interest are the regional dummies. Up to column (7), we augment the model by a firm-specific control and estimate the parameters using the OLS estimation method. The regressions use data from 2006-2015. The standard errors are clustered at the firm level and bootstrapped 200 times. Significance: *** p<0.01, ** p<0.05, * p<0.1*

In models of firm heterogeneity higher markups are typically linked to higher productivity because more productive firms have lower costs and thus can counteract their competitors. This makes productivity differences the underlying source for markup differences. Our approach provides us with estimates of both a firm's markup and productivity. Hence, we can assess the relation of productivity to markups. Column(6) presents regression results when controlling for (log) productivity. The coefficient on productivity is positive and statistically significant; which confirms the prediction of models of firm heterogeneity. However, δ_1 is still statistically insignificant and δ_2 increases to 0.0408. To remove aggregate trends in markups, in column (7), we control for the year-industry interaction. The coefficient on the Flanders dummy is now equal to 0.0112 but is still statistically insignificant and the coefficient on the Wallonia dummy goes up from 0.0408 to 0.0629. This implies, that firms in Wallonia charge 6.29% higher markups than firms in Brussels. In order to assess the importance of region-specific aggregate trends for markup differences, we further interact the year with the regional dummies. Column (8) presents this regression results. The coefficients on regional dummies are similar to the ones obtained in column (7).

The results of the regression analysis show that there is no statistical evidence of firms in Flanders charging different markups from firms in Brussels-Capital: the coefficient on the Flanders indicator variable is not statistically different from zero in all regression specifications. However, firms in Wallonia charge higher markups than firms in Brussels-Capital. Also, firms in Wallonia have the highest markup differences relative to the Flanders region. The results shed light on the importance of firm level characteristics, namely productivity, as well as sector-

specific aggregate trends in explaining the markups. This implies that a detailed study on the productivity/market-structure relation is warranted to provide potential mechanisms underlying markup differences among regions.

5. Conclusion

This report investigates whether firms located in Flanders and Wallonia charge different markups than firms in the Brussels-capital region. In order to answer this question, we follow a flexible methodology to estimate markups derived from a model of firm behavior and then regress the latter on location dummies and firm-specific characteristics.

We find substantial heterogeneity in the average/median markup by sector and by region. The results also indicate significant differences in markups between firms located in Wallonia relative to firms in the Brussels-Capital region: while there is no statistical evidence of firms in Flanders charging different markups from firms in Brussels-Capital, firms located in Wallonia do seem to set higher markups than firms located in both Brussels-capital and the Flanders regions.

The empirical results suggest that firms on average enjoy a certain degree of market power that differs by sector and by region. This sheds light on the importance of other factors related to the market structure of the sector in which firms operate in explaining markup differences. Moreover, our sample of firms covers most of the sections of the economy and NACE 2-digit activities seem to be spread across regions. This leads us to question, beyond demand conditions, the relevance of institutional characteristics specific to each region for explaining the differences in markups.

Finally, our markup estimates are based on a Cobb-Douglas production function specification, which assumes that firms in the sector adopt the same technology. This restricts the output elasticity of inputs to be constant across firms and over time. In order to capture the heterogeneity of firms in terms of markups (and productivity), a more flexible production function specification is needed. Typically, we can estimate a translog production function that allows the output elasticity of inputs to be firm-specific.

6. References

Amiti, M. and Konings, J. (2007), "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia," *American Economic Review* 97(5), 1611–1638.

De Loecker, J. (2011), "Product Differentiation, Multiproduct Firms, and Estimating the Impact of Trade Liberalization on Productivity," *Econometrica* 79(5), 1407–1451.

De Loecker, J. and Warzynski, F. (2012), "Markups and Firm-Level Export Status," *American Economic Review* 102(6), 2437–2471.

De Standaard (2017a), "Concurrentiewaakhond laat zijn tanden zien," 09/05/2017, [url] http://www.standaard.be/cnt/dmf20170508_02872267, geraadpleegd op 16/06/2017.

De Standaard (2017b), "Alles is duurder in België, behalve fruit en groenten," 15/06/2017, [url] http://www.standaard.be/cnt/dmf20170614_02925513, geraadpleegd op 16/06/2017.

De Standaard (2017c), "Mijn vlakke land, mijn dure land," 16/06/2017, [url] http://www.standaard.be/cnt/dmf20170615_02926986, geraadpleegd op 16/06/2017.

Europese Commissie (2017), Landverslag België 2017, http://ec.europa.eu/info/sites/info/files/2017-european-semester-country-report-belgium-nl.pdf

Hall, R. (1986), "Market Structure and Macroeconomic Fluctuations," *Brookings Papers on Economic Activity* 2(1986), 285-322.

Konings, J., Van Cayseele, P. and Warzynski, F. (2001), "The Dynamics of Industrial Markups in Two Small Open Economies: Does National Competition Policy Matter?" *International Journal of Industrial Organization* 19(5), 841–859.

Konings, J., Van Cayseele, P. and Warzynski, F. (2005), "The Effect of Privatization and Competitive Pressure on Firms' Market Power: Evidence from Emerging Markets", *Review of Economics and Statistics* 87(1), 124–134.

Konings, J., Van Cayseele, P. and Warzynski, F. (2011), "The Implementation of National Competition Policy Law and the Dynamics of Price-Cost Margins: Evidence from Belgium and the Netherlands 1993-1999," in Gaffard, J. L. en Salies, E. (eds.), *Innovation, Economic Growth*

and the Firm: Theory and Evidence of Industrial Dynamics, hoofdstuk 9, Edward Elgar, Cheltenham, VK, pp. 191–213.

Appendices

A.1 Estimates of the output elasticities, returns to scale, and markups

The output elasticities of the three inputs, returns to scale and markup estimates across sectors are reported in table 9. The estimates of the output elasticities of labor, capital, and materials are consistent with a gross output Cobb-Douglas specification of the production function.

Except for sectors 5, 52, 75, and 84, we note that all remaining sectors display a sector average close to 1 for their returns to scale, which implies constant returns to scale. However, since the returns to scale are inherent to the firm, it is likely that some firms in certain sectors have increasing returns to scale while the estimate of the sector average is close to 1. For further investigation of this, we need to estimate a more flexible production function (e.g. a translog production function) that provides output elasticities at the firm level.

Table A1: Average output elasticities, returns to scale and markups by sector

	Output Elasticities				Markup	
sector	Labor	Capital	Materials	Returns to scale	Average	Median
1	0.10 (0.02)	0.03 (0.01)	0.82 (0.04)	0.95 (0.02)	1.32 (0.05)	1.16
2	0.14 (0.06)	0.03 (0.06)	0.82 (0.18)	0.99 (0.14	1.35	1.15 (0.39)
3	-0.06 (3.49)	0.15 (3.75)	0.83 (2.56)	0.91 (2.84)	1.27	1.32 (2.44)
5	0.61 (0.40	-0.13 (0.32	0.77 (0.27	1.24 (0.38	1.41	1.16 (0.50
8&9	0.25 (0.11	0.06 (0.06)	0.70 (0.14)	1.01 (0.08)	1.09	1.03 (0.23)
10	0.15 (0.02)	0.00 (0.01)	0.84 (0.03)	1.00 (0.02)	1.23	1.07 (0.06)
11	0.09 (0.06	0.03 (0.02	0.93 (0.08	1.05 0.07	1.47	1.41 0.13
12	0.08 0.10	0.03 0.05	0.93 0.23	1.03 0.18	1.28	1.22 0.31
13	0.22 0.06	-0.01 0.02	0.78 0.07	1.00 0.02	1.13	1.02 0.10
14	0.25 0.05	0.01 0.02	0.75 0.05	1.01 0.03	1.14	0.99 0.07

	0.11	0.05	0.84	1.00	1.49	1.11
15	0.03	0.03	0.06	0.04		0.26
	0.13	0.02	0.85	0.99	1.21	1.10
16	0.05	0.02	0.07	0.04		0.10
	0.14	0.06	0.75	0.95	1.32	1.00
17	0.06	0.02	0.10	0.06		0.19
	0.13	0.02	0.81	0.97	1.41	1.22
18	0.03	0.01	0.05	0.03		0.10
	-1.12	0.63	1.38	0.90	2.06	1.63
19	0.93	0.39	0.77	1.35		1.19
	0.16	0.04	0.80	0.99	1.10	1.00
20	0.07	0.03	0.04	0.02		0.06
	0.28	-0.01	0.70	0.97	1.08	0.96
21	0.11	0.05	0.11	0.08		0.17
	0.11	0.01	0.88	0.99	1.30	1.20
22	0.03	0.01	0.04	0.03		0.06
	0.17	0.03	0.77	0.98	1.10	1.05
23	0.03	0.01	0.05	0.02		0.07
	0.24	0.07	0.72	1.03	1.00	0.92
24	0.26	0.05	0.26	0.13		0.37
	0.19	0.02	0.77	0.98	1.32	1.13
25	0.02	0.01	0.03	0.01		0.05
	0.18	0.03	0.79	1.00	1.23	1.12
26	0.05	0.02	0.06	0.02	0.10	
	0.33	0.00	0.69	1.02	1.18	0.98
27	0.12	0.04	0.14	0.07		0.22
	0.17	0.03	0.80	1.01	1.37	1.18
28	0.04	0.01	0.04	0.01		0.06
	0.28	-0.03	0.76	1.01	2.45	1.05
29	0.10	0.03	0.09	0.02		1.00
	0.35	-0.13	0.80	1.03	1.22	1.09
30	0.25	0.10	0.25	0.08		0.35
	0.17	0.02	0.80	1.00	1.27	1.14
31	0.04	0.01	0.05	0.05		0.07
	0.12	0.01	0.89	1.02	1.47	1.23
32	0.06	0.03	0.08	0.07		0.14
	0.37	-0.04	0.62	0.95	1.27	0.97
33	0.08	0.03	0.10	0.03		0.20

	-0.01	0.09	0.92	1.00	2.20	1.18
35	0.09	0.06	0.15	0.12		0.53
	0.13	0.00	0.87	0.99	1.30	1.21
36	0.09	0.16	0.17	0.23		0.26
	0.11	0.03	0.81	0.96	1.43	1.24
37	0.08	0.03	0.24	0.24		0.39
	0.27	0.07	0.64	0.98	1.01	0.89
38	0.13	0.05	0.16	0.05		0.25
	0.15	0.02	0.81	0.98	1.24	1.09
41	0.03	0.01	0.03	0.01		0.05
	0.20	0.02	0.75	0.97	1.46	1.08
42	0.06	0.02	0.07	0.03		0.22
	0.14	0.02	0.84	1.00	1.36	1.23
43	0.01	0.00	0.01	0.00		0.02
	0.12	0.02	0.84	0.98	1.26	1.05
45	0.01	0.01	0.01	0.00		0.06
	0.12	0.01	0.85	0.97	1.17	0.98
46	0.02	0.00	0.04	0.02		0.07
	0.09	0.02	0.88	0.99	1.13	1.03
47	0.00	0.00	0.01	0.00		0.02
	0.19	0.04	0.74	0.97	1.46	1.31
49	0.02	0.01	0.02	0.01		0.05
	0.12	0.01	0.81	0.94	1.07	0.91
50	0.04	0.02	0.07	0.03		0.09
	0.10	0.01	0.87	0.98	1.33	1.02
51	0.03	0.01	0.05	0.02		0.16
	0.16	0.04	0.79	0.99	1.27	0.95
52	0.02	0.01	0.02	0.01		0.04
	0.16	0.02	0.80	0.98	1.23	1.08
53	0.05	0.02	0.10	0.06		0.15
	0.10	0.06	0.86	1.03	1.43	1.31
55	0.01	0.00	0.02	0.01		0.03
	0.11	0.03	0.86	1.00	1.37	1.20
56	0.01	0.00	0.01	0.01		0.11
	0.13	0.02	0.85	1.00	1.28	1.17
58	0.05	0.02	0.05	0.02		0.08
	0.26	0.05	0.84	1.15	1.60	1.22
59	0.17	0.05	0.21	0.10		0.45

	0.19	0.04	0.77	1.00	1.46	1.33
60	0.02	0.01	0.03	0.01		0.06
	0.33	0.07	0.63	1.02	1.15	0.81
61	0.07	0.02	0.08	0.05		0.16
	0.25	0.03	0.73	1.01	1.58	1.27
62	0.04	0.02	0.05	0.01		0.14
	0.19	0.03	0.73	0.95	1.29	0.92
63	0.03	0.02	0.05	0.04		0.10
	0.23	0.01	0.69	0.94	2.08	1.00
64	0.05	0.02	0.06	0.04		0.36
	0.26	0.07	0.33	0.67	0.78	0.59
65	0.10	0.05	0.20	0.16		0.50
	0.23	0.00	0.79	1.02	1.73	1.51
66	0.04	0.01	0.04	0.02		0.08
	0.12	0.10	0.79	1.00	2.61	1.69
68	0.03	0.01	0.04	0.02		0.44
	0.25	0.02	0.71	0.99	1.49	1.31
69	0.02	0.01	0.02	0.01		0.04
	0.30	0.04	0.65	0.98	1.77	1.15
70	0.04	0.01	0.04	0.02		0.15
	0.27	0.04	0.68	0.99	1.50	1.07
71	0.04	0.01	0.04	0.03		0.12
	0.25	0.04	0.71	1.00	1.42	1.14
72	0.06	0.02	0.06	0.03		0.11
	0.20	0.04	0.80	1.04	1.25	1.04
73	0.04	0.02	0.04	0.04		0.07
	0.31	0.02	0.67	1.00	1.73	1.10
74	0.02	0.01	0.02	0.01		0.09
	-0.18	0.09	1.17	1.07	1.63	1.57
75	0.40	0.21	1.63	1.75		2.43
	0.11	0.08	0.84	1.02	2.16	1.41
77	0.06	0.02	0.10	0.06		0.47
	0.52	0.00	0.51	1.03	3.74	2.10
78	0.06	0.03	0.10	0.05		0.87
	0.11	0.02	0.87	1.01	1.08	0.94
79	0.04	0.01	0.07	0.06		0.09
	0.44	0.02	0.57	1.04	1.79	1.20
80	0.07	0.03	0.07	0.03		0.27

	0.45	0.01	0.54	1.00	2.49	1.05
81	0.02	0.01	0.02	0.01		0.23
	0.26	0.03	0.69	0.98	1.55	1.09
82	0.03	0.01	0.03	0.02		0.08
	-0.07	0.20	1.25	1.38	1.60	1.41
84	1.45	0.88	1.43	2.28		2.04
	0.21	0.06	0.73	1.00	2.50	1.29
85	0.03	0.02	0.06	0.03		0.67
	0.14	0.06	0.58	0.78	1.28	1.00
86	0.02	0.01	0.09	0.09		0.25
	0.52	0.03	0.44	0.99	1.27	1.19
87	0.07	0.01	0.07	0.02		0.19
	0.43	0.05	0.45	0.93	2.82	2.11
88	0.16	0.05	0.34	0.21		2.19
	0.00	0.04	0.89	0.92	1.44	1.28
90	0.07	0.04	0.13	0.10		0.22
	0.25	-0.03	0.66	0.89	1.38	1.12
91	0.39	0.27	0.51	0.49		1.07
	0.20	0.02	0.79	1.01	1.45	1.25
92	0.04	0.01	0.04	0.02		0.07
	0.13	0.05	0.86	1.03	1.52	1.38
93	0.02	0.02	0.04	0.02		0.08
	0.04	-0.04	0.90	0.90	2.08	1.60
94	0.14	0.05	0.32	0.32		0.79
	0.31	0.00	0.68	0.99	1.46	1.12
95	0.08	0.02	0.09	0.03		0.20
	0.21	0.04	0.77	1.02	1.63	1.27
96	0.02	0.01	0.03	0.02		0.16

Note: table reports the sector average output elasticities of the three inputs: Labor, capital, and materials. The returns to scale variable is the sum of the output elasticities. We report the sector average and median markups since the latter is not affected by outliers. Bootstrapped standard deviations of average, by sector, output elasticities and markups are in parentheses.

There is considerable variation in markups across sectors. For every sector, the average markup is above 1, which implies that firms engage in noncompetitive behavior and set prices above marginal cost. However, the median markup per sector is substantially below the average markup. Some sectors have a median markup close to and even below 1.

A.2 Robustness check: removing outliers of the markup estimates

Table A2: Regression results – Average markup differences across regions after removing outliers in the markup distribution

VARIABLES	Log $\hat{\mu}_{it}$							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.Flanders	0.000371	-0.00758	-0.00667	-0.00863	-0.0137**	-0.0132**	-0.000962	0.00870
	(0.0073161)	(0.007101)	(0.0070634)	(0.0073034)	(0.0073164)	(0.0079929)	(0.0053138)	(0.0085198)
1.Wallonië	0.0183	0.0194*	0.0194*	0.0177*	0.0157*	0.0237*	0.0489***	0.0566***
	(0.0083462)	(0.0083345)	(0.008327)	(0.0083319)	(0.008385)	(0.0091826)	(0.0053051)	(0.0069313)
l		0.0135***	0.0152***	0.0131***	0.0564***	0.0425***	0.0526***	0.0541***
		(0.0020118)	(0.0019984)	(0.0025813)	(0.0047413)	(0.0057096)	(0.0043773)	(0.0043991)
lage			-0.0103***	-0.0112***	-0.0111***	-0.0101***	-0.0123***	-0.0130***
			(0.0033173)	(0.0032082)	(0.0032157)	(0.0041685)	(0.0023958)	(0.0024266)
k				0.00263*	0.0170***	0.0152***	0.00681***	0.00718***
				(0.001748)	(0.0018266)	(0.0020765)	(0.001717)	(0.0017548)
lk					-0.00728***	-0.00594***	-0.00532***	-0.00550***
					(0.0006483)	(0.0007211)	(0.0005243)	(0.0005285)
lomega						0.220***	1.186***	1.197***
						(0.0455282)	(0.1640467)	(0.161366)
1.Wallonië#2007.year								0.00616
								(0.0052181)
1.Wallonië#2008.year								-0.0220
								(0.0317757)
1.Wallonië#2009.year								-0.00915
								(0.0075304)
1.Wallonië#2010.year								-0.00631
								(0.007608)
1.Wallonië#2011.year								-0.00890
								(0.0083175)
1.Wallonië#2012.year								-0.0173*
								(0.0079688)
1.Wallonië#2013.year								-0.0174
								(0.0087482)
1.Wallonië#2014.year								-0.00817
								(0.0094722)
1.Wallonië#2015.year								-0.00633
								(0.0097554)
1.Flanders#2007.year								0.00844
								(0.0051887)
1.Flanders#2008.year								0.00353
								(0.0286514)
1.Flanders#2009.year								-0.00520
								(0.0079656)
1.Flanders#2010.year								-0.00458
								(0.0081391)
1.Flanders#2011.year								-0.0134*
								(0.0085131)
1.Flanders#2012.year								-0.0178
								(0.0079113)
1.Flanders#2013.year								-0.0189*
								(0.0088657)
1.Flanders#2014.year								-0.0145
								(0.0094358)
1.Flanders#2015.year								-0.00926
								(0.0095915)
Constant	0.157***	0.134***	0.159***	0.153***	0.0898***	0.0440***	-0.209**	-0.0727
	(0.0115993)	(0.0116558)	(0.0127051)	(0.013443)	(0.013071)	(0.0174172)	(0.0534918)	(0.1850803)
Observations	228,445	228,445	228,436	228,436	228,436	228,312	228,312	228,312
R-squared	0.001	0.006	0.007	0.007	0.018	0.071	0.422	0.405
Firm FE	NO	NO	NO	NO	NO	NO	NO	NO
Sector-Year FE	NO	NO	NO	NO	NO	NO	YES	
Sector FE								YES
Year FE								YES

Note: the dependent variable in the log firm-level markup. Our regressors of interest are the regional dummies. Up to column (7), we augment the model by a firm-specific control and estimate the parameters using the OLS estimation

*method. The regressions use data from 2006-2015. We remove outliers in the 1st and 99th percentiles of the markup distribution. The standard errors are clustered at the firm level and bootstrapped 200 times. Significance: *** p<0.01, ** p<0.05, * p<0.1*