Competition and regulation,
Belgium, 1997 to 2004

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Abstract - The aim of this paper is to describe product market competition in the Belgian economy for the period 1997-2004 and to illustrate some causality with market regulation. The analysis is held at the industry level, for selected manufacturing and services industries. Emphasis is given to the profit elasticity (PE) measurement of competition (the "Boone" indicator) and the average profitability (AP) indicator (an approximation of the mark-up indicator). We applied the OECD Regimpact indicator as a proxy for regulation. We present some stylized facts, for Belgium in comparison with selected EU countries; and through an econometric exercise we illustrate the potential of regulation as an explanatory variable for competition.

Jel Classification: D40, L50.

Keywords: Competition, indicators, regulation.

Executive summary

Over the last two decades the European Union (EU) and its Member States have been engaged in implementing structural reforms aimed at strengthening the European economic potential. The Lisbon strategy which is a comprehensive 10-year strategy (2000-2010) covers product, labour and capital market reforms aimed at increasing productivity growth rates, employment and overall economic efficiency. Policy makers, as being suggested by economic theory, have appealed to competition-enhancing reforms as a way to boost economic activity and growth. In this paper, we try, on the one hand, to identify the changes in market competition in the Belgian economy for over the period 1997 to 2004, and on the other hand, in a tentative framework, to trace the impact of regulation on those changes. Additionally, we compare the Belgian findings with some selected EU members and their EU average.

In particular, we report the findings of two distinct indicators of market competition, namely the profit elasticity (PE) and the average profitability (AP), for the Belgian economy. The two indicators extend in different time periods and are calculated from different data sets. We choose to present both indicators because of their complementarities both in terms of time coverage and of theoretical background. The PE, known in the literature as the "Boone" indicator is estimated from firm-level data and covers the period 1997-2004, whereas the AP (Lerner index, an approximation of the market mark-up) indicator is calculated from industry level data and covers the 1985-2004 period. We find that the two indicators are generally positively correlated both over time and across industries. However, there are a number of cases where this is not the case, and the two measures seem to exhibit substantial independent variation. Without complete information about the dynamics of competition in an industry, it is difficult to say whether the profit elasticity is empirically better than the average profitability. We believe that each indicator serves as a useful empirical complement to the other, for both analytical and policy purposes. The AP represents a strategic variable (pricing) whereas, PE represents a structural variable (interaction between cost structures and pricing). Both variables are needed for the understanding of the competition dynamics in an industry and for this reason they may be considered complementary. As a general result and for the period 1997 to 2004, we may state that the competition degree in Belgium is lower than in the EU on average and this is confirmed by both indicators; and that there is a tendency of increasing competition in Belgian manufacturing average whereas for the services industry we observe a decrease in competition interpreted as a mark-ups increase.

In order to study the effect of regulation on competition levels and changes, we are employing the impact indicators of product market reform in the services industries, provided by the OECD Regimpact database on regulation. The indicators of regulation impact (RI) are industrial indicators that measure the 'knock-on' effects of regulation in non-manufacturing industries on all industries of the economy. They cover the period 1997-2003 and all manufacturing, construction and services industries. We choose to use this indicator for its time and industrial coverage.

Regulation in Belgium had the greatest restrictive impact on public utilities, communications and transport following the same pattern at the European level and it belongs to the most restrictive cohort together with Austria, Italy, France and Spain. An econometric exercise illustrates the potential of regulation as an explanatory variable for competition. The correlation of each of our competition indicators with the RI indicator was found to have the expected sign. The profit elasticity coefficient is statistically insignificant; whereas the average profitability coefficient is statistically significant.

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1. Introduction

Developments, in terms of competition, in the goods and services markets are of essential importance for economic performance. Market competition can influence innovative activity and policy makers have appealed to competition-enhancing reforms (as the Single Market Programme in the European level and/or various regulatory reforms at the national level) in order to raise rates of innovation and growth. This paper focuses on measuring competition in manufacturing and services industries for the Belgian economy. We do so by presenting two competition indicators considered complementary and we compare the Belgian competition degree with the European average and with some Members States.

In addition, we consider the effect of market regulation on the degree of competition. We choose to use the Regimpact indicator constructed by the OECD, for its time, industrial and country coverage and we derive some preliminary results on the relationship of competition with regulation. Our results point to the right direction, i.e. that regulation has an impact on the degree of competition.

The paper is structured as follows. Section two presents the theoretical background of the competition measurements used in this analysis. We present a short introduction on competition measurements that, far from being exhaustive, reports the main indicators used in the literature and their properties. Section three presents our findings on the levels and the evolution of competition in Belgium comparing it with some predefined EU averages and in some cases with other EU-countries. Section four, first we present the OECD regulation impact indicator (RI) and its implications for selected Belgian industries. Second, we report the results of our econometric exercise investigating the causality relationship between RI and our two competition measurements. Section five concludes by briefly summarizing and discussing our results.

2. Competition

Competition is a complex phenomenon and measuring it, is not a straightforward task. Firms are competing in the product markets in order to maximise their profits. The outcome (output and prices) of this game depends on many factors. Among the determinants of competition are the individual firm's characteristics, firms' strategic interaction, number of competitors and the regulatory environment. All this information is difficult to capture in one single figure.

In the empirical literature, several measures of market competition have been developed and used. We may distinguish two approaches to measuring competition and we call them the direct and the indirect one. According to the direct approach, competition is often measured with variables like concentration (e.g. Herfindahl index), rents, price cost margins, entry/exit rates, import penetration, etc. These measurements are relatively easy to calculate but they usually assume homogeneous costs structures for the firms in the same industry, a fact that may result in wrong indication for the change in competition especially in industries where low costs and high costs firms operate together. Competition has two effects in a market. First, it always raises profits of a firm relative to the profits of a less efficient firm. This is called the reallocation effect of competition. Second, a rise in competition reduces the profits of the least efficient firm active in the market (the selection effect). We may imagine a situation where the entry in an industry is liberalized and new firms enter the market. This is an exogenous shock that intensifies competition; the firms with low marginal costs (high productivity levels) will exploit their efficiency advantage by pushing aside the less efficient firms (in some cases these will be obliged to exit the market: selection effect) and earn relatively more profits at the expense of the latter (reallocation effect). So, a rise in the entry increases competition but a more aggressive interaction in the market may cause inefficient firms to exit. An increase in competition would then be associated with fewer firms in the industry and would not have captured the reallocation effect. The "indirect" approach proposes methods that are better grounded in theory but harder to calculate. In brief, there exist two methods, the structural and non-parametric method[1]. Both approaches model an industry as a representative firm and try to identify a parameter of which variation conjectures the variation of competition. The main problem with the indirect method is misspecification. We give a non exhaustive taxonomy of the competition measurements in the table that follows.

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1   See Bresnahan (1989).

Table 1   Competition measurements

	Examples of indicators	Main advantage	Main disadvantage
Direct approach	Market Concentration	Relatively easy to calculate	Not monotone to competition (they may incorrectly show an increase in competition, when in fact competition has declined)
	Price cost margins		
	Import penetration		
	Entry/exit		
Indirect approach	Price cost margins (Hall 1988, Roeger 1995)	Better grounded to theory	Harder to calculate and sensitive to the specifications chosen
	Profit elasticity (Boone 2000)		

In this paper, we have opted for the calculation of two indicators, one directly calculated from the data that is an approximation of the price cost margin (PCM), the average profitability indicator (AP) and, one that belongs to the indirect approach, and has been developed by Boone (2000), namely the profit elasticity indicator (PE). Theoretically, the latter corrects the former for the reallocation effect which is important in some highly concentrated industries (in theory, the indicators can differ, because they respond differently to a reallocation of output from inefficient to efficient firms). We have chosen the AP indicator, following the lead of Griffith et al. (2006), its advantage is that it is directly calculated from the data (the provision of data on the capital stock by EUKLEMS database greatly facilitates the calculation). The combined study of the two indicators is expected to shed light on particularities of the different industries.

In the remainder of this section, we describe the estimation/calculation methods for PE and AP and present the data we used.

2.1. Profit Elasticity (PE)

The profit elasticity (PE) measure was introduced by Boone (2000). It is an indirect measure of competition, based on the notion that competition rewards efficiency and punishes inefficiency, in the sense that fiercer competition leads to (relatively) more profits of the high productive firms at the expense of low productive ones. In a more competitive market, the same percentage increase in cost causes a bigger fall in profit. Fiercer competition is graphically represented by a steeper slope of the relation between relative profits and relative levels of productivity. The Boone indicator, estimated by using firm-level data, is measured over time and across industries; in other words, it measures the degree of competition at the industry level.

Following the methodology of Boone et al. (2007), the two-way fixed-effect regression has been estimated:

$$\ln(\pi_{it}) = \alpha_i + \alpha_t - \beta_t \ln(c_{it}) + \varepsilon_{it}$$

where

α_i is the firm fixed effect,

α_t is the time fixed effect,

π_{it} denotes the profit of firm i in year t,

c_{it} denotes the marginal cost,

ε_{it} the error term,

β_t the profit elasticity, referred to as the Boone indicator, measuring competition at the industry level.

Marginal cost is approximated by the ratio of variable cost and operating revenue (or turnover). Variable cost is obtained as the sum of material cost and employees' salaries. For all countries, except the UK[2], material cost is approximated by the cost of intermediate inputs. Profit (π_{it}) is defined as the difference between a firm's revenue and its variable cost. β_t is obtained, as expected, with a negative sign because an increase in marginal cost causes a decrease in profit. For the analysis and interpretation, we use the absolute value of beta. Comparing two markets, it is that in the more competitive market the same increase in cost will result in a bigger fall in profit. The absolute value of beta, therefore, may be used in order to express the degree of competition. The higher it is, the higher the competition. It is obtained at the industry level for each year. Following Boone et al. (2007), profit elasticity is assumed constant and hence variables are expressed in logarithm.

Our analysis involves the period from 1997 to 2004. This period marks the major economic decisions which include the Single Market Program and the implementation of the Uruguay Round trade agreement. The most notable event during this period was the liberalization of the network industries. Hence, whether liberalization policies hinders or bolsters market competition in the EU countries is a significant issue during this period, which we aim at analyzing in the latter part of the paper.

The profit elasticity measure is based on firm-level panel data. The data used for the estimation of the Boone indicator is taken from the 2007 Amadeus DVD (Bureau van Dijk) for seven European countries (Belgium, Finland, France, Italy, Spain, Sweden, and United Kingdom), ten manufacturing industries and eleven non-manufacturing industries. Since this huge firm level data set contained some errors due to various reasons, we cleaned the data. We removed a firm when:
– turnover was missing for at least one year
– salary was missing for at least one year
– profits or intermediate inputs were negative
– turnover decreased by more than 80% in the next consecutive year
– turnover increased by more than 500% in the next consecutive year.

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2   The Amadeus database for the UK does not provide data on intermediate goods costs. The "costs of goods sold" has been used a s a proxy.

Table 2 gives the classification of industries we have used in our analysis (both for the PE and the AP indicators). In brackets, we include the shortcuts of the industries' labels as used in graphs and tables throughout the paper.

Table 2   Selected industries

Manufacturing sectors		
Food, Beverages and Tobacco	15t16	(Food)
Textiles, textile, leather and footwear	17t19	(Textile)
Wood and of wood and cork	20	(Wood)
Pulp, paper, printing and publishing	21t22	(Paper)
Chemical, rubber, plastics and fuel	23t25	(Chemicals)
Other non-metallic mineral	26	(Non-metallic)
Basic metals and fabricated metal	27t28	(Metals)
Machinery NEC	29	(Machinery)
Electrical and Optical equipment	30t33	(ICT)
Transport equipment	34t35	(Motor)
Non-manufacturing sectors		
Electricity, gas and water supply	E (40t41)	(Public utilities)
Construction	F (45)	(Construction)
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	50	(Garage)
Wholesale trade and commission trade, except of motor vehicles and motorcycles	51	(Wholesale)
Retail trade, except of motor vehicles and motorcycles; repair of household goods	52	(Retail trade)
Transport and storage and communication	I (60t64)	(Transport, storage and communications)
Transport and storage	60t63	(Transport)
Post and telecommunications	64	(Communication)
Financial intermediation	J (65t67)	(Finance)
Real estate, renting of m&eq and other business activities (for AP calculations)	K (70t74)	(Real estate & business)
Real estate and renting of m&eq and other business activities and computer and related activities (for PE calculations)	70t72	

2.2. Average Profitability (AP)

In both the theoretical and empirical literature, we find attempts to develop techniques of estimating the mark-up that corrects for the constant returns to scale assumption and the business cycle. Mark-ups at different levels of aggregation (countries, industries) have been directly computed from available data (Griffith et al. (2006), Griffith et al. (2007)) and/or estimated using econometric techniques (Roeger (1995), Martins et al. (1996)). Here, we calculate a simple measure of average profitability (AP), directly from the data, at the industry level, that can be shown that it is equivalent to the measure proposed by Roeger (1995) and to the price cost margins[3] (PCM) under constant returns to scale, such that marginal cost is equivalent to average cost[4]

We know that, given a production function with capital, labour inputs and intermediate inputs, and provided that information on the costs of inputs is available, mark-ups can be computed in a straightforward way. The following identity then holds:

$$\frac{\mu}{\lambda} = \frac{P * Q}{w * L + r * K} \qquad (1)$$

where Q, L, and K stand for real output, labour and capital inputs with P, w, and r their respective prices. μ is the mark-up ratio of prices over marginal costs and λ is the degree of returns to scale (λ=average cost/marginal cost). Under constant returns to scale (λ =1), the mark-up can be directly derived from the above identity. We define average profitability as the above ratio and we rewrite it (Lerner Index), in terms of the labels used in the principal data set we used, i.e. the EUKLEMS database

$$AP_{ijt} = \frac{VA_{ijt}}{LAB_{ijt} + CC_{ijt}} \qquad (2)$$

where VA stands for value added, LAB for labour costs and CC for capital costs. All variables are in nominal prices. The index i is the country index, j the industry index and t the year index.

Compared to the true mark-up, the AP is biased downwards (upwards) with increasing (decreasing) returns to scale. Data for value added and labour compensation are found directly in the EUKLEMS database. For the capital costs (which are equal to the capital stock multiplied by the users' cost of capital) we have taken the capital stock from EUKLEMS and construct the user's cost[5] of capital according to the formula (equation (3)) for the calculation of the user's cost of capital in terms of the investment goods prices (found in the available data),

$$p_{it}^{j} = p_{it-1}^{j}\left(R_{it} + \delta_{it}^{j} - \pi_{it}^{j}\right) \qquad (3)$$

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3   PCM has a long tradition as a measure of competition. Aghion et al. (2005) and Nickell (1996) calculate it directly as the profit/sales ratio. Berry et al. (1995), Hausman et al. (1994) and Nevo (2001) first estimate demand and cost functions and given the competitive regime, they calculate the optimal firm's PCM. Hall (1988) developed a method of testing for a positive PCM without calculating it. Roeger (1995) adopting Hall's method estimates mark-ups as averages over time. Recently, Christopoulou et al. (2008) have provided industrial average mark-ups for the euro area based on the Roeger method. In Annex I, we provide a brief comparison of our findings with those of Christopoulou et al. (2008).

4   See Klette (1999).

5   See Oulton (2005).

with p_{t-1}^{j}: the price of the investment goods at *t-1* for industry *j*,

R_{it}: the long term nominal interest rate for country *i* at time *t*,

δ_{it}^{j}: the industry depreciation rate,

$\pi_{it}^{j} = 1 - \dfrac{p_{it-1}^{j}}{p_{it}^{j}}$: the investment goods price change.

We took the country-specific time series for the long-term interest rate from the AMECO database. For the depreciation rates, we use EUKLEMS data to construct country and industry specific capital depreciation.

Equation (3), however, cannot be used as such for the computation of the uses'-cost of capital since the investment prices do not include fixed capital. In order to correct for this, we take a five years average of equation (3) as a proxy for the user's cost of capital, i.e.

$$ucc_{it}^{j} = \frac{\sum\limits_{t-4}^{t} p_{it}^{j}}{5} \qquad (4)$$

The data of capital for Belgium are not available in the EUKLEMS and we have been using data provided by the Federal Planning Bureau. We have calculated the AP for seven EU countries (Austria, Belgium, Denmark, Finland, Italy, Netherlands, United Kingdom), ten manufacturing industries, nine[6] non manufacturing industries (including public utilities and construction); and for the period 1985 to 2004. Note that we defined eight non-manufacturing industries for Belgium. We could not disaggregate the transport, storage, post and telecommunications industry due to a lack of data on capital.

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6   There is a difference in classification between PE and AP. We could estimate the PE for NACE 70, 71 and 72 separately, whereas we could calculate the AP only for the aggregate 70t74. For the analysis of the PE we aggregated 70, 71 and 72 and compare it to the 70t74 aggregate of the AP. We should take into consideration this difference when drawing conclusions.

3. Competition in Belgium

Before exposing our findings, we should to keep in mind some remarks concerning the two indicators.

(1) We agree that the PE indicator measures competition in terms of its intensity resulting from the difference in marginal costs within the industry. The higher the value of the PE is, the stronger the intensity of competition. An increase in PE is therefore associated with an increase in inter-industry competition: the bigger the discrepancy in productivity between firms the fiercer the fight to keep one's position in the market. In this sense, we may safely talk about relatively more or less dynamic industries or countries.

(2) The AP, as mentioned already, is a measurement of the mark-up and as such a measurement of the economic rents and the pricing regime of a firm or an industry. Compared to the true mark-up, the AP is biased downwards (upwards) under increasing (decreasing) returns to scale. In analysing our findings, we should keep in mind the following features of the measurement: (i) various data incompatibilities in the measurement of capital and value added across countries affect the cross-industry variation of the AP; (ii) for most countries the AP appears to exhibit an upwards trend over time, and this trend has been associated, among others, with reductions in the bargaining power of workers and with increases in the returns to scale; (iii) the AP is generally pro-cyclical. When the AP enters into econometric relations with other variables such as regulation and innovation, these features are usually corrected for by using dummy variables for country, industry and time effects. Nevertheless and for a descriptive analysis of competition, we argue that the AP may vary well serve as an indicator of the market-power (or mark-up) evolution in the time-industry-country framework.

3.1. Levels and evolution

Tables 3 and 4 describe the average level for the PE and AP indicators respectively. In particular, Table 3 reports the 1997-2004 average PE for Belgium and the EU-6*[7]. Competition is less intense in Belgium with respect to the EU-6* for both the manufacturing and non-manufacturing averages. We find that manufacturing is more competitive than the services industry. Public utilities and construction seem to perform better than their European counterparts

Table 3 reports both the mark-ups for Belgium and the eu-6**[8] and their evolution between 1985-1997 and 1997-2004 periods. First, in terms of evolution, we may notice that the average manufacturing mark-up remained almost constant whereas the non-manufacturing it increased in order to achieve almost the same levels for both categories during 1997-2004. Changes in the individual manufacturing industries are smaller than those in the non-manufacturing industries. In terms of comparison with the EU-6** average, we observe relatively higher mark-ups in Belgium than in the EU. This is not only true for the average but also for the majority of the selected industries. Moreover, we observe that the

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7   Finland, France, Italy, Spain, Sweden, United Kingdom.
8   Austria, Denmark, Finland, Italy, Netherlands, United Kingdom.

average 1997-2004 mark-up for Belgium converges to the average EU mark-up. Both our indicators testify for a lower degree of competition for Belgium than their EU counterparts, although we must be aware of the differences between the employed European aggregations.

Table 3   Profit Elasticity in selected industries

	Belgium 1997-2004	EU-6* 1997-2004
Manufacturing		
Average	2,02	2,33
Food	1,38	2,05
Textile	2,16	2,45
Wood	2,19	3,06
Paper	1,25	1,56
Chemicals	1,49	1,77
Non metallic	2,36	2,17
Metal	1,31	2,52
Machinery	2,79	2,87
ICT	2,06	2,33
Motor	3,19	2,50
Non manufacturing		
Average	1,11	1,34
Public utilities	0,78	0,63
Construction	2,06	1,75
Garage	1,32	2,43
Wholesale	1,35	1,71
Retail trade	1,14	2,05
Transport	0,91	1,14
Communication	1,22	1,35
Finance	0,57	0,77
Real estate, renting, and computer	0,96	0,96

* Finland, France, Italy, Spain, Sweden, United Kingdom

Source: Amadeus 2007, own calculations.

Table 4   Average Profitability in selected industries

	Belgium		EU-6**	
	1985-1996	1997-2004	1985-1996	1997-2004
Manufacturing				
Average	1,11	1,10	1,05	1,09
Food	1,14	1,13	1,11	1,12
Textile	1,04	1,06	1,01	0,99
Wood	0,89	1,03	1,01	1,06
Paper	1,17	1,11	1,05	1,09
Chemicals	1,37	1,29	1,10	1,22
Non-metallic	1,14	1,10	1,10	1,11
Metals	1,06	1,02	1,05	1,06
Machinery	1,08	1,18	1,06	1,07
ICT	1,10	1,02	1,09	1,20
Motor	1,11	1,02	0,92	1,02
Non manufacturing				
Average	1,06	1,10	1,00	1,09
Public utilities	1,17	1,21	0,95	1,11
Construction	1,14	1,13	1,07	1,10
Garage	1,24	1,21	1,08	1,15
Wholesale	1,33	1,24	1,20	1,21
Retail trade	1,19	1,16	1,00	1,02
Transport, storage and communication	0,78	0,88	0,84	0,93
Transport (1)	*0,79*	*0,88*	*0,85*	*0,93*
Communication (1)	*0,94*	*1,05*	*1,01*	*1,11*
Finance	1,08	1,17	1,16	1,25
Real estate, renting, and business activities	0,96	1,13	0,87	1,04

**   Austria, Denmark, Finland, Italy, Netherlands, United Kingdom

(1): values for Belgium obtained by disaggregating the Transport, storage and communications value of AP, based on the EU-6** calculated values
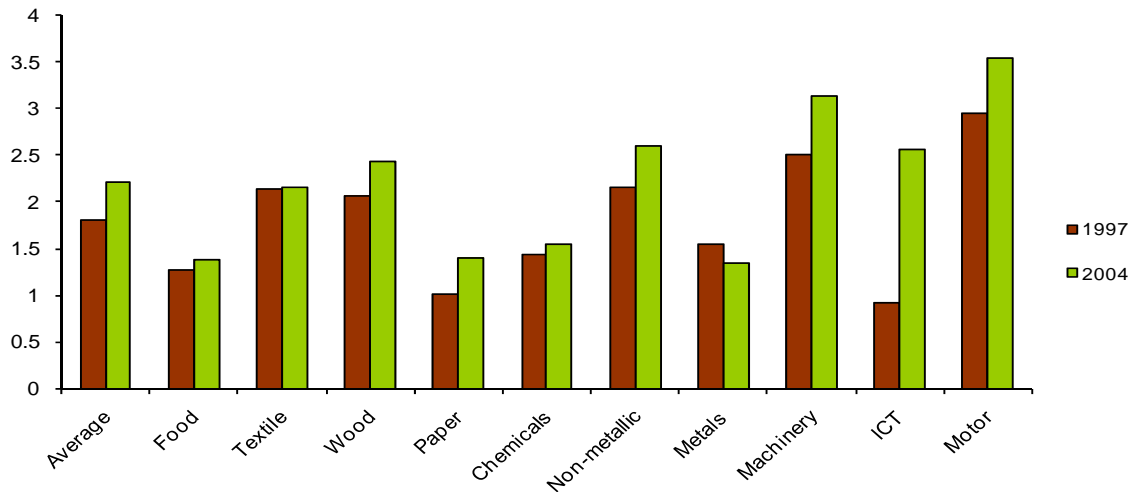
Source: EUKLEMS, FPB own calculations.

Graphs 1 to 4 report the evolution of the two indicators for Belgium by giving their values for 1985 (only for the AP), 1997 and 2004.

The PE of the average of the selected manufacturing industries reports an increase in the intensity of competition, whereas AP reports a decrease of the mark-up between 1985 and 1997 followed by nearly no change in 2004. The two indicators agree on five out of ten selected industries, namely, Paper, Chemicals, Metals, ICT and Motor.

The PE of the average selected non-manufacturing industry suggests a decrease in competition and agrees with the AP which registers an increase in the average mark-up, implying an decrease in competition. Among the individual industries the two indicators agree on three out of seven industries, not considering the transport and communications industry. For the latter and due to a lack of data, we could not obtain AP values for the transport-storage and the post-telecommunications industries separately. Nevertheless, the PE suggests a decrease in competition for the transport-storage industry and an increase for the post-telecommunications industry. The AP for the aggregate industry registers an increase in the mark-up which would imply a decrease in competition. Unfortunately,
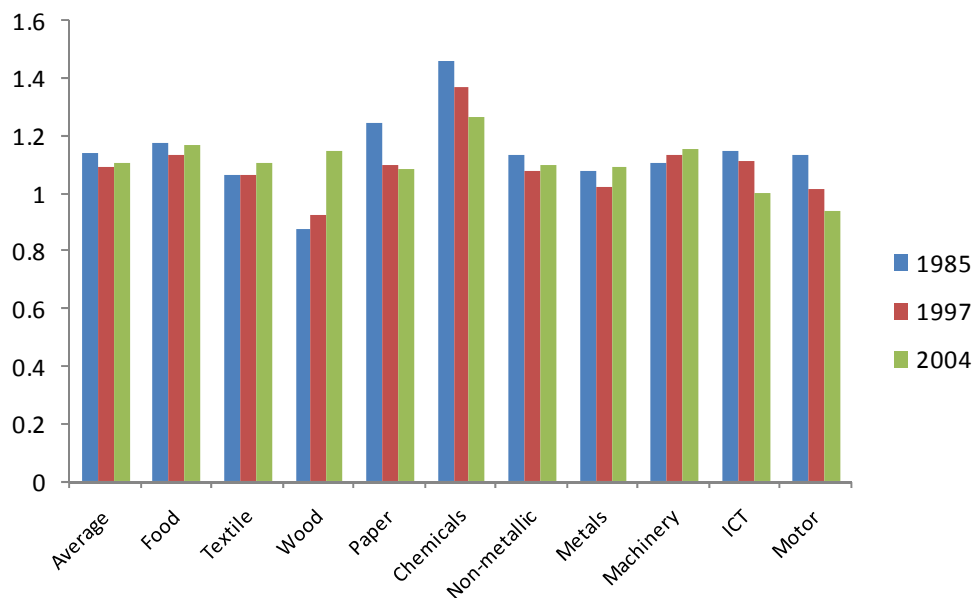
without disaggregated data and keeping in mind that transport is usually a heavily subsidized industry, the AP indicator is not informative in this case.

Graph 1   Profit Elasticity in manufacturing industries, Belgium

Source: Amadeus 2007, own calculations.

Graph 2   Average Profitability in manufacturing industries, Belgium

Source: EUKLEMS, FPB own calculations.

Graph 3   Profit Elasticity in non-manufacturing industries, Belgium
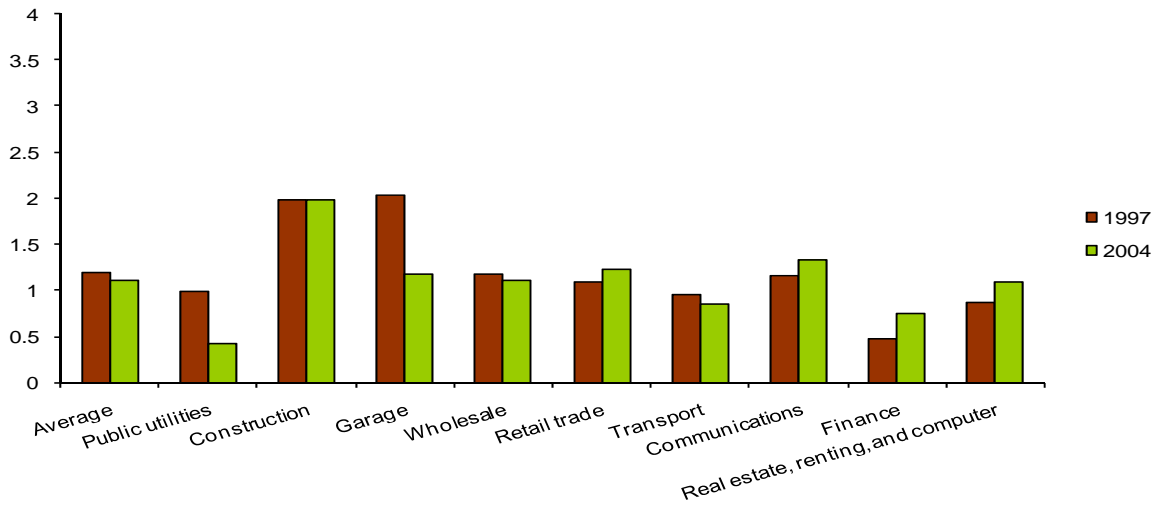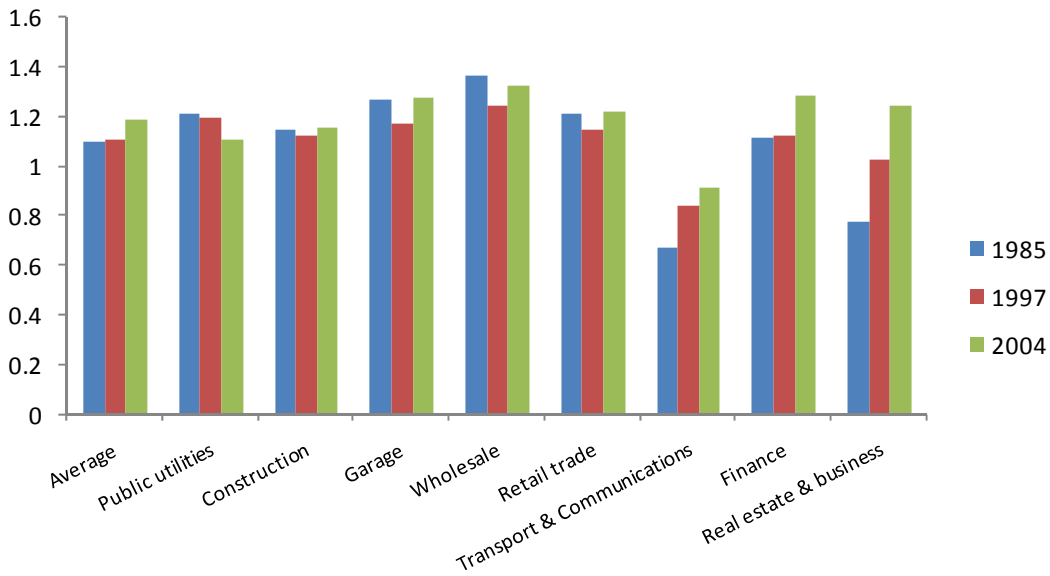

Source: Amadeus 2007, own calculations.

Graph 4   Average Profitability in non-manufacturing industries, Belgium
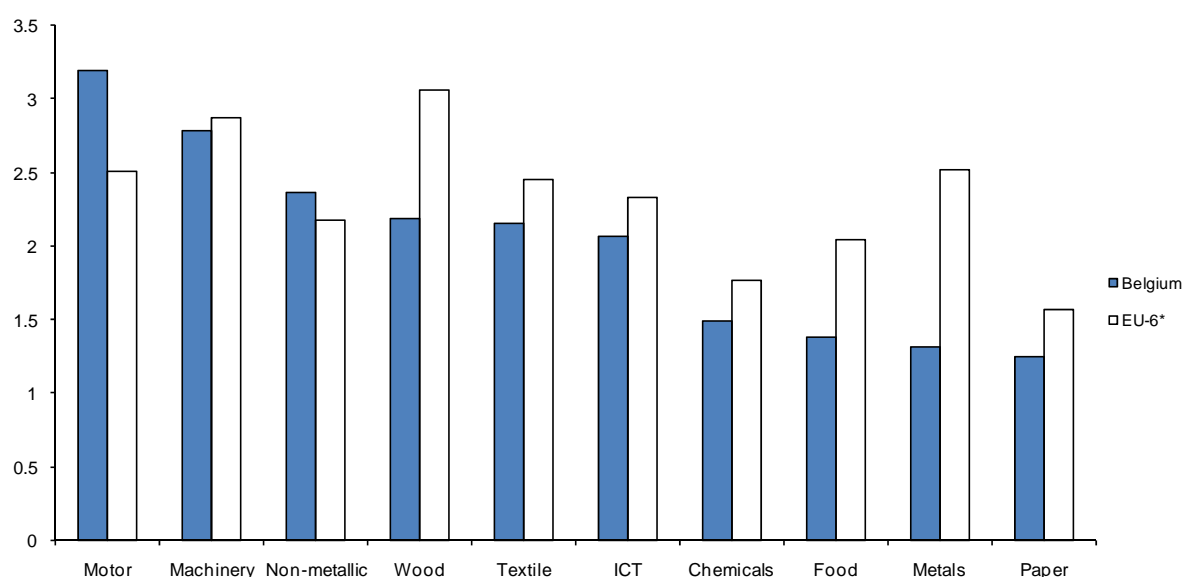

Source: EUKLEMS, FPB own calculations.

3.2. Industry and country rankings

Graphs 5 to 8 present a ranking of the selected manufacturing and services industries in terms of 1997-2004 average levels of the PE and AP for Belgium. There is not a one to one relationship of the rankings obtained by the two indicators. Nevertheless, the rankings may serve as guides when studying a specific industry. For example, Chemicals is ranked first in terms of the mark-up implying that it has the lower degree of competition among the selected industries. The PE rank for Chemicals puts it in the lower competition cohort of industries. Textiles, Motor, Wood and Food industries get the same ranking for both indicators.

For the selected non-manufacturing industries, it is interesting to note that Wholesale and Garage are ranked as the least competitive in terms of the mark-up but as the more competitive in terms of competition intensity. Both indicators place Retail in about the same position.

Graph 5   Profit Elasticity ranking of manufacturing industries, 1997-2004 averages

Source: Amadeus 2007, own calculations.

Graph 6   **Average Profitability ranking of manufacturing industries, 1997-2004 averages**
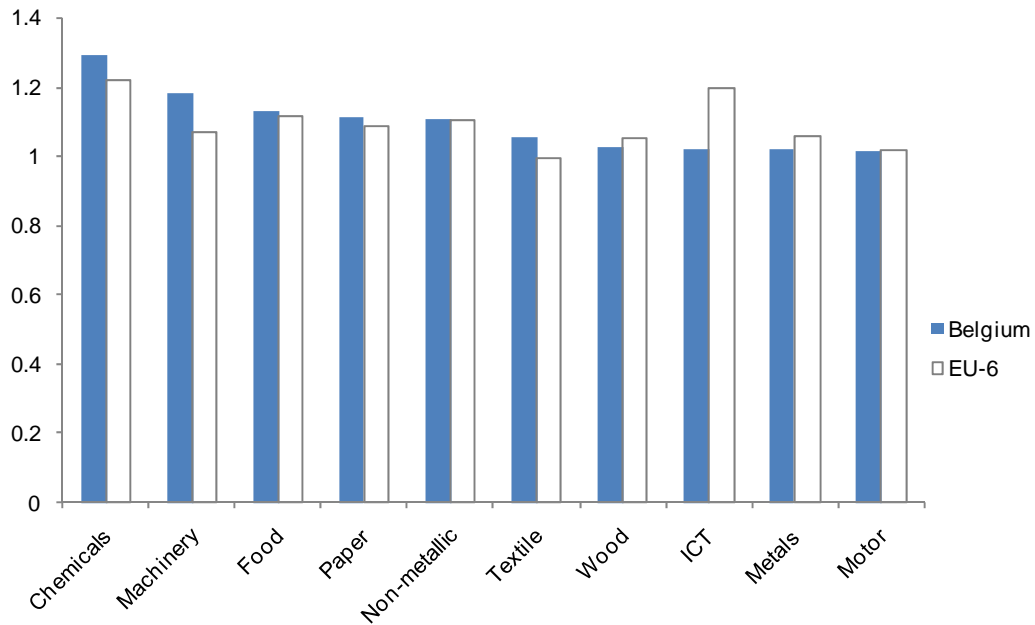
Source: EUKLEMS, FPB own calculations.

Graph 7   **Profit Elasticity ranking of non- manufacturing industries, 1997-2004 averages**

Source: Amadeus 2007, own calculations.

Graph 8   Average Profitability ranking of non-manufacturing industries, 1997-2004 averages

Source: EUKLEMS, FPB own calculations.

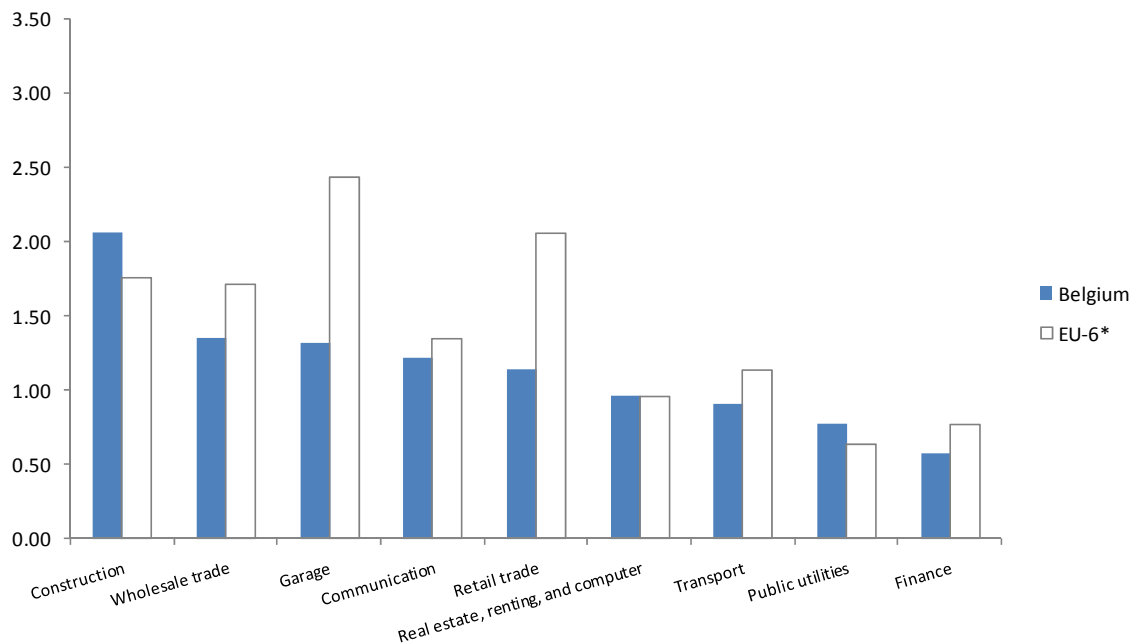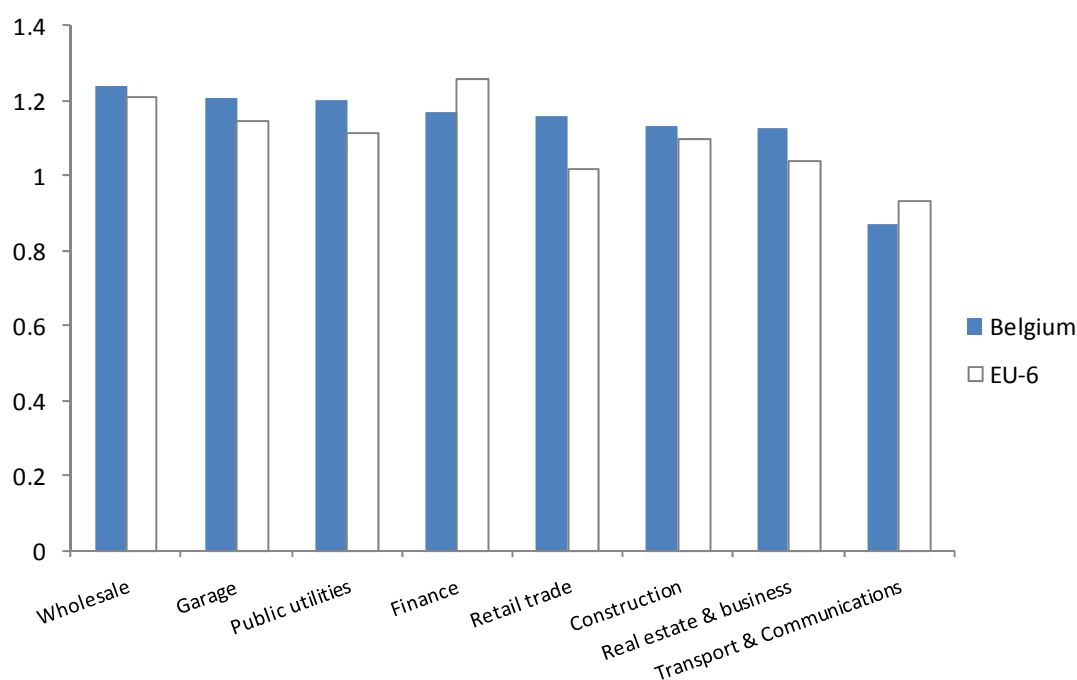Tables 5 and 6 provide for each industry a country ranking of the performance of our indicators. In terms of competition intensity (PE ranking) for the selected manufacturing industries, Belgium occupies one of the first three places in five out of ten industries; and one of the first four places in seven out of ten. For the selected non-manufacturing industries the scores are three industries out of eight in the top three and four out of eight in the top four. This is a good score implying that industries are dynamic in terms of competition. It is worth noting here that the PE ranking is quite systematic, in the sense that for the majority of industries (15 out of 18) the United Kingdom seems to be the country where competition is highest. Sweden is the country with the lowest degree of competition in the selected manufacturing industries. Belgium has the lowest degree of competition for Retail, a fact that has also been pointed out in the 2008 OECD country survey for Belgium (OECD (2009), referring to the 1996-2006 period).

In terms of the AP ranking, the Belgian industries perform worse than suggested by the PE indicator. For the manufacturing industries, Belgium ranks only two industries out of ten in the top three and in three out of ten in the top four. For the non-manufacturing industries, Belgium ranks in only one out of seven industries in the top three. This is the Wholesale industry. Retail trade, is again found in weak competition position as implied by the relatively high mark-up.

Table 5   Countries[9,] Profit Elasticity ranking from strong to weak competition, 1997-2004 averages

	Highest Competition	Lowest Competition	Belgium
Manufacturing			
Food	United Kingdom	Sweden	6
Textile	United Kingdom	Sweden	3
Wood	United Kingdom	Sweden	4
Paper	United Kingdom	Sweden	3
Chemicals	United Kingdom	Sweden	5
Non-metallic	United Kingdom	Sweden	2
Metals	United Kingdom	Sweden	6
Machinery	United Kingdom	Sweden	3
ICT	United Kingdom	Sweden	4
Motor	United Kingdom	Sweden	2
Non manufacturing			
Public Utilities	Spain	Italy	3
Construction	United Kingdom	Italy	3
Garage	United Kingdom	Sweden	6
Wholesale	United Kingdom	Sweden	6
Retail trade	Spain	Belgium	7
Transport	United Kingdom	Italy	4
Communication	United Kingdom	Sweden	3
Finance	Spain	Finland	6

Source: Amadeus 2007, own calculations.

Table 6   Countries[10] Average Profitability ranking from strong to weak competition, 1997-2004 averages

	Highest competition	Lowest Competition	Belgium
Manufacturing			
Food	Italy	Netherlands	5
Textile	Finland	Austria	6
Wood	Italy	Austria	3
Paper	Denmark	Finland	5
Chemicals	United Kingdom	Netherlands	5
Non-metallic	Denmark	Finland	5
Metals	United Kingdom	Austria	4
Machinery	Denmark	Austria	6
ICT	Netherlands	Finland	2
Motor	Italy	Austria	5
Non-manufacturing			
Public Utilities	Netherlands	Denmark	5
Construction	Finland	Austria	5
Garage	Denmark	Austria	5
Wholesale	Denmark	Finland	3
Retail trade	Denmark	Belgium	7
Finance	Italy	Finland	4
Real estate, renting, and business activities	Denmark	Italy	5

Source: EUKLEMS, FPB own calculations.

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9 Table 5 presents the country with the highest and the one with the lowest PE among Belgium, Finland, France, Italy, Spain, Sweden, and the United Kingdom. The last column presents the position of Belgium in this classification (e.g. Belgium ranks last (7th) for Retail trade, having the lowest competition intensity among all covered countries).

10 Table 6 presents the country with the lowest AP (highest competition) and the one with the highest AP (lowest competition) among Austria, Belgium, Denmark, Finland, Italy, Netherlands, and the United Kingdom; the last column presents the position of Belgium in this classification (e.g. Belgium ranks last (7th) for the retail trade, the highest mark-up/lowest competition among all the other countries).

3.3. Combining the two indicators

Graph 9 presents an integrated analysis of the two indicators for Belgium. The AP tis measured along the horizontal axis, whereas the vertical axis measures the Boone (PE) indicator. The horizontal axis is divided into a low and to the high mark-up area. The vertical axis is divided into moderate and high competition intensity.

In the quadrant of low market power (mark-ups between -15% and +10%) and moderate competition intensity (PE between 0.5 and 2.0), we find: Transport, Metals, and Communication.

In the low market power and high competition intensity quadrant we find four manufacturing industries: in increasing competition intensity order, we find: ICT, Wood, Textile and Motor.

In the high market power and moderate competition intensity quadrant, we find the majority of industries. In increasing order of the mark-up, we have: Paper, Food, Retail trade, Finance, Public utilities, Garage ,Wholesale, and Chemicals.

In the high market power and more than moderate competition intensity quadrant, we find non-Metallic, Construction and Machinery.

Graph 9   Competition mapping of Belgian industries according to Profit Elasticity and Average Profitability
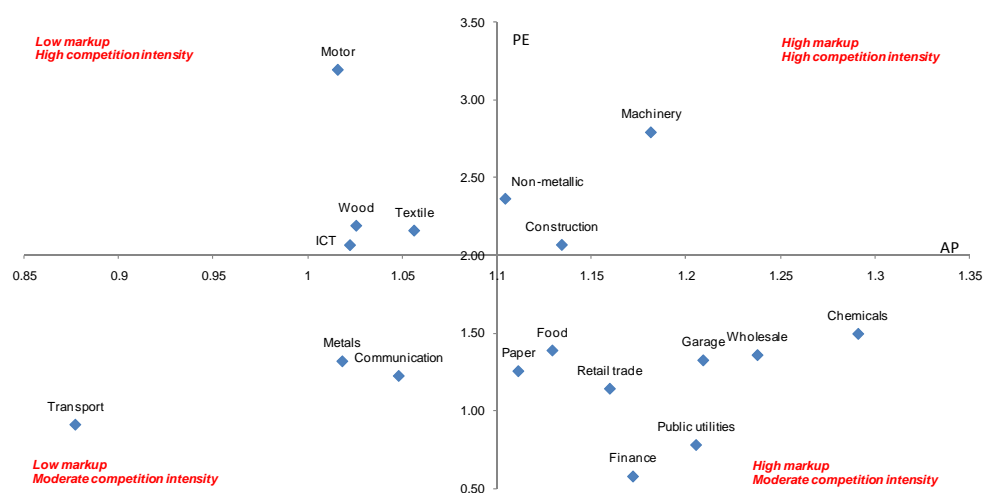
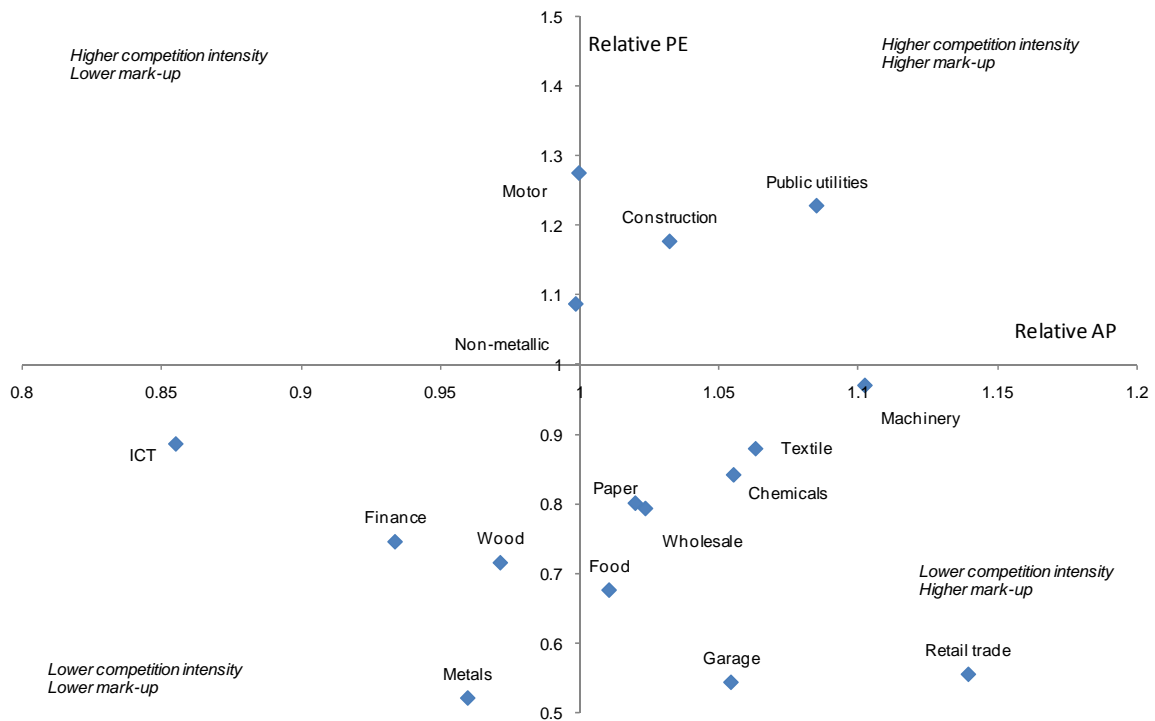Source: Amadeus 2007, EUKLEMS, FPB, own calculations

Graph 10 maps, for the two competition indicators the ratio of the Belgian and European scores.

The South-East quadrant represents the area where the Belgian PE is lower than its European counterpart and the Belgian AP is higher than the European one. In other words, both indicators agree that the Belgian manufacturing industries of Machinery, Textile, Chemicals, Paper and Food; and the non-manufacturing ones of Retail trade, Garage, Wholesale, exhibit lower degrees of competition with respect to the European average.

The North-East and South-West quadrants represent the areas where the two indicators disagree.. Construction and Public utilities exhibit higher competition intensity but also higher mark-ups than their European averages. Finance, ICT, Wood and Metals exhibit both lower competition intensity and lower mark-ups.

Last, the North-West quadrant, which represents agreement of the indicators in the case of stronger competition for Belgium with respect to the EU, contains industry. This means that both indicators agree that no Belgian industry exhibits stronger competition than the European average. For Transport and Non-metallic, the graph reports that their mark-ups are in line with the European averages but competition intensity is higher.

Graph 10   Comparison of degrees of competition (Belgium vs EU) according to relative profit elasticity and relative average profitability
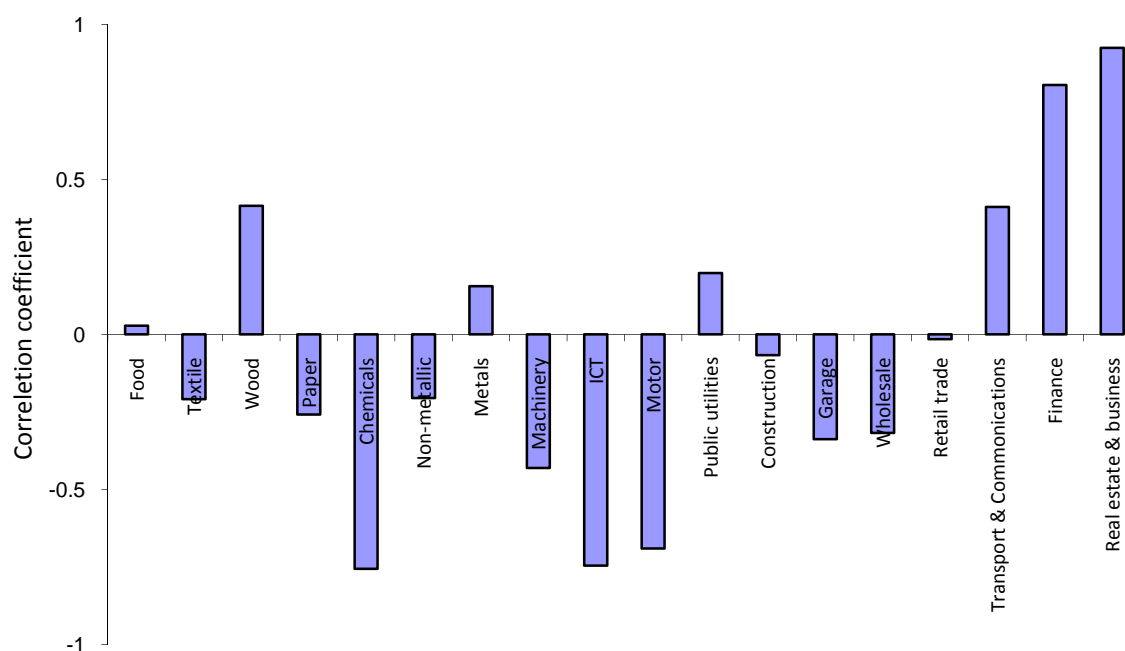

Source: Amadeus 2007, EUKLEMS, FPB, own calculations

Graphs 11 and 12 are showing the correlation between the two competition measurements.

Graph 11 shows the within industry (across time) correlation between AP and PE. We observe that it does not have the expected sign for seven out of eighteen industries. The two indicators should be negatively correlated in order to agree on the direction of the change of competition, since an increase in AP is implying a decrease in competition which is translated in a decrease in PE.

Graph 12 shows the within a year (across industries) correlation for each year. It has the expected sign for all years except 1998. Note that Belgium was affected by a recession that year[11]. Since the AP is more cyclical than the PE, the two indicators not correlated across industries for that year.
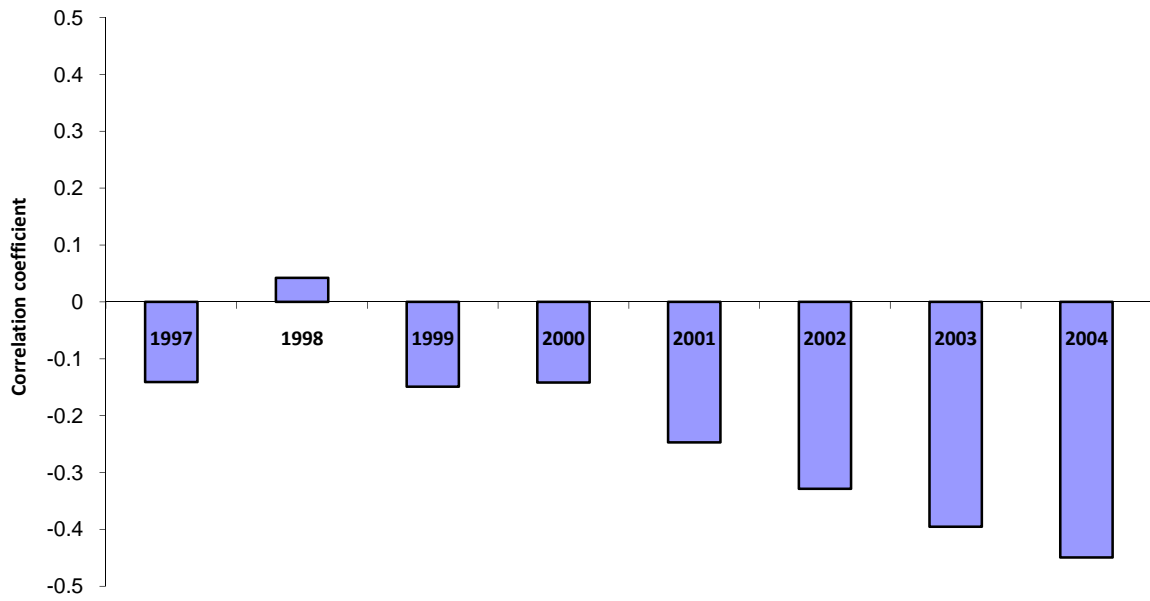
Graph 11   Profit Elasticity and Average Profitability within industries (across time)

Source: Amadeus 2007, EUKLEMS, FPB own calculations

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11   See BFP (2008), page 3, the graph on real and potential GDP.

Graph 12   Profit Elasticity and Average Profitability within a year (across industries)

Source: Amadeus 2007, EUKLEMS, FPB own calculations

4.   Competition and regulation

Market structure determines the nature and degree of competition in the marketplace. The market structure is characterised by aspects such as the industrial patterns of entry and exit, the industry concentration, and the regime of market regulation. In this section we present an econometric exercise aimed at shedding light on the relation between regulation and competitive performance. We start by briefly presenting the OECD indicators for regulation and in particular the Regimpact indicator (RI) which we choose to use as explanatory variable, since it is the more complete in terms of time, industry and country coverage. Then, we present our econometric model and draw our conclusions both at the European and the Belgian level.

Concerning market regulation, empirical evidence has only recently become available through the provision of comparable regulation indicators across countries by the World Bank and the OECD. The empirical evidence suggests that product-market regulation has the effect of a brake on economic performance. For instance, Cincera and Galgau (2005) show that tighter regulation leads to less entry and, for Griffith et al. (2006) it is implying higher mark-ups. Product market regulation functions as a mobility barrier for firms and imposes compliance costs on enterprises that divert resources away from productive allocations. Product market regulation has become less restrictive during the last twenty years, since regulatory reform is aimed primarily at stimulating competition and improving economic performance.

The OECD has developed a range of indicators of product market regulation at both the economy-wide and industrial levels. They all measure the extent to which policy settings promote or inhibit competition in areas of the product market where competition is viable. There are:

(1) The economy-wide indicators of policy regimes in OECD countries called indicators of product market regulation (PMR). They have been constructed for 1998, 2003 and 2008. These indicators summarise a wide array of different regulatory provisions across OECD countries.

(2) Regulation in the professional services. These indicators measure regulatory conditions in the professional services. The professional services indicators cover entry and conduct regulations in the legal, accounting, engineering, and architecture professions and have been estimated for 1996, 2003 and 2008.

(3) Indicators measuring regulatory conditions in the retail industry. The retail indicators have been estimated for 1998, 2003 and 2008.

(4) The indicators of regulation in energy, transport and communications (ETCR) summarise regulatory provisions in seven industries: telecoms, electricity, gas, post, rail, air passenger transport, and road. They are estimated for a long time period (starting 1975 and updated up to 2008).

4.1. The Regimpact indicator (RI)

Product market regulations with anticompetitive effects will also have an impact on firms operating in other industries of the economy that use their output as intermediate inputs. Conway and Nicoletti (2006) developed for the OECD a regulatory impact indicator (Regimpact or RI) that measure the 'knock-on' effect of regulation in non-manufacturing industries on all industries of the economy. We have decided to employ the (RI) indicators for three reasons: (i) they cover all industries and countries (at the industrial rather than the economy wide level) we are interested in, (ii) they are constructed for each year from 1975 to 2003 and (iii) they are constructed explicitly to measure the restrictive impact of the bulk of regulation (i.e. in the non-manufacturing industries) on all industries in the economy. Their values are normalized from 0 to 1, from least to most restrictive, i.e. a higher the value of the indicator of the industry means strong regulatory restrictions which implies low competition in the industry. The principle for the construction of these indicators is the fact that the effect of product market regulations that restrict competition in non-manufacturing industries is by no-means confined to these industries. In any given country the magnitude of these 'knock-on' effects is a reflection of two factors: (i) the extent of anti-competitive regulation in non-manufacturing industries and, (ii) the importance of these industries as suppliers of intermediate goods. The RI has been calculated using coefficients derived from harmonised input-output tables. The RI is based on data for the following regulated industries: electricity, gas, airlines, rail and road transport, wholesale and retail trade, postal services, telecoms, financial services and business services.

Graphs 13 to 15 report the "knock-on" effect of the regulation on Belgian non-manufacturing industries to all our selected industries and the corresponding measures for EU-9[12]. Regulation in Belgium had (as expected by the construction of the indicator) the greatest restrictive impact on public utilities, communications and transport following the same pattern at the European level and it belongs to the most restrictive cohort together with Austria, Italy, France and Spain.

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12 Austria, Denmark, Finland, France, Italy, the Netherlands, Sweden and the UK.

Graph 13   Regulation impact index for selected Belgian and EU-9 industries, 1997-2003 averages
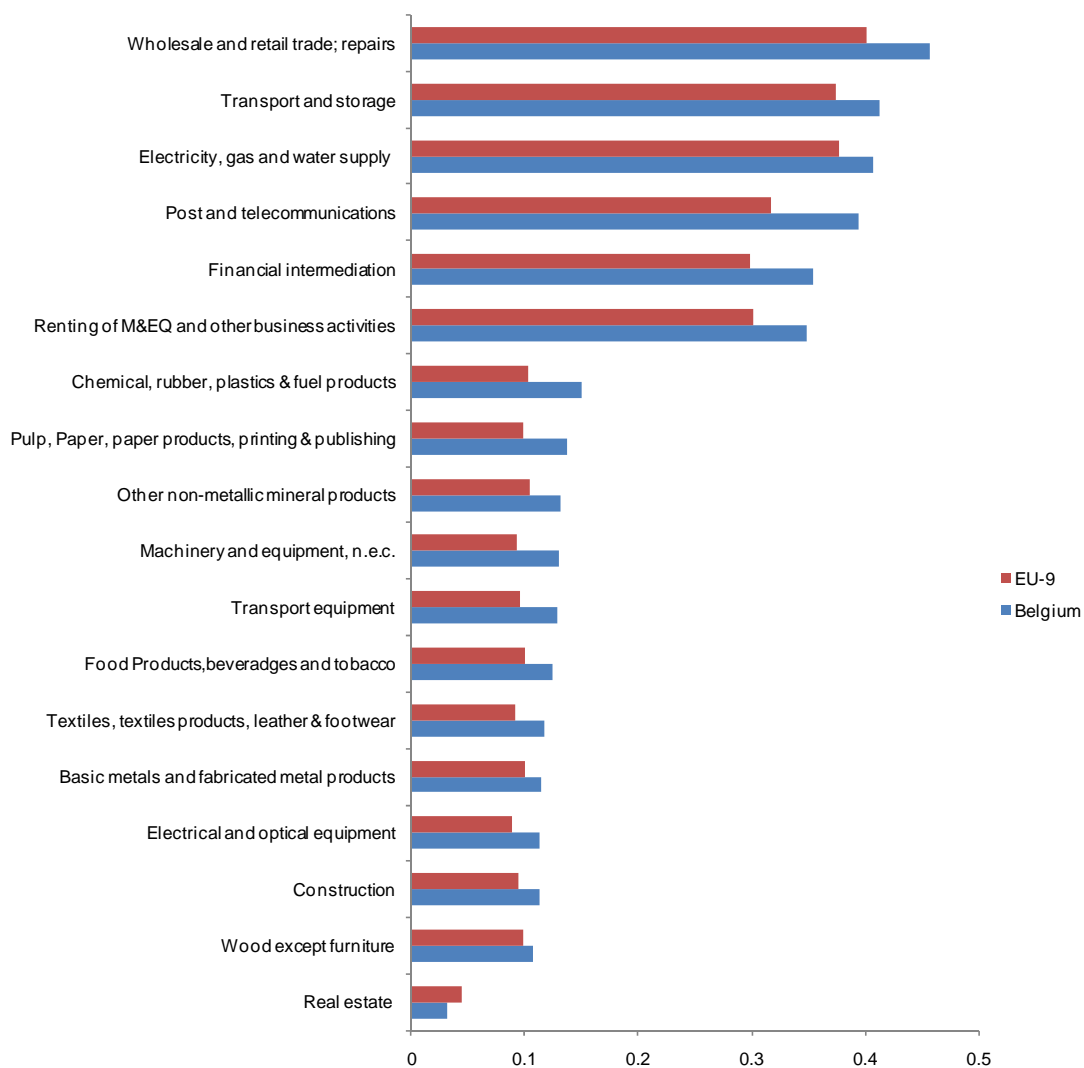
EU-9: AUT, DNK, FIN, FRA, ESP, ITA, NLD, SWE, UK

Source: OECD, own calculations

Graph 14   Country average regulation impact for the 1997-2003 average manufacturing industry
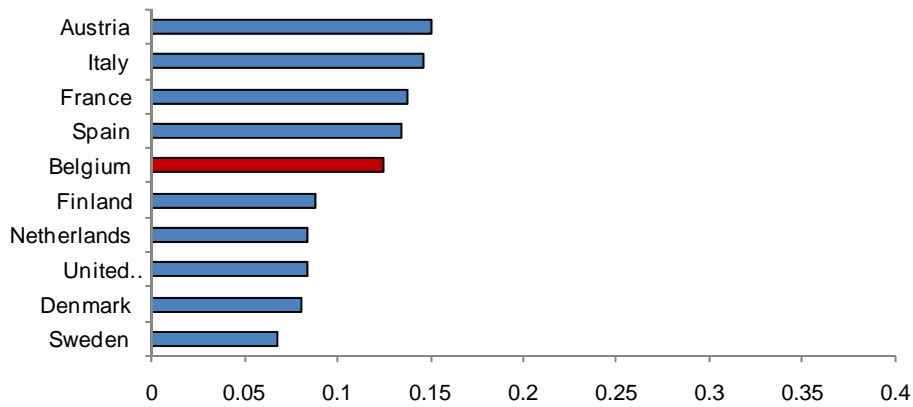
Source: OECD, own calculations

Graph 15   Country average regulation impact for the 1991-2003 average non-manufacturing industry

Source: OECD, own calculations

4.2. The effect of the regulation impact indicator on profit elasticity and average profitability: a first approach

As mentioned above, over the past 20 years, the EU Member States have implemented vast economic reforms in order to stimulate competition and economic performance, the Single Market Program (SMP) and the Lisbon strategy in particular. The Lisbon Strategy is a comprehensive strategy of increasing innovation efforts (increasing R&D investments) and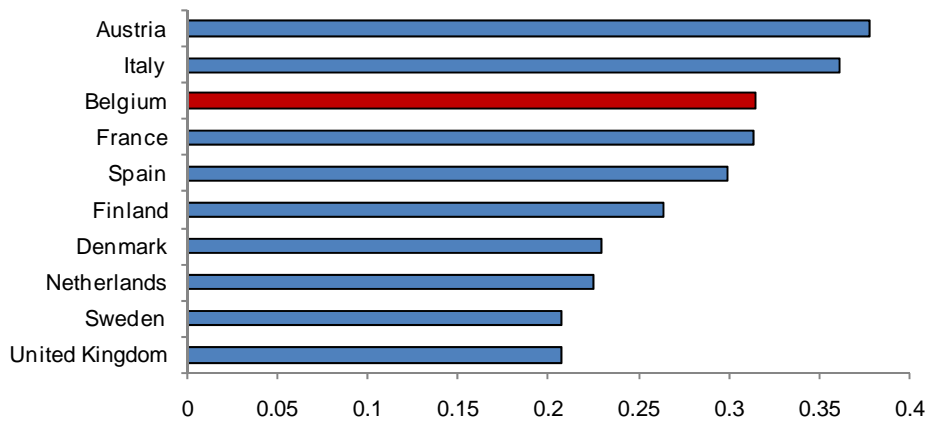 structural reforms of factor and product markets, aimed at increasing productivity growth and employment rates. Product market reform was guided by the Single Market Program and intends to complete a unified market in the EU, which would enhance product market competition and hence investment (innovation) effort.

A major difficulty in a statistical analysis of the determinants of product market competition is the availability of data on the exogenous variation of market structure, covering a sufficient number of industries and countries, at a sufficient level of detail such that a one-to-one mapping of data and market (industry) is possible. For the period under consideration, basically two categories of variables can be taken into account.

The first category concerns data on tariff and non-tariff trade barriers, which are in particular available from the World Bank. However, given that trade policy is an EU-level competence, these data do not provide intra-EU variation of market regulation. Moreover, these data are only available for the manufacturing industries, given that they are taken from international trade regulation. The second source of product market regulation data OECD Regimpact database, discussed above. Given its time and industrial coverage as well as the fact that network services deregulation was a major element of market structure reform in the EU (and the SMP), we opted for the RI indicator as a proxy for market regulation in an exploratory analysis of the determinants of market competition in the EU in the past ten years.

For the purpose of our analysis and in order to maintain complementarities with the Boone indicator, we consider seven EU countries namely, Belgium, France, Italy, United Kingdom, Spain, Sweden, and Finland for a period of 1995-2003. The Boone indicator is calculated from firm-level data from Amadeus 2007, based on Boone et al, 2007. It is considered for the period 1997-2005. We consider a two year lagged RI values, taking into account the fact that regulatory measures take some time to have its effect on market competition.

In case of AP, same set of countries and time period as in the Boone indicator could not be considered owing to the lack of data availability. Hence for AP, we consider Italy, Belgium, United Kingdom and Finland for the period of 1997-2004. Consequently, the RI indicator is considered for a period of 1996-2003 with one year lag.

Given that the competition indicators (the Boone indicator as well as the average profitability indicator) are computed at the industry level for the countries and time period mentioned above, the data used to assess the impact of market reform on competition are structured as a data panel with three dimensions: country, industry and time. The following equations are estimated:

$$\mu_{ijt} = bRI_{ijt-2} + a_i + a_j + a_t + a_{ij} + a_{jt} + a_{it} + e_{ijt} \qquad (5)$$

$$\alpha_{ijt} = b'RI_{ijt-2} + a'_i + a'_j + a'_t + a'_{ij} + a'_{jt} + a'_{it} + e'_{ijt} \quad (6)$$

Equation (5) describes the general relationship between PE (denoted by μ) and REGIMPACT (denoted by RI). Hence, in the regression exercise, PE is considered as the dependent variable and RI as the independent variable. Given the lack of consensus about the determinants of competition on top of the rather poor data availability regarding market structure, we control for additional determinants of product market competition by a full set of dummy variables, which includes country dummies ($a_{i,-}a'_i$) industry dummies ($a_{j,-}a'_j$), year dummies ($a_{t,-}a'_t$) and a full set of interaction dummies (industry-year, country-year and industry-country dummies). These control for industry, country or time specific unobservable factors that may be correlated with product market reforms and imply that the equations can be estimated using ordinary least squares.

Likewise, equation (6) demonstrates the relationship between AP (denoted by α) and the RI indicator. The only difference with equation (1) is the different lagged periods of RI, owing to the variability of the time periods considered. It may be noted in this context that for regression with the Boone indicator, two year lagged values of RI were considered. But for Average Profitability, one year lagged value of RI is taken into account because the value of 2005 is not present for AP.

We illustrate our regression results in the following table:

Table 7   AP **and** PE **explained by Regimpact**

	Profit Elasticity	Average Profitability
Regimpact	-0,42	0.72**
Observations	1197	512
Standard Error	0,56	0,28
F-statistic	87,92	11,26
R-squared	0,97	0,88

** significance at the 5% level

From the regression results obtained (see table 7), we find a negative relationship between the Regimpact and the Boone indicator. This confirms the theoretical view that when regulation in the economy is eased, markets become more liberalized and consequently there is an increase in competition. The increase in the absolute value of the Boone indicator indicates that there is an increase in competition after a decrease in regulation. However, the estimated coefficient is statistically insignificant which implies that the negative relationship between the two indicators is only weak. Yet, the substantial number of dummy variables included may cause multicollinearity between the determinants, which may bias the standard error estimation of the parameters.

From the regression analysis between AP and RI, we obtained a positive coefficient. As it was the case for the PE, this result is in tandem with the general perspective that a decrease in regulation causes a decrease in the AP. This view is established from the presumption that an increase in AP implies a decrease in competition. Also with the increase in PMR, there should be a decrease in competition. Hence, they should be positively correlated. The estimated result, thus obtained, is positive and significant,

which implies that there is a strong positive relationship between the two indicators. The R^2 and F-statistic in both the cases show that the instruments have sufficient explanatory power. The difference in significance of RI for the two empirical indicators of market competition can be the consequence of the different samples that are used for the two regressions and, hence, may point to country heterogeneity in the relationship between product market competition and market regulation.

Our findings suggest that a decrease in market regulation did lead to an increase in competition (as measured by a decrease in AP or an increase in PE). In this sense it indicates that the market reforms, undertaken in the EU since the 1990s, and the Single Market Program overall seem to have had a positive impact on market structure.

5. Conclusion

In this paper we have considered two indicators to measure/estimate competition in Belgian markets, the average profitability measurement (equivalent to the mark-up) and the profit elasticity measurements (based on relative profits).

The general conclusions in terms of the competition degree of the Belgian industries can be summarized as follows: competition is weaker in Belgium than in the EU on average. There is a tendency of convergence between the Belgian and the European levels. Competition intensity seems to be higher in manufacturing than in services; a fact that is in line with the higher mark-ups found for the selected services industries. Although the two competition measurements do not always agree with the ranking of the industries, there is consensus on the following industries experiencing strong competition (both low mark-up and high competition intensity): Textile, Wood, ICT, and Motor. On the other hand both indicators agree that the following industries experience weak competition: Food, Paper, Chemicals, Public utilities, Wholesale, Retail trade, Finance and Real estate. This may imply stricter regulation in Belgium and comes to agree with the reports on the regulation degree. Belgium ranks fifth out of ten countries in terms of restrictive impact of regulation for the selected manufacturing industries and third out of ten for the non-manufacturing ones.

We find in most cases that the correlation between profit elasticity and average profitability measures has the expected sign, both over time and across industries. However, there are a number of cases where this is not the case, and the two measures seem to exhibit substantial independent variation. The reasons why the two measures may give different conclusions concerning the levels and the evolution of competition are not yet fully understood by economists[13]. The different sensitivity of the indicators to the business cycle and the sensitivity of the profit elasticity to the data cleaning can be mentioned as possible reasons. Without complete information about the dynamics of competition in an industry, it is difficult to say whether the profit elasticity is empirically better than the average profitability. Nevertheless, the two measures may be considered empirical complements in both policy and econometric analysis. AP represents a strategic variable (pricing) whereas, PE represents a structural variable (interaction between cost structures and pricing). They may be considered complements since both variables are needed for the understanding of the competition dynamics in an industry.

Finally, a simple econometric exercise which needs to be elaborated further (by adding, for example, more control variables), confirms that regulation may have an impact on the competitive profile of an industry.

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13 See Griffith et al. (2005)

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7.   Annex

In this annex we provide a brief comparison of our findings concerning the markups with those of Christopoulou et al. (2008), since this is, for the best of our knowledge, the most recently published paper, in which estimates of the markup are given. We start by drawing the attention on the differences between the two methods: Christopoulou et al. (2008), estimate, using the Roeger method, an average mark-up for the period 1981-2004, whereas we calculate a Lerner index for each year from 1985 to 2004. Keeping in mind the methodological and sample differences we can control for agreement of our measurement with theirs in terms of the following three stylized facts that they affirm. (i) *"Perfect competition is widely rejected across most industries and all countries; markup rations are generally larger than one"*. Our findings confirm this. (ii) *"average markups are heterogeneous across countries"*: This is also confirmed by our analysis; and (iii) "*markups are heterogeneous across industries, with services having higher markups on average than manufacturing"*: Our findings confirm this stylized fact as well for the countries both studiehave in common (namely Austria, Belgium, Finland, Netherlands, Italy and their average) and for the aggregates they are using[14]. Table 8, compares the markups found for Belgium by the ECP paper and by our paper.

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14 Their services industry includes market services and non public utilities and transport and communications.

Table 8   Mark-ups for Belgian industries: ECB study) vs FPB study

	ECB (1981-2004)		FPB (1985-2004)	
food & beverages	15	1.09	15t16	1.14
tobacco	16	1.06		
textiles	17	1.08		
wearing apparel, dressing and dying of fur	18	1.09	17t19	1.05
leather	19	1.09		
wood&cork	20	1.1	20	0.94
paper, pulp	21	1.12	21t22	1.14
print, publish	22	1.16		
coke, petroleum, fuel	23	1.07		
chemicals	24	1.19	23t25	1.34
rubber, plastics	25	1.13		
non-metallic	26	1.15	26	1.13
basic metals	27	1.13	27t28	1.05
fabricated metals	28	1.12		
machinery nec	29	1.16	29	1.12
office machinery	30	1.56		
electrical machines	31	1.12	30t33	1.07
radio media machine	32	1.06		
medical	33	1.17		
motor	34	1.06	34t35	1.07
other motor	35	1.05		
electricity gas	40	1.53	40t41	1.18
water supply	41	1.41		
construction	45	1.17	45	1.14
garage	50	1.25	50	1.23
wholesale	51	1.21	51	1.29
retail sale	52	1.21	52	1.18
transport inland	60	1.26		
transport water	61	1.07		
transport air	62	1.04	60t64	0.82
auxilliary transport	63	1.3		
post and telecommunications	64	1.59		
financial intermediation	65	1.45		
insurance pension	66	1.55	65t67	1.11
other financial activities	67	1.31		
real estate	70	3.81		
renting of machinery	71	1.63		
computer related	72	1.17	70t74	1.03
r&d	73	0.94		
other business	74	1.31		

Source: own calculations, Christopoulou et al. (2008)