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Economic integration and the dynamics of firms' competitive behavior

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ABSTRACT

We investigate the evolution of firms' competitive behavior in the EU by studying the dynamics of firms' price-cost margins (PCMs) across four countries (France, Italy, Poland and Sweden), in three manufacturing and three services industries for around 170,000 firms over the period 1999–2007. By looking at density distributions of the PCM across firms, we detect an aggregation problem affecting country specific measures of PCM levels, with PCM changes providing instead an unbiased representation of industry dynamics. A Laspeyres-type decomposition of PCM changes shows pro-competitive effects over the period, induced mainly by the reallocation channel, and a tendency to a quality upgrading of firms, revealed by the positive interaction term. These trends are stronger after 2002. We also observe a trend towards lower PCMs across manufacturing industries, while the latter is not true for services. These findings are confirmed by a dynamic panel econometric exercise performed on the pooled firm-level sample.

1. Introduction

European firms have faced in the last 10 years a number of competitive shocks. The introduction of the euro in 2002 as a single currency has increased the pace of the integration process. At the same time, the European Union has faced the largest enlargement process of its history: 10 countries have joined the EU in 2004, and an additional two, Bulgaria and Romania, in 2007. Such a widening and deepening process has thus expanded the single market, significantly intensifying the competitive pressures within it.

And still, researchers and policy makers are at odds in properly investigating how the firms' competitive behavior has evolved over time in a comparative perspective, since homogeneous data across countries tend to be available only in an aggregate (at the industry or sub-industry level) form. In this paper we aim instead at explicitly using firm-level data, now available in a relatively comprehensive format for a large number of European countries, in order to provide a more detailed analysis of the competitive behavior of firms in the Single Market. In particular, we focus on a selected number of both manufacturing and services industries (food, chemicals, car production, retail services, telecoms, real estate) in 4 different EU member states (France, Italy, Poland and Sweden). Our analysis is based on an average of around 170,000 firms observed each year over the period 1999–2007.[1]

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[1] The source of data is the AMADEUS database developed by Bureau van Dijk, a consulting company which collects balance sheet data and ownership data for more than 11 million of active firms in 41 European countries. However, the quality and coverage of these firm-level data varies across countries.

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The use of firm-level data allows to grasp information on the average changes taking place in each industry and across countries, as well as on the distribution and sources of these changes in terms of individual firms' pricing behaviour and market share, an information which is impossible to gather in detail from aggregate, traditional sector-level measures. However, using firm-level data for such a comparative analysis poses a number of methodological problems, which we try to present and address in this work. The latter, in our opinion, constitutes the main contribution of the paper to the literature.

We start by identifying a measure of the competitive behavior of firms: the firm-level price-cost margin (PCM) and its changes over time. As the latter is typically a proxy of profitability, analysing its variation by industries and countries across firms allows to extract information on changes in the competitive environment.[2] When presenting the indicator, we also discuss its application to firms operating in services, which might have a relatively larger share of unaccounted for variable costs driving profitability, typically associated with intangible assets such as R&D and skilled labor.

Building on the existing literature, we have then analysed the variation over time of the density distribution of the firm-level PCMs within each country. The latter allows to exploit the informational content of firm-level heterogeneity to assess potential, systematic cross-country differences in the PCM distribution. In performing this exercise, we have detected a significant aggregation problem affecting country specific measures of the PCM: comparing data within the same industries, we have found a systematic country-specific difference in the aggregate distribution of PCM *levels*. However, we have found that the distribution of PCM *changes* is highly comparable across countries.

Capitalising on this finding, and in order to explore the drivers of the country- and industry-specific PCMs' dynamics, we have then performed a Laspeyres-type decomposition of the changes in the aggregate PCM, thus retrieving the within, reallocation and interaction effects driving the evolution of firms' pricing strategies, as well as the impact of firms' entry and exit. We have found evidence of an average pro-competitive effect over the considered period, induced mainly by the reallocation channel, as well as a general tendency to a quality upgrading for Italian, French and Swedish firms, as revealed by the positive interaction term. All these trends are stronger after 2002, the year of the introduction of the euro. Changes in the PCM of Polish firms, on the contrary, seem to be still subject to increasing competitive pressures generated by the transition to a market economy. In general, we observe a trend towards lower PCM across manufacturing industries, while the latter is not true for services.

These findings are confirmed when pooling together firms across countries in an econometric exercise. The latter exploits dynamic panel estimation techniques, given the persistence of the firm-level PCM measure over time. Results confirm a common trend across firms towards lower PCMs in the manufacturing industries, possibly as a consequence of pro-competitive pressures induced by the adoption of the euro, but not in services.

The paper is structured as follows. Section 2 provides a brief overview of the literature on PCM estimation and its application to the analysis of firms' competitive behavior. Section 3 describes the database and defines the firm-level measure of price-cost margin on which the analysis is based, discussing the potential problems of calculating PCM for services firms, as well as the aggregation issues arising when using firm-specific PCM measures. Section 4 presents the analysis of PCM distributions and decompositions across countries, industries and time. Section 5 corroborates these results with econometric evidence. Section 6 concludes.

2. Related literature

Several studies have investigated how competitive pressures affect market power. One stream of literature measures competition by estimating an industry-level mark-up adopting methodologies by either Hall (1986, 1988) or Roeger (1995).

Hall's insight is to introduce imperfect competition in a growth accounting model based on a standard Cobb–Douglas production function augmented with a technological shock.[3] Adopting Hall's (1988) approach, Bottasso and Sembenelli (2001) show that the Single Market Program has reduced mark-ups in Italy's manufacturing sector, while Small (1997) investigates the cyclicality of mark-ups in manufacturing and service industries in United Kingdom. Nishimura et al. (1999) estimate mark-ups for a panel of large Japanese firms in 21 industries over 24 years (1971–1994).

A shortcoming of the Hall's methodology is however linked to the presence in the estimating equation of an unobserved technological shock, which may be correlated with the input factors and may thus bias the estimated PCM. The latter endogeneity is in principle difficult to overcome, since instrumental variables for productivity are hard to find at the firm-level. The problem can be solved following Roeger (1995), who is able to decompose the price-based (or dual) Solow residual according to a different expression, in which the unobserved productivity shock is canceled out. Therefore, the simultaneity bias previously discussed disappears. Badinger (2007) applies the Roeger's (1995) methodology on a sample of 10 European countries over the period 1981–1999, always to investigate the effect of Single Market Programme.

Still, the application of the Roeger (1995) methodology to firm-level data is not ideal, as the dual production function introduced by Roeger requires a correct measurement of the cost of capital, and is based on the assumption of constant returns to scale. Indeed, the method has been successfully applied to firm-level data when the average

[2] These changes in competitive behavior may be induced by a number of factors, such as changes in pricing strategy, quality upgrading, dynamic efficiency, product mix changes, evolution of market shares, entry or exit.

[3] See Altomonte et al. (2010) for a detailed discussion of the alternative econometric models to estimate mark-ups.

effect of a regressor (e.g. a trade shock) has to be gathered on the PCM,[4] as the algorithm yields an estimate for the average PCM across the cross-variational subsample of firms. However, as no individual firm-level estimates of the PCM are available, a comparative static analysis of the kind we intend to perform in this paper is not possible when measuring the PCM through the Hall's or Roger's methods.

More recently, De Loecker and Warzynski (2009) have proposed an alternative framework which fully takes into account the endogeneity problem induced by productivity. They suggest to enrich Hall's (1988) specification by modelling the unobserved firm-level productivity via the control function suggested by Olley and Pakes (1996). They show that the inclusion of this term allows to relax the assumption of constant returns to scale, as the proposed estimation does not require to calculate the user cost of capital. Moreover, they demonstrate that this methodology can be adapted to account for the firms' natural selection process. However, their method requires the deflationing of nominal balance sheet variables in order to retrieve the 'real' figures for output and inputs. Besides, still no individual firm-level estimates of the PCM are available from the algorithm.

A second line of research, to which this work is more closely related, focuses instead on the empirical distributions of indicators of firms' performance. Starting from the seminal article by Mueller (1977), the 'persistence of profits' literature investigates the persistence over time of the relative performance of firms, with a special focus on firms' profits and profitability. Among many contributions to this line of research, the most prominent are Cubbin and Geroski (1987), Geroski and Jacquemin (1988), Schohl (1990), Waring (1996) and Goddard and Wilson (1999).

More recently, Glen et al. (2003) investigate the persistency of two components of profitability: the profit margin, measured by the ratio of profits to sales, which is essentially another way to measure the PCM, and capital productivity, proxied by the output/capital ratio. Bottazzi et al. (2008) investigate the distribution of a sample of Italian firms in both manufacturing and services, exploring the relationship among three dimensions of performance: productivity, profitability and growth. They focus on two indicators of firms' profitability: the return on sales (ROS) and the return on investment (ROI), and widen the scope of the analysis by interacting structure and performance of firms with their financial conditions (i.e. credit constraints). Finally, Bottazzi et al. (2010) perform a similar exercise, adding a cross country perspective: they investigate the productivity–profitability–growth relationships in Italy and France. Notice that their measure of profitability, namely the ratio of gross operating margins (i.e. value added minus cost of labour) over total sales is our variable of interest in the subsequent analysis. The authors observe a positive association between productivity and profitability, while no evidence emerges in the relationship between growth and profitability.

[4] See for example Konings and Vandenbussche (2005).

		Efficiency	
		Low	High
Equity	Low	Mediterraneans	Ango-saxons
	High	Continentals	Nordics

Fig. 1. Taxonomy of countries according to social models (Sapir, 2005).

3. The data

3.1. Database construction

Our choice of the countries considered in the analysis is based on the availability of data and the relevance of the country in terms of its economic size and/or structural characteristics, such as institutions and labour markets. To that extent, we consider the partition of social models identified by Sapir (2005), in which countries are classified on the basis of a combination of efficiency and equity that their institutions are able to achieve. The partitioning identifies four different groups of countries, as reported in Fig. 1.

On the basis of the availability of data, both in terms of number of firms recorded in the database and quality of the balance sheet information, we have identified the following countries for each group: Italy for the Mediterraneans; France for the Continentals; Sweden for the Nordics and Poland as a representative of a new EU Member State, with a model of economic governance still in evolution.[5]

Firm-level data are sourced from the AMADEUS database, developed by Bureau van Dijk: in particular, for each firm we have collected data on activity codes (NACE 4-digit), as well as balance sheet information over time. The four countries included in the database report a large enough number of firms (in most cases the census of firms formally obliged to present balance sheets), which ensures a high coverage. To assess the robustness of our sample with respect to official statistics, we have compared AMADEUS data with the Structural Business Statistics database of Eurostat, calculating from our sample and for each country the number of active enterprises and the total turnover in each NACE 2-digit industry in a given year (2006). As for the number of firms, the correlation between our micro-based measure and the official aggregated one ranges from 0.72 in Poland to 0.98 in France, while for the turnover the correlation ranges from 0.64 in France to 0.83 in Poland and Sweden.

In terms of industries, we have picked three 'prototype' industries in manufacturing, following Pavitt's taxonomy: a traditional industry, Food (15), a science-based industry such as Chemicals (24) and one characterized by economies of scale, Automotive (34); we have then added three services industries: Telecoms (642), Retail (52) and Real Estate

[5] Ideally we would have liked to include also data from the United Kingdom as a prototype Anglo-Saxon economy, but the quality of the available balance sheet information (very few firms reporting sales or turnover, with existing data generally biased towards large firms) made the exercise not comparable to the other countries analysed.

(70). In terms of years, our data cover the period from 1999 to 2007, i.e. the time span encompasses the competitive environment in Europe before and after the shocks of the euro adoption, the EU enlargement and the entry of China into the WTO.

3.2. Retrieving the PCM at the firm level

The price-cost margin is generally considered a rivalry indicator of competition, since it relates to the average profitability of a given industry. Firms within an industry compete by choosing their pricing or output strategies, with enhanced competition having the effect of lowering the equilibrium price, once we correct for the quality of the product. At the limit, the price will equal the marginal cost of production, forcing less efficient firms to exit. As a consequence, the price-cost margin provides an inverse measure of the intensity of competition.

However, when looking at it from a firm-level perspective, the PCM might be considered also as a structural indicator. Indeed, if the price-cost margin is measured at the firm level, the relevant notion of demand in this theoretical relationship is that of residual demand, which measures the variation of the equilibrium output of a firm due to a change in its price, given the strategic reaction of all actual and potential competitors. Such a strategic reaction can be considered itself a function of the market structure (e.g. driven by barriers to entry, minimum efficient scale, etc.). It then follows that the price elasticity of the residual demand summarizes the competitive conditions faced by a firm and stemming from both the structural features of the market in which it operates and the conducts of all the other market players. Thus, when measured at the firm-level, the PCM can represent a solid indicator of the firms' competitive behavior as it combines a structural and a rivalry component.

Indeed, the standard approach used by the literature to retrieve the PCM specifies a demand function and the derivation of its first-order equilibrium condition, in which it can be shown (e.g. in the Cournot case) that for a given firm i the FOC (First Order Condition) amounts to $L_i = \alpha_i/\varepsilon$, where α_i is the market share of the firm, ε is the elasticity of demand and L_i is the PCM, or Lerner Index, calculated as $(P - MC)/P$, i.e. how far a firm's price (P) is from its marginal cost (MC).

Two different empirical versions of the Lerner Index are available in the literature, and both can be directly used at the firm-level. The basic one is a simple ratio between profits and sales of a single firm, as in the case of Aghion et al. (2005) and Nickell (1996). The second, closely related, approach is the one followed by Tybout (2003), in which the PCM at the firm level is defined taking the difference between production value and total variable costs (employment plus material costs) divided by production value. This measure is not free from shortcomings. It implicitly assumes that the unit labor and material costs are flat with respect to output: Hall (1988) discusses the case of overhead labor and labor hoarding, thus allowing for the possibility that costs may not be linear with respect to production. Also Tybout (2003) allows for the possibility that the PCM depends on a factor capturing the competitive return on capital over revenues. Additionally, Nickell (1996) enumerates and discusses a number of factors which are likely to influence the measurement of the PCM, such as potentially asymmetric cyclical factors and various measures of competition.

These factors might be particularly relevant when measuring the price-cost margins of firms operating in services industries, which for this reason are discussed in a separate section henceforth. Notwithstanding these shortcomings, directly observed PCM measures have been employed quite extensively by the literature, in particular given the fact that, as already discussed, other estimation methods of the PCM (such as Hall, 1988 or Roeger, 1995 and their refinements) do not allow to retrieve an individual firm-specific measure, and thus cannot take into account the underlying firm heterogeneity.

Given the availability of individual firm-level cost and revenue information in our balance sheet data, we have thus adopted the Tybout (2003) approach to retrieve our baseline measure of price-cost margin. Starting from yearly balance sheet data, the firm-level PCM can be proxied as:

$$\mathrm{PCM}_{it} \simeq \frac{\mathrm{sales}_{it} - \mathrm{variable\_costs}_{it}}{\mathrm{sales}_{it}} = \frac{(p*q)_{it} - (c*q)_{it}}{(p*q)_{it}} = \frac{p_{it} - c_{it}}{p_{it}} \tag{1}$$

for the firm i at time t, where quantity is simplified within the ratio, leaving in the expression unit price p and unit variable cost c. Then, for a given NACE industry I we would define the observed PCM as:

$$\overline{\mathrm{PCM}}_{It} = \frac{1}{N_I}\sum_{i \in I} \mathrm{PCM}_{it} \tag{2}$$

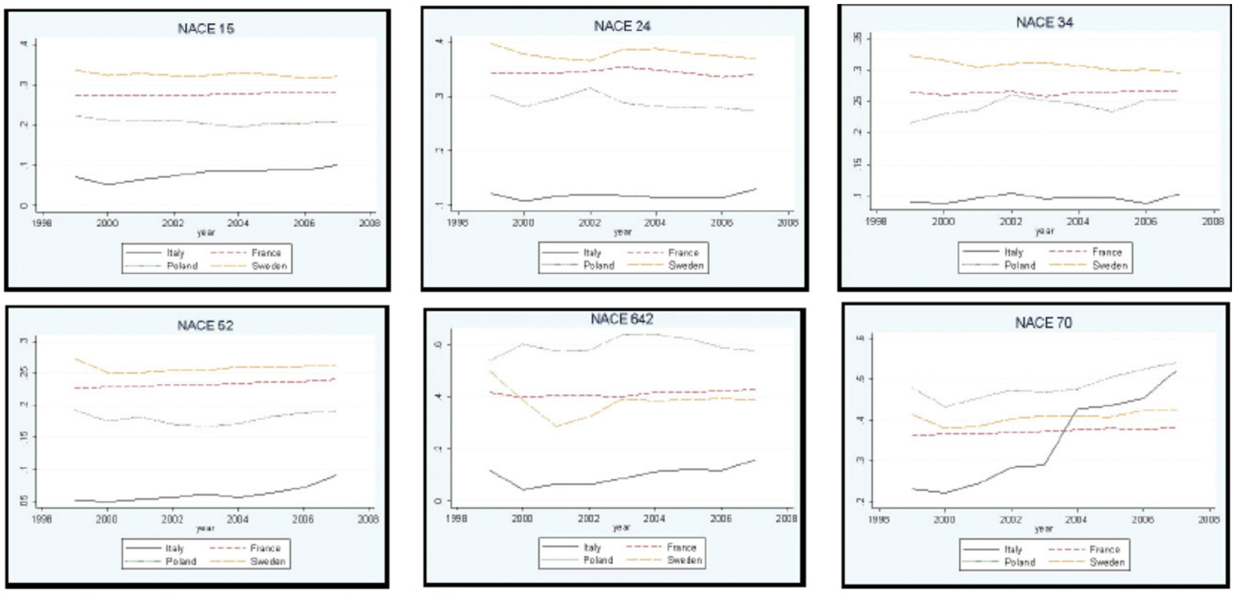
where I is the desired level of aggregation. Alternatively, one could also retrieve an aggregate index of price-cost margin as a weighted average of the individual firms' PCMs, where weights are given by market shares. In this case, for a given NACE industry I we would have that the weighted PCM is:

$$\widetilde{\mathrm{PCM}}_{It} = \sum_{i \in I} s_{it}\mathrm{PCM}_{it} \tag{3}$$

where I is the desired level of aggregation and s_{it} are the market shares of individual firms in a given year, such that $\sum_{i \in I} s_{it} = 1$. In what follows, we will use changes in our micro-based aggregate PCM as measured in (3) as an indicator of industry or country-specific competitive dynamics.

3.3. PCM in the services sector

As already stated, in our analysis we retrieve the firm-level PCM for firms operating in both the manufacturing and services. In particular, in Eq. (1) we retrieve the price-cost margin using information on the costs for materials and costs for employees, considering the cost of capital as a fixed cost. While the latter assumption is less problematic, minimizing the biases in retrieving a firm-specific PCM measure would however require to include variable costs and other costs that help in increasing efficiency, such as investment in R&D or in patents, as proxied



Notes: Figures display average values of PCM

Fig. 2. PCM evolution across countries, industries and years.

by the depreciation of the stock of the intangibles from one year to the other (see Fisher and McGowan, 1983). Indeed, the observed PCM implies the use of a firm-level accounting rate of return, not necessarily corresponding to the economic definition of profits because of the missed capitalization of certain activities (for example research activities). The latter could thus create an unobserved variable bias when comparing firm-level PCM in manufacturing vs. services, as services could be characterized by different (unaccounted for) variable costs driving profitability.

Moreover, from a theoretical point of view, the peculiarity of the services in a context of industrial dynamics can be gathered when appraising the often used assumptions of a production function characterized by Hicks-neutral technical change (e.g. the Cobb–Douglas). As factors of production of service firms could be less adjustable than manufacturing ones, given the higher reliance of services on specific labour inputs (e.g. high-skill labour), it then follows that services firms might be characterised by some stickiness in the adjustment of the input (cost) component to productivity shocks, ultimately inducing a slower adjustment of the structural competition parameters to the new equilibrium.

Another concern might derive from the quality of the available data. Waldmann (1991), in a comment to Hall (1988), warns that, in some service industries, measurement errors in the construction of real value added might hamper the interpretation of the retrieved PCMs.

We deal with these two potential problems as follows. First of all, we exploit one advantage of the accounting-based proxy of PCM (as of Eq. (1)), which, contrary to other traditional methods of PCM calculation (e.g. Hall, 1988), does not incorporate a measure of productivity. As a result, nothing should change between manufacturing and services, but for the evidence of a possible generally higher level of the labor cost component.

Second, in order to assess the potential bias deriving from PCM measures which do not incorporate the cost of intangibles in services, we exploit a unique feature of the Italian balance sheet data, which allow to disentangle information on tangible vs. intangibles' depreciation. By comparing for both manufacturing and services' firms the evolution of the PCM distribution calculated with and without intangibles in the definition of the variable costs, we have not detected any significant difference between the two measures.[6]

Therefore, the only limit mentioned in the literature, as far as the extension of the analysis to services is concerned, seems to be data availability.

4. Empirical evidence on firm-level PCM

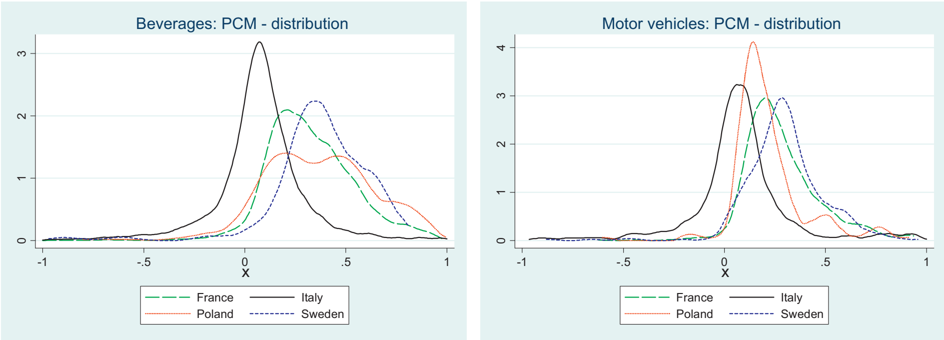
4.1. PCM distributions and the aggregation problem

Fig. 2 presents the evolution over time of the average observed PCM by NACE 2-digit industries across countries.

At a first inspection the PCM does not seem to present clear and different time trends. As far as levels are concerned, the Italian PCMs appear constantly lower than the others – with the exclusion of the real estate sector (NACE 70), whose PCM dramatically increases over time. When looking at manufacturing industries, we observe no trend but a clear ranking, with Italy displaying the lowest levels of PCM, followed by Poland, France and finally Sweden. Overall, we observe average levels of PCM in manufacturing which are lower than the ones in services.

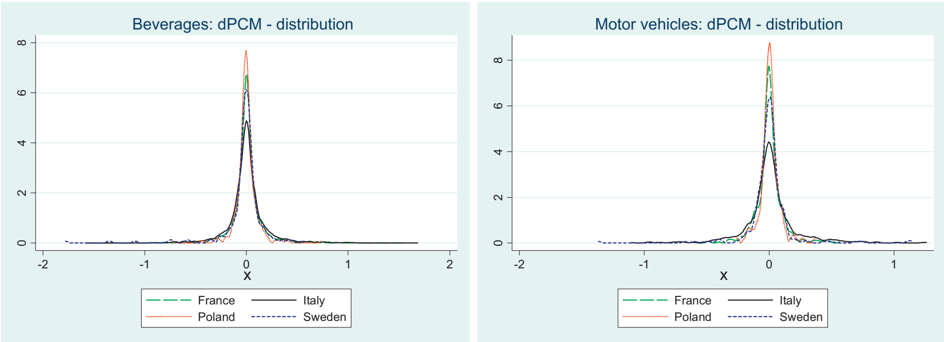
As for the latter category, the evidence is not clear-cut. The retail industry (NACE 52) is characterised by a relatively lower average PCM (between 10% and 30%) with respect

[6] Results are available on request.



Notes: Kernel densities for PCM in NACE 159 (Beverages) and NACE 341 (Motor Vehicles)

Fig. 3. PCM distribution (levels).



Notes: Kernel densities for first differences of PCM in NACE 159 (Beverages) and NACE 341 (Motor Vehicles)

Fig. 4. PCM distribution (first differences).

to the levels of real estate and telecoms, with a similar ranking across countries. The increasing tendency is particularly evident in the real estate sector, where the PCM displays a quite significant positive trend. Poland appears as the less competitive market. Interestingly, the countries showing relatively higher PCMs over time do not belong to the European Monetary Union (EMU).

Such a high degree of cross-country heterogeneity in the reported levels of PCMs might be attributable to different sample characteristics, e.g. Italy might be characterised by a sample in which small and medium-sized firms are relatively more prevalent (and thus the PCM might be smaller).[7] To check for the latter compositional effect, we have compared the distribution of the Italian and French samples by firm sizes, finding the two samples to be rather homogeneous: hence, the downward bias in Italian PCM must depend on other country-specific (e.g. tax-related) characteristics which go beyond the scope of this paper. This finding is important for our purposes, as it greatly affects the possibility of retrieving unbiased aggregate indicators of competitive dynamics across the EU.

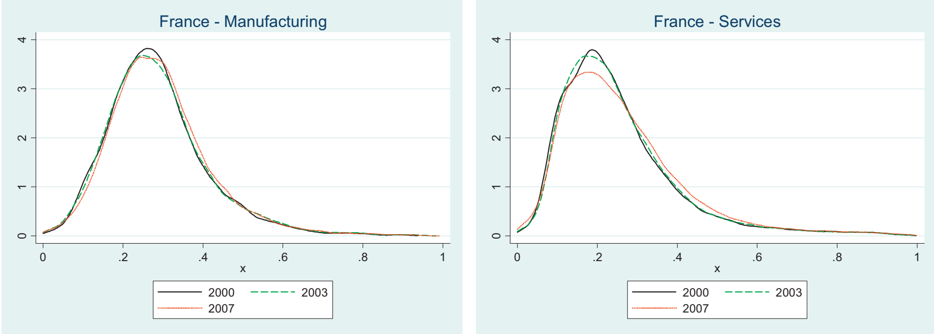
To provide some insights on the extent of the problem, consider for example two NACE 3-digit industries, beverages (NACE 159) and motor vehicles (NACE 341). Fig. 3 plots the distributions of PCMs in levels across the four countries.[8] We observe four different distributions, which suggests that the PCMs in the four countries belong, for a number of economic and institutional reasons, to different metrics. As such, any aggregation of these measures in levels is by definition biased, and thus aggregate official statistic cannot (and should not) be calculated.

Instead, Fig. 4 reports the distribution of the first differences of PCMs. In this case the four distributions almost perfectly overlap. Indeed, when considering first differences, we are implicitly looking at PCMs at a business cycle frequency. Thus, firms in the four markets seem to share the same reactions to the cycle. As it can be seen, first differencing allows to filter the data from idiosyncratic components that may give rise to aggregation problems, and thus provides a way to properly compare countries' behaviors. Given its relevance, a more detailed discussion of the aggregation problem is reported in Altomonte et al. (2010) and, for convenience, in Appendix A of this paper.

An interesting feature of the availability of firm-level PCMs is that one can go beyond traditional analyses which

[7] Small and medium-sized firms might be characterized by a lower PCM to the extent that, due to lower economies of scale, they face higher unit costs. However, in our sample we also find evidence of SMEs having higher than average PCM: the latter might derive from the higher quality/specialisation of the goods produced by small and medium-sized firms. Hence, no trend can be detected ex-ante for this category of firms.

[8] All density estimations presented in this work are performed using Epanenchnikov kernel, where the bandwidth is the "optimal" width (Silverman, 1992).



Manufacturing

year	median	mean	variance
1999	0.2714	0.2839	0.0183
2000	0.2700	0.2818	0.0180
2001	0.2684	0.2821	0.0187
2002	0.2694	0.2833	0.0196
2003	0.2705	0.2840	0.0190
2004	0.2717	0.2860	0.0192
2005	0.2739	0.2860	0.0199
2006	0.2740	0.2864	0.0195
2007	0.2776	0.2881	0.0193
Total	0.2722	0.2850	0.0192

Services

year	median	mean	variance
1999	0.2146	0.2439	0.0248
2000	0.2179	0.2459	0.0246
2001	0.2184	0.2459	0.0245
2002	0.2210	0.2489	0.0244
2003	0.2199	0.2476	0.0252
2004	0.2222	0.2500	0.0260
2005	0.2245	0.2512	0.0274
2006	0.2249	0.2507	0.0282
2007	0.2275	0.2530	0.0285
Total	0.2219	0.2491	0.0263

Notes: Figure presents kernel densities for PCM in 2000, 2003 and 2007. The Tables present summary statistics for PCM over the time period considered.

Fig. 5. Distribution of observed PCM over time, France.

look at the average evolution of the aggregate PCM across industries (with the ensuing aggregation problem), retrieving instead information from the entire distribution of firms over time. With this respect, in what follows we present the kernel-density distributions of PCM for each country. In the exercise we aggregate firms within service and manufacturing industries, given the relatively large differences existing across these two groups of industries, but the relative homogeneous trends existing within them for a given country, as shown in Fig. 2. In order to track the evolution of PCM distributions over time, we compare the distribution in 2000 with the ones in 2003 and 2007.[9]

We use Fig. 5, which presents the distribution of PCM for French firms, to discuss a number of common features of the country-specific PCM distributions. Both in manufacturing and services, the distribution of the price-cost margin is skewed to the right and seems to shift to the left over time. The shape is consistent with theory: a mass of firms having lower-than-average margins and few firms that, because of their efficiency (lower costs) or market power, can extract very high PCM.[10] Additionally, the Tables present the evolution over time of the first and second moments of the distribution, jointly with the median. As it can be seen, given the asymmetric distribution, the median is much more informative than the mean as an indicator: as such, any aggregate 'average' measure of PCM is by definition upward biased. The distribution of PCMs in the early years of the sample is very skewed to the right, as expected, and fairly concentrated around the median. However, in both sectors the mean and median PCM increase over time, with the distributions becoming more dispersed. Indeed, the variance is constantly increasing over time, suggesting a rise in heterogeneity.

The development of the PCM distributions in Italy, Poland and Sweden, reported in Appendix A, by and large mirrors the one in France, with two exceptions. First, we observe a marked rise of dispersion in Italy, especially in services. This is mirrored in the steep increase of the second moment. Recalling that in Sapir's (2005) taxonomy Mediterranean countries such as Italy tend to be characterized by low efficiency and low equity of market institutions, we may interpret the marked rise in Italian PCMs as a failure of Italian institutions to properly regulate competition.

[9] The PCM distribution reported in the graphs is bounded between 0 and 1 to increase readibility (i.e. avoiding reporting a long, flat left tail), while in the tables we report percentiles for the entire distribution (i.e. including also negative values of the PCM). However, negative values represent in general less than 5% of the cumulated density of the reported PCMs.

[10] The potential drivers of this distribution will be explored in Section 4.2, in which we present the PCM decomposition.

As for the other peculiar distribution observed, the one of Polish services, we observe that a two-peaked distribution gives way over time to a more classical one, with a mass of firms in the left tail. This suggests that, starting from a singular distribution of PCM, and a model of economic governance in evolution, Poland presents at the end of the period considered a distribution much more similar to the one in the other member states.

Finally, notice that changes in distributions may be driven also by compositional effects. Indeed, within both manufacturing and services a change in the relative presence of different industries, exogenously determined by data availability or endogenously driven by market forces may affect the shape and evolution of the observed distributions. Therefore, in order to find conclusive evidence on industries' dynamics, we implement a Laspeyres decomposition of PCM.

4.2. PCM decomposition

The underlying drivers of the above distributions can be assessed by exploiting our firm level information through a decomposition of a weighted change of the PCM at the NACE 3-digit level, as follows:

$$\mathrm{PCM}_{t+1} - \mathrm{PCM}_t = \sum_{i \in I} s_{it+1}\ pcm_{it+1} - s_{it}\ pcm_{it} \quad (4)$$

where I is a given NACE 3-digit industry, PCM_{it} is the price-cost margin of a given firm i at time t, and s_{it} is the market share of firm i at time t. To construct the weighted change of the PCM, we need the information, for both PCM and market share, in two subsequent periods, t and $t+1$.

Eq. (4) can be analytically decomposed, to catch three different possible responses of the competitive behavior to structural market changes: the classical reduction of the PCM that firms have to face in order to maintain the same level of demand over time; the shift of some firms towards production of goods with a higher content of value-added or quality; the effects deriving from the demography of firms entering and exiting. Note that, as the decomposition analyses PCM changes, it is not affected by the previously discussed aggregation problem.

More specifically, the components of the weighted average are disentangled, according to a Laspeyres decomposition:

$$\begin{aligned}\mathrm{PCM}_{t+1} - \mathrm{PCM}_t = & \sum_{i \in I}\left[\overbrace{s_{it}(\mathrm{pcm}_{it+1} - \mathrm{pcm}_{it})}^{\text{within effect}} + \overbrace{\mathrm{pcm}_{it}(s_{it+1} - s_{it})}^{\text{reallocation effect}}\right] + \\ & \sum_{i \in I}\left[\overbrace{(\mathrm{pcm}_{it+1} - \mathrm{pcm}_{it})(s_{it+1} - s_{it})}^{\text{interaction effect}}\right] + \\ & \underbrace{\sum_{i \in I_{t+1} \setminus I} s_{it+1}\,\mathrm{pcm}_{it+1} - \sum_{i \in I_t \setminus I} s_{it}\,\mathrm{pcm}_{it}}_{\text{entry-exit effect}}\end{aligned}$$

The elements of the decomposition are:

- the *within effect*, which is the change attributable to the pricing behaviour of the incumbents, given their market share;
- the *reallocation effect*, which accounts for the redistribution of market shares among incumbents, holding the PCM constant;
- the *interaction effect*, which gives information about the underlying market dynamics: a negative sign would show that PCMs and market shares are moving in different directions, either because firms are expanding thanks to a reduction in PCM, or because their market share in the industry is decreasing after an increase in the PCM; a positive sign, instead, would indicate that shares and margins are moving in the same direction either upwards, e.g. in the case of a successful innovation, or downwards, e.g. in the case of obsolete firms, which are losing market shares even with a declining PCM;
- the *entry and exit effects*, indicative of the market dynamics, as driven by the removal of technological or institutional barriers, fostering entry, and exogenous shocks (e.g. the increased competitive pressures from China) leading some firms to exit.

A characteristic of the AMADEUS database is that the number of firms available in a given country might change from year to year, as new firms are added to the database, while at the same time inactive firms are dropped from the database provided that they stay inactive for more than 5 years. Thus, we consider a firm as an entry in the market in a given year when a positive value of its revenues is present in that year, no values are present in the preceding years, and its incorporation can be dated no more than 2 years before that given year.

On the other hand, a firm will be considered as exiting when it is labelled 'inactive' in the last available year of our sample (an information available in the AMADEUS database), or it has not reported data on revenues for at least two consecutive years till the end of the period of analysis.[11] Note that, since our data start in 1999, the latter implies that there will be no exit data recorded before 2001.[12]

Although the nature of the data allows to capture fairly well the underlying firm dynamics in the market, the limitations on the measurement of entry and exit from balance sheets data clearly call for some caution when interpreting the latter elements in the decomposition. From the year after a firm has entered the sample, instead, the same firm belongs to the set of continuing firms, and thus the first three elements of the decomposition do not suffer from this potential measurement error.

[11] Indeed, there can be a lag from the legal incorporation of a firm to the beginning of its economic activities and from the effective exit of a firm from the market and its legal foreclosure.

[12] A first implementation of this routine has been made by Altomonte and Colantone (2008), who analyse firm-level data for Romanian firms. They compare the demography of the firm-level sample with official data of the Romanian statistics office, revealing that the method is a good proxy for the entry and exit dynamics reported in census data. Here we improve on the routine by including the date of incorporation.

In terms of timing, we calculate the decomposition year by year. As 2007 is the last year in the sample we do not observe exit for this year: we therefore consider the PCM decomposition for the years from 2000 to 2006, since PCM changes for 2007 might be slightly upward biased by the lack of exit data.

To sum up the large amount of information available, Table 1 reports the average PCM changes over time obtained in the different countries for industry aggregates, while Tables A.1–A.4 in Appendix A present the detailed results at the NACE 3-digit level. Clearly, as PCM changes are by definition influenced by a business cycle frequency, the time span over which averages are constructed might significantly affect the aggregate interpretation of the results, as one might capture different phases of the business cycle. Hence, we have performed some robustness checks by measuring average changes in a number of different ways (e.g. by taking the difference between the average change in the first vs. the last 2 years of the sample, etc.), always obtaining qualitatively similar results.

In particular, we observe a general tendency to decreasing PCMs in manufacturing and increasing price-cost margins in services, apart from Sweden, where both trends are negative. Interestingly, the within and reallocation effects tend to be negative, in line with pro-competitive industry dynamics. Also, the reallocation term is generally much larger in size, suggesting that changes in PCM generally take place through a decrease in the market share of firms characterized by relatively higher PCMs, rather than through decreases of PCM within firms.

The effect of entry is generally positive: entering firms, which are typically small in size, have to cover fixed costs with a lower volume of production and hence with higher PCMs, whereas big incumbent firms can smooth fixed costs on larger volumes of production. Given the possibility to differentiate the product, a start-up may thus fix a higher price and still gain market power once entering the market. On the other side, exiting firms tend to display negative PCM changes, as suggested by economic theory.

Looking at the interaction term, the interaction effect is generally positive for Italy, France and Sweden (with the exception of services in the latter country): PCMs and market shares are moving in the same direction. This finding likely suggests that firms are able to gain market shares after moving towards the production of goods with higher value added, in line with a quality upgrade evolution of industries in the period concerned.[13] The exception is Poland, where the interaction term is always negative: this suggests that, not surprisingly, in the transition towards a market economy firms initially characterized by higher PCMs are losing market shares, while firms characterized by lower PCM are acquiring market shares.

To investigate whether there are different patterns before and after 2002, the year of the introduction of the euro, we repeat the same exercise splitting the sample in two periods. Results are reported in Table 2. We observe different dynamics over the two periods considered. With the notable exception of Sweden, which presents negative signs on the aggregate change both in the first and in the second period, all the remaining countries display negative signs only in the second period, consistently with the idea that the single currency can be indeed characterized as a pro-competitive shock affecting the European internal market.

5. Econometric evidence

The previous analyses have mainly dealt with the countries of interest separately, with each country considered *per se* and then results compared across countries, in accordance with a proper aggregation method. Although this approach might yield interesting comparative statics, in order to explore more structured research questions, it is necessary to statistically investigate common features across countries starting from pooled firm-level observations, accounting at the same time for the unobserved panel effect. The latter also allows for a medium to long-run perspective, exploring the long-term evolution of PCMs beyond business cycle effects.

In this section we thus present a prototype econometric exercise in which we assume that all firms are operating within a unified market. In particular, for expositional reasons, we have selected a simple research question, already explored by the literature in an aggregate manner, that is whether PCM levels are indeed decreasing within the Single Market, in line with the pro-competitive emphasis of the EU policies.

In order to avoid distortions induced by the quality of country data over time (with new data on active firms being available at different times across countries), we have constructed a pooled balanced sample of firms which were active in 2000, and we have then explored their PCM evolution until 2007.[14]

Before implementing any econometric exercise, it is necessary to investigate the stationarity of the PCM variable. Thus, we present the Im–Pesaran–Shin (2003) unit root test, which does not assume a common autoregressive parameter across all panels. Therefore, the null hypothesis is that all panels contain a unit root, while the alternative is that some panels are stationary. Results are reported in Table 3.

The t-bar$_{NT}$ statistic is appropriate when you assume that both N and T fixed: the exact critical values are reported in Im et al. (2003). We observe that the null hypothesis is rejected under different specifications of the test. Indeed, column (1) reports the simplest test, which includes only a constant. As t-bar$_{NT}$ statistic is less than its 1% critical value, we strongly reject the null hypothesis that all series contain a unit root in favor of the alternative that a nonzero fraction of the panels represent stationary processes. The t-tilde-bar$_{NT}$ statistic differs from t-bar$_{NT}$ in that

[13] An alternative, not conflicting explanation is that some firms falling behind the quality ladder might not be able to detain market share even after lowering their prices.

[14] We are aware that focusing on a balanced sample may entail a selection bias. However, as our results are confirmed by the decomposition, we are confident that the possible bias introduced is limited. We thank an anonymous referee for rising this point.

Table 1
PCM decomposition, 2000–2006 averages.

	Within	Reallocation	Interaction	Entry	Exit	Aggregate
France (2000–2006)						
Total	−0.0006	−0.0123	0.0017	0.0153	−0.0021	0.0020
Manufacturing	−0.0006	−0.0124	0.0015	0.0137	−0.0024	−0.0003
Services	−0.0005	−0.0120	0.0021	0.0181	−0.0016	0.0060
Italy (2000–2006)						
Total	−0.1796	−0.3616	0.5393	0.0083	−0.0050	0.0014
Manufacturing	−0.0429	−0.0122	0.0535	0.0035	−0.0029	−0.0010
Services	−0.4157	−0.9651	1.3783	0.0166	−0.0085	0.0055
Poland (2000–2006)						
Total	0.0031	−0.0147	−0.0011	0.0183	−0.0017	0.0034
Manufacturing	0.0004	−0.0064	−0.0017	0.0094	−0.0018	−0.0001
Services	0.0077	−0.0289	−0.0002	0.0337	−0.0014	0.0094
Sweden (2000–2006)						
Total	−0.0029	−0.0038	0.0003	0.0042	−0.0005	−0.0027
Manufacturing	−0.0036	−0.0037	0.0009	0.0039	−0.0003	−0.0030
Services	−0.0017	−0.0039	−0.0007	0.0047	−0.0007	−0.0022

Note: Average values of decompositions over the interval 2000–2006, obtained as means of NACE 3-digit average values of decompositions (see Tables A.1–A.4).

Table 2
PCM decomposition, 2000–2001 vs. 2002–2006 averages.

	Within	Reallocation	Interaction	Entry	Exit	Aggregate
France						
2000–2001						
Total	−0.0015	−0.0196	0.0022	0.0293	0.0000	0.0103
Manufacturing	−0.0025	−0.0184	0.0016	0.0225	0.0000	0.0032
Services	0.0002	−0.0216	0.0032	0.0409	0.0000	0.0227
2002–2006						
Total	−0.0002	−0.0094	0.0015	0.0097	−0.0029	−0.0013
Manufacturing	0.0001	−0.0101	0.0014	0.0101	−0.0033	−0.0016
Services	−0.0008	−0.0082	0.0017	0.0089	−0.0022	−0.0006
Italy						
2000–2001						
Total	−0.0516	−0.4730	0.5186	0.0107	−0.0005	0.0043
Manufacturing	−0.0092	−0.0100	0.0156	0.0037	−0.0001	0.0001
Services	−0.1249	−1.2726	1.3875	0.0228	−0.0012	0.0115
2002–2006						
Total	−0.2308	−0.3171	0.5475	0.0073	−0.0067	0.0002
Manufacturing	−0.0564	−0.0131	0.0687	0.0034	−0.0040	−0.0015
Services	−0.5320	−0.8421	1.3746	0.0141	−0.0114	0.0032
Poland						
2000–2001						
Total	0.0043	−0.0192	−0.0023	0.0315	0.0000	0.0145
Manufacturing	−0.0007	−0.0131	−0.0018	0.0177	0.0000	0.0022
Services	0.0131	−0.0296	−0.0031	0.0554	−0.0001	0.0357
2002–2006						
Total	0.0026	−0.0129	−0.0011	0.0130	−0.0023	−0.0010
Manufacturing	0.0009	−0.0038	−0.0017	0.0061	−0.0025	−0.0010
Services	0.0056	−0.0286	−0.0001	0.0250	−0.0019	−0.0011
Sweden						
2000–2001						
Total	−0.0040	−0.0061	−0.0003	0.0047	0.0000	−0.0057
Manufacturing	−0.0036	−0.0091	0.0001	0.0047	0.0000	−0.0078
Services	−0.0047	−0.0011	−0.0009	0.0048	0.0000	−0.0019
2002–2006						
Total	−0.0025	−0.0028	0.0005	0.0039	−0.0006	−0.0015
Manufacturing	−0.0036	−0.0016	0.0012	0.0035	−0.0005	−0.0010
Services	−0.0004	−0.0050	−0.0006	0.0047	−0.0010	−0.0022

Note: Average values of decompositions over the intervals 2000–2001 and 2002–2006, obtained as means of NACE 3-digit average values of decompositions (see Tables A.1–A.4).

Table 3
Unit root test for PCM.

Im–Pesaran–Shin unit-root test for PCM Ho: All panels contain unit roots Ha: Some panels are stationary	(1)	(2)	(3)	(4)	(5)	(6)
t-bar_{NT}	−2.144	−2.145	−2.661			
exact critical value at 1%	−1.750	−1.750	−2.420			
t-tilde-bar_{NT}	−1.478	−1.479	−1.663			
$Z_{\text{t-tilde-bar}}$	−90.311	−90.629	−1.5e+02			
	(0.000)	(0.000)	(0.000)			
$W_{\text{t-bar}}$				−82.711	−1.1e+03	−1.3e+02
				(0.000)	(0.000)	(0.000)
AR parameter	Panel-specific	Panel-specific	Panel-specific	Panel-specific	Panel-specific	Panel-specific
Panel means	Included	Included	Included	Included	Included	Included
Time trend	Not included	Not included	Included	Not included	Not included	Included
ADF regressions	No lags included	No lags included	No lags included	1 lag	2 lags	1 lag
Cross-sectional means		Removed				

Harris–Tzavalis unit-root test for PCM Ho: Panels contain unit roots Ha: Panels are stationary	(1)	(2)	(3)	(4)
Statistic	0.182	0.182	−0.141	−0.141
z	−3.5e+02	−3.5e+02	−2.3e+02	−2.3e+02
	(0.000)	(0.000)	(0.000)	(0.000)
AR parameter	Common	Common	Common	Common
Panel means	Included	Included	Included	Included
Time trend	Not included	Not included	Included	Included
Cross-sectional means		Removed		Removed

Note: Results obtained on a balanced subsample.

a different estimator of the Dickey–Fuller regression error variance is used. A standardized version of this statistic, $Z_{t-tilde-bar}$ has an asymptotic standard normal distribution. Again, the p-value corresponding to $Z_{t-tilde-bar}$ is zero, thus rejecting the null that all series contain a unit root.

Column (2) presents the results after demeaning of the variable, a procedure suggested to mitigate cross-sectional dependence. Again, we reject the presence of a unit root. Column (3) reports the results when a time trend is included. Then, columns (4)–(6) present the tests obtained allowing for serial correlation in the augmented Dickey–Fuller regressions. Results are robust.

The lower panel of the Table reports instead the results of the Harris–Tzavalis test (1999). The difference with the Im–Pesaran–Shin test is in the alternative hypothesis. This test is more restrictive, and does not allow for different autoregressive parameters across panels. Thus, we are assuming a common autoregressive parameter, which implies that now the alternative hypothesis is that all panels are stationary. Again, across different specifications of the test, we reject the null hypothesis of unit root in all panels.

After this preliminary evidence on the data at hand, we may now turn to the econometric estimation. To that extent, we propose a simple model of the form

$$\text{PCM}_{it} = a_i + \beta_1 \text{PCM}_{it-n} + \beta_2 T_t + \varepsilon_{it} \quad (5)$$

which, in line with the potential persistence of the PCM, includes lagged values of the dependent variable (more precisely, we provide evidence for $n = 1, 2, 3$) and a simple time trend, T_t. The term a_i takes into account the idiosyncratic firm-specific component, and thus controls for the previously discussed aggregation problem of PCM measures. However, the inclusion of both the lags of the dependent variable PCM_{it-n} and the unobserved panel effects a_i implies that, by construction, the latter are correlated with the lagged dependent variables, making standard estimators inconsistent. To overcome this difficulty, we adopt a generalized method of moments estimator. While we present the results using the Blundell and Bond (1998) dynamic panel-data estimator, results are robust also using the less demanding Arellano and Bond (1991) estimator.[15] The Blundell and Bond estimator assumes no autocorrelation in the idiosyncratic errors. Because the first difference of i.i.d. idiosyncratic errors will be autocorrelated, rejecting the null hypothesis of no serial correlation at order one in the first-differenced errors does not imply that the model is misspecified. However, rejecting the null hypothesis at higher orders implies that the moment conditions are not valid. As we are able not to reject the null hypothesis at the second order when including at least three lags of the dependent variable, we do not report results including a lower order of lags.[16]

Table 4 presents the results. We observe a marked persistence of PCMs, while detecting evidence of a significant decreasing trend over time. As the preliminary analysis in Section 3 has suggested different time dynamics for manufacturing and services industries (see Fig. 2), we repeat

[15] Results are not reported, but are available upon request.

[16] The results are obtained with the two-step estimator, with Windmeijer (2005) WC-robust standard errors.

Table 4
Evolution of PCM levels across countries, 2000–2007.

	Full sample	Manufacturing	Services
PCM_{it-1}	0.441***	0.392***	0.453***
	(0.0105)	(0.0203)	(0.0120)
PCM_{it-2}	0.169***	0.148***	0.175***
	(0.00899)	(0.0174)	(0.0103)
PCM_{it-3}	0.0697***	0.0545***	0.0745***
	(0.00779)	(0.0130)	(0.00922)
Trend	-0.000379***	−0.00161***	−.0000891
	(0.000129)	(0.000251)	(0.000149)
Constant	0.0747***	0.101***	0.0681***
	(0.00512)	(0.00999)	(0.00585)
Obs.	485642	98493	387149
Arellano–Bond test for zero autocorrelation in first-differenced errors. First order	-45.28***	−24.70***	−38.77***
	(0.000)	(0.000)	(0.000)
Arellano–Bond test for zero autocorrelation in first-differenced errors. Second order	−0.852	−0.214	−0.844
	(0.394)	(0.831)	(0.399)

Note: Dependent variable is PCM of firm *i* at time *t*. Results obtained on a balanced subsample. Blundell–Bond linear dynamic panel-data two-step estimation with three lags. Number of instruments is 25. WC-robust standard errors are reported in parentheses.
*Significant at 10%.
**significant at 5%.
*** Significant at 1%.

the same exercise considering separately these sectors. As reported in the second and third columns, we indeed find that manufacturing firms' PCMs have decreased. On the other side, price-cost margins in services have not significantly changed over time. Concerning the magnitude of the coefficients, we notice a higher persistence of PCMs in services. As expected, a clear compositional effect is apparent for coefficient estimates on the full sample: the betas are always included between those estimated for manufacturing and those estimated for services.

6. Conclusions

In this article we have presented some methodological tools useful to investigate in a comparative perspective the evolution of firm-specific price-cost margins across four European countries. In particular, we focus on a selected number of manufacturing and services industries (food, chemicals, car production, retail services, telecoms, real estate) in 4 EU Member States (France, Italy, Poland and Sweden), for an average of around 170,000 firms observed over the period 1999–2007.

The firm-level perspective allows us to grasp information on the average changes in PCM taking place in each industry and across countries, as well as the distribution and the sources of these changes in terms of individual firms' pricing behavior and market shares, an information which is impossible to gather from aggregate, traditional industry-level measures.

In particular, by looking at the density distributions of individual firm-specific PCMs across countries, we have observed a general skewness of the PCM distributions, as well as a trend towards lower PCMs in manufacturing, which is not present in services industries. Moreover, we have detected a significant aggregation problem affecting country or industry-specific measures of the PCM: comparing data from different countries in the same industry we have found a systematic difference in the country-specific distribution of PCM *levels*. However, we have found that the distribution of PCM *changes* is highly comparable across countries.

As a result, we have applied a Laspeyres-type decomposition of (weighted) price-cost margin *changes*, retrieving the within, reallocation and interaction effects of the firms' pricing strategies on their market shares, as well as the impact of the entry and exit dynamics, in order to explore the drivers of the PCM changes in the various industries/countries/years. We have found the within and reallocation effects to be negative across countries, in line with pro-competitive industry dynamics. Also, the reallocation term is generally much larger in size, suggesting that changes in PCM mostly take place through a decrease in the market share of firms characterized by relatively higher PCMs, rather than through decreases of PCM within firms. The effect of entry is generally positive, while on the other side exiting firms by and large contribute negatively to the aggregate PCM changes. Looking at the interaction term, the effect is in general positive for Italy, France and Sweden: PCMs and market shares are moving in the same direction. This finding likely suggests that firms are able to gain market shares by moving towards the production of goods with higher value added, in line with a quality upgrade argument. The exception is Poland, where the interaction term is always negative: this suggests that in the transition towards a market economy, not surprisingly firms initially characterized by higher PCMs are losing market shares, while firms characterized by lower PCM are acquiring market shares.

Finally, we have proposed a simple methodology in order to explore pooled firm-level PCM data econometrically. Given the persistence of the PCM measure over time, we have discussed the importance of estimation techniques able to take into account the dynamic panel nature of the underlying PCM model, while we have been able to confirm a common trend across firms towards lower PCMs in the manufacturing industries, possibly as a consequence of pro-competitive pressures induced by the adoption of the euro. Services, on the contrary, seem to be still relatively shielded from competition, a finding that justifies the recent policy actions aimed at fostering a better integration of this sector across the Single Market.

Acknowledgement

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Appendix A. The aggregation issue in details

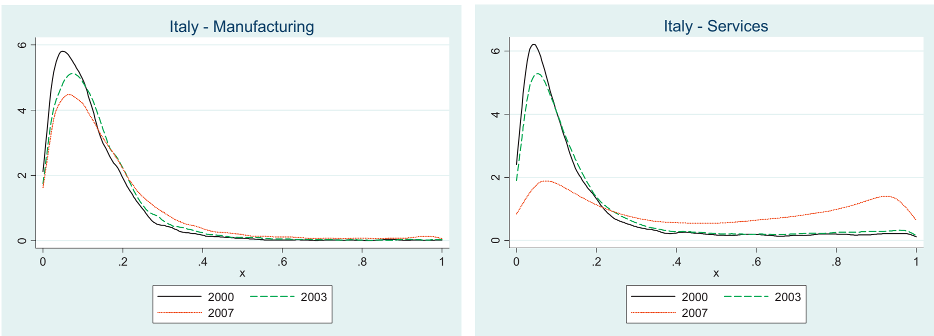
In Section 4.1 we have presented some evidence of the aggregation problem considering two industries in our four countries: beverages (NACE 159) and motor vehicles (NACE 341) (Figs. A.1–A.3).

In Fig. A.4 we report the evolution over time of the average PCM in the beverages industry for Italy and France: the left panel reports simple average price cost margins, showing the substantially higher PCMs for France, consistently with the aggregate PCM measures previously discussed. The right panel reports the same plot using weighted average PCMs, where the weights are firms' market shares. The gap between the two markets seems even wider.

The same exercise for motor vehicles is reported in Fig. A.5. Still, large differences show up in the left panel as regards the average PCM in France and Italy. The picture is slightly different when considering weighted PCM, reported in the right panel. Indeed, when assigning a greater weight to the PCMs of large companies we observe a rise of average PCMs in Italy and a decrease in France, possibly induced by differences in competition in the car industry across the two countries. However, systematic differences in the two PCMs persist.

Note that using data at the NACE 3-digit level of aggregation should limit differences due to possible compositional effects within the (relatively aggregate) underlying NACE 2-digit industry. Moreover, also note that these differences do not derive from different sample properties, as the two countries have a very similar underlying distribution in terms of firms' sizes.

If we pretend that these two countries make up the European Union, can we therefore simply pool the two series together in order to retrieve a synthetic, EU-based indicator of PCM? Assuming that the two countries belong to the same common market, we should compute the average PCM weighting each firm by the relative share of the

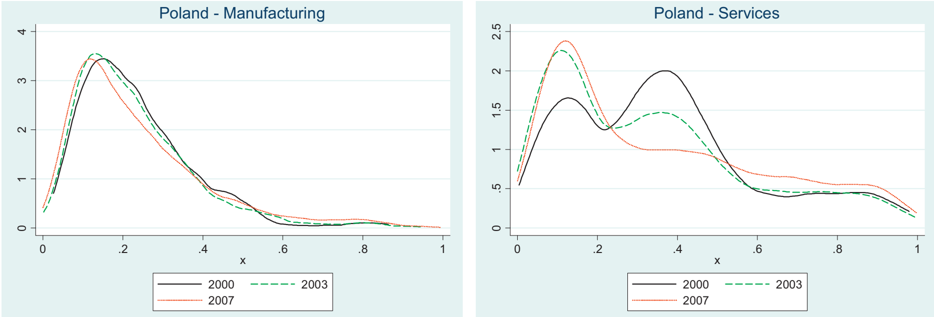


Manufacturing			
year	median	mean	variance
1999	0.0867	0.0873	0.0205
2000	0.0716	0.0717	0.0237
2001	0.0802	0.0827	0.0246
2002	0.0908	0.0897	0.0275
2003	0.0907	0.0952	0.0265
2004	0.0917	0.0949	0.0374
2005	0.0925	0.0960	0.0385
2006	0.0900	0.0949	0.0376
2007	0.0956	0.1079	0.0471
Total	0.0889	0.0935	0.0341

Services			
year	median	mean	variance
1999	0.0692	0.1052	0.0615
2000	0.0622	0.0984	0.0630
2001	0.0718	0.1168	0.0793
2002	0.0759	0.1115	0.0730
2003	0.0760	0.1211	0.0772
2004	0.1398	0.2396	0.1517
2005	0.1505	0.2519	0.1545
2006	0.1642	0.2689	0.1559
2007	0.2856	0.3562	0.1730
Total	0.1411	0.2524	0.1494

Notes: Figure presents kernel densities for PCM in 2000, 2003 and 2007. The Tables present summary statistics for PCM over the time period considered.

Fig. A.1. Distribution of observed PCM over time, Italy.



Manufacturing

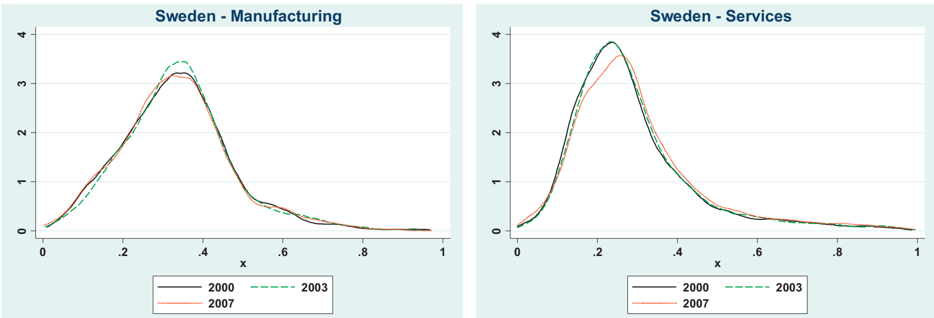
year	median	mean	variance
1999	0.2102	0.2398	0.0299
2000	0.2026	0.2299	0.0216
2001	0.2055	0.2327	0.0241
2002	0.2119	0.2388	0.0266
2003	0.1959	0.2272	0.0236
2004	0.1950	0.2194	0.0245
2005	0.1971	0.2252	0.0249
2006	0.1881	0.2260	0.0371
2007	0.1885	0.2273	0.0373
Total	0.1953	0.2276	0.0302

Services

year	median	mean	variance
1999	0.3076	0.3741	0.0826
2000	0.3417	0.3599	0.0609
2001	0.3336	0.3585	0.0658
2002	0.3172	0.3479	0.0657
2003	0.2924	0.3325	0.0628
2004	0.2881	0.3323	0.0636
2005	0.2744	0.3329	0.0693
2006	0.2890	0.3458	0.0766
2007	0.2818	0.3505	0.0808
Total	0.2989	0.3451	0.0718

Notes: Figure presents kernel densities for PCM in 2000, 2003 and 2007. The Tables present summary statistics for PCM over the time period considered.

Fig. A.2. Distribution of observed PCM over time, Poland.



Manufacturing

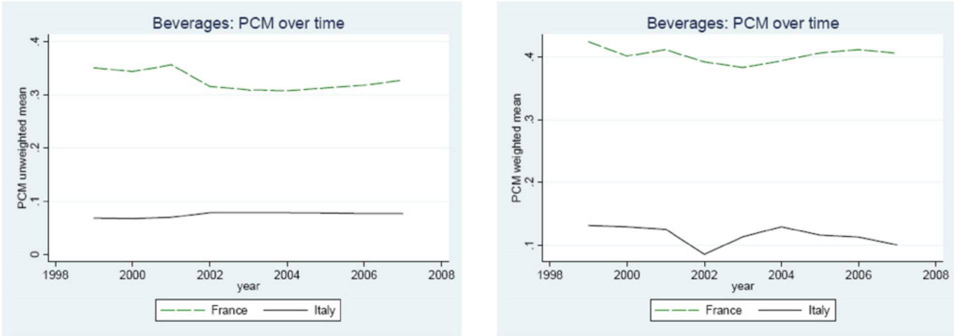
year	median	mean	variance
1999	0.3358	0.3442	0.0257
2000	0.3304	0.3310	0.0213
2001	0.3273	0.3309	0.0241
2002	0.3290	0.3280	0.0260
2003	0.3319	0.3318	0.0247
2004	0.3341	0.3348	0.0231
2005	0.3287	0.3302	0.0224
2006	0.3264	0.3240	0.0264
2007	0.3256	0.3249	0.0249
Total	0.3298	0.3306	0.0243

Services

year	median	mean	variance
1999	0.2549	0.3013	0.0400
2000	0.2491	0.2746	0.0284
2001	0.2486	0.2745	0.0308
2002	0.2526	0.2804	0.0300
2003	0.2531	0.2801	0.0286
2004	0.2580	0.2845	0.0290
2005	0.2598	0.2838	0.0317
2006	0.2612	0.2864	0.0331
2007	0.2626	0.2857	0.0325
Total	0.25595	0.2835	0.0316

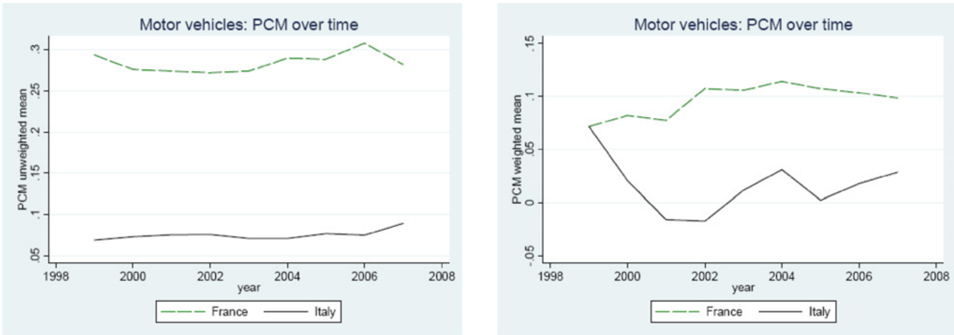
Notes: Figure presents kernel densities for PCM in 2000, 2003 and 2007. The Tables present summary statistics for PCM over the time period considered.

Fig. A.3. Distribution of observed PCM over time, Sweden.



Notes: Left panel displays unweighted average values of PCM, right panel displays weighted means, where weights are given by market share. Results for NACE 159

Fig. A.4. PCM over time, beverages.

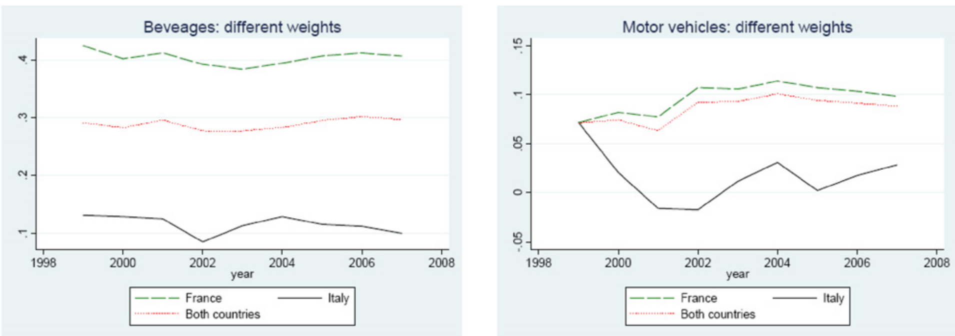


Notes: Left panel displays unweighted average values of PCM, right panel displays weighted means, where weights are given by market share. Results for NACE 341

Fig. A.5. PCM over time, motor vehicles.

combined sales in the two markets. This would yield the dotted line in the middle in Fig. A.6. Obviously, this 'aggregate' PCM is a mean of the two PCMs previously found, with the average closer to the series of the country whose market is larger (France). It is obvious as well that such an aggregate PCM would be a heavily biased measure of the underlying market dynamics.

However, since average PCMs are retrieved from firm-level observations, we can evaluate the extent of the bias introduced when considering averages across countries by plotting the distributions of PCMs in the two countries. Indeed, we find that these are poorly overlapping. In particular, Fig. A.7 shows in the left panel the kernel densities for PCMs in the beverages industry for France and Italy. The Kolmogorov–Smirnov test for the equality of the distribution functions rejects at the 1% significance level the equality between the two distributions, both on the whole time period and in the two intervals plotted (1999–2000 and 2006–2007). Table A.5 reports the results.



Notes: Left panel displays unweighted average values of PCM, right panel displays weighted means, where weights are given by market share. The red line is the "ideal" average PCM obtained assuming that France and Italy are one unique market. Results for NACE 159

Fig. A.6. Comparison of different weights.

Table A.1
PCM decomposition in France, 2000–2006 averages (NACE 3-digit).

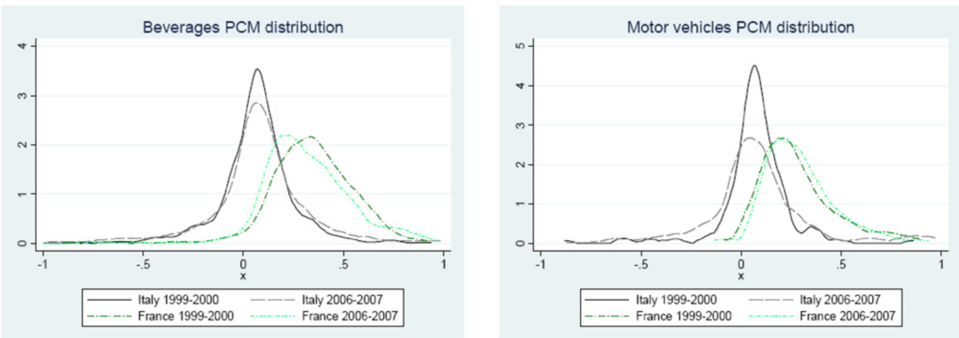
	Within	Reallocation	Interaction	Entry	Exit	Aggregate
France (2000–2006)						
Manufacturing						
151	0.0025	−0.0073	−0.0003	0.0105	−0.0014	0.0041
152	0.0043	−0.0235	0.0004	0.0258	−0.0019	0.0051
153	−0.0007	−0.0130	0.0074	0.0261	−0.0061	0.0136
154	0.0051	−0.0392	−0.0005	0.0291	−0.0002	−0.0058
155	0.0020	−0.0022	0.0013	0.0057	−0.0048	0.0019
156	0.0033	−0.0148	−0.0012	0.0174	−0.0004	0.0043
157	−0.0002	−0.0206	0.0002	0.0289	−0.0015	0.0067
158	0.0027	−0.0193	0.0015	0.0184	−0.0024	0.0009
159	0.0009	−0.0209	0.0016	0.0143	−0.0028	−0.0070
241	−0.0071	−0.0119	−0.0002	0.0112	−0.0019	−0.0100
242	0.0022	−0.0024	−0.0037	0.0072	−0.0001	0.0031
243	−0.0030	−0.0069	0.0009	0.0037	−0.0009	−0.0062
244	0.0059	−0.0136	0.0055	0.0085	−0.0009	0.0053
245	−0.0001	−0.0087	0.0010	0.0089	−0.0035	−0.0024
246	−0.0002	−0.0066	0.0003	0.0091	−0.0004	0.0021
247	−0.0173	−0.0072	0.0045	0.0123	−0.0132	−0.0210
341	−0.0014	0.0000	0.0000	0.0002	0.0000	−0.0012
342	−0.0006	−0.0072	0.0034	0.0088	−0.0026	0.0018
343	−0.0097	−0.0108	0.0060	0.0141	−0.0001	−0.0005
Services						
521	−0.0010	−0.0090	0.0012	0.0115	−0.0004	0.0023
522	0.0006	−0.0112	0.0004	0.0127	−0.0016	0.0010
523	−0.0033	−0.0372	0.0005	0.0511	−0.0011	0.0099
524	−0.0010	−0.0126	0.0006	0.0164	−0.0010	0.0024
525	−0.0007	−0.0158	0.0000	0.0175	−0.0013	−0.0003
526	0.0015	−0.0122	0.0010	0.0094	−0.0013	−0.0017
527	−0.0046	−0.0166	0.0002	0.0224	−0.0027	−0.0013
642	0.0044	0.0113	0.0032	0.0169	−0.0002	0.0355
701	−0.0072	−0.0214	0.0195	0.0160	−0.0040	0.0029
702	0.0042	0.0061	−0.0045	0.0107	−0.0009	0.0156
703	0.0014	−0.0139	0.0015	0.0142	−0.0032	0.0001

Note: Average values of decompositions over the interval 2000–2006 for each NACE 3-digit industry.

In the right panel of Fig. A.7 we repeat the exercise for PCMs in the motor vehicles sector. Again, the Kolmogorov–Smirnov test rejects the equality between the two distributions, both for the whole time period as in the two intervals plotted. Thus, in levels, the distributions of PCM in France and Italy are actually drawn from statistically different distributions and, as such, they cannot simply be pooled together.

In order to get a more precise assessment of the bias we are introducing through the aggregating function, Fig. A.8 reports the distributions of firm-level PCMs for France, Italy, and the 'artificial' PCM obtained by pooling together the two country-specific ones. The pooled distribution is clearly different from the single countries' distributions not only in terms of mean, but also in terms of variance, thus conveying a very different, and potentially biased, messages in terms of the type of reallocation ongoing in the market.

To solve this aggregation problem, we exploit the finding of a quite symmetric pattern of adjustment of the distribution over time for both Italy and France, and in general across the four countries considered. Indeed, if we plot



Notes: Kernel densities for PCM in the interval 1999-2000 and 2006-2007 in France and Italy.

Fig. A.7. PCM distribution in France and Italy.

Table A.2
PCM decomposition in Italy, 2000–2006 averages (NACE 3-digit).

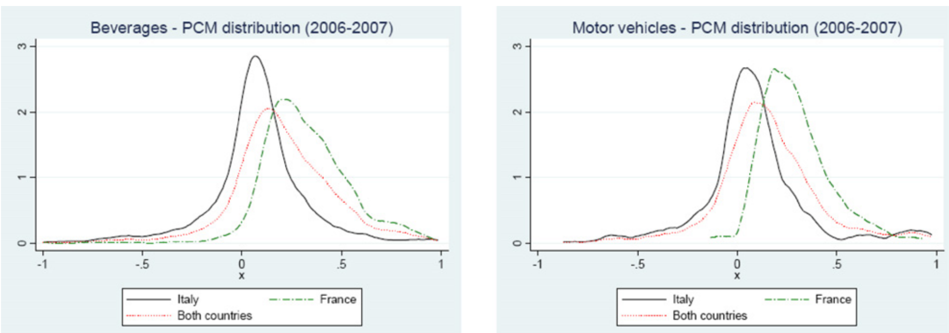
	Within	Reallocation	Interaction	Entry	Exit	Aggregate
Italy (2000–2006)						
Manufacturing						
151	−0.0385	−0.01	0.0484	0.0024	−0.0017	0.0005
152	−0.0695	−0.0063	0.0747	0.0015	0.0002	0.0006
153	−0.0067	−0.0033	0.0132	0.0027	−0.0013	0.0046
154	−0.0195	−0.0224	0.044	0.0014	−0.0003	0.0033
155	−0.0470	−0.0093	0.0565	0.0063	−0.0042	0.0022
156	−0.0273	−0.0038	0.0266	0.0021	−0.0005	−0.0029
157	−0.006	−0.0024	0.0106	0.001	−0.0015	0.0017
158	0.003	−0.0057	0.0043	0.0054	−0.0064	0.0005
159	−0.4965	−0.0147	0.5115	0.0014	−0.0077	−0.0059
241	−0.0102	−0.0038	0.0104	0.0036	−0.003	−0.0031
242	0.0018	−0.0589	0.0566	0.0043	−0.0006	0.0032
243	−0.0054	−0.0086	0.0131	0.0031	−0.0029	−0.0007
244	−0.0181	−0.0099	0.0262	0.0049	−0.0051	−0.0021
245	−0.0008	−0.0352	0.0274	0.0099	−0.0048	−0.0034
246	−0.0066	−0.0084	0.0111	0.0035	−0.0021	−0.0025
247	−0.0195	−0.0006	0.0148	0.0007	−0.0007	−0.0054
341	−0.0008	−0.0064	0.0019	0.0031	−0.0044	−0.0065
342	−0.0175	−0.0103	0.0275	0.0062	−0.0057	0.0002
343	−0.0304	−0.0121	0.0383	0.0029	−0.0025	−0.0038
Services						
521	−0.0173	−0.0369	0.0546	0.0004	0.0001	0.0009
522	−0.0031	−0.0065	0.008	0.0036	−0.0058	−0.0038
523	−0.0206	−0.0105	0.0345	0.002	−0.0047	0.0008
524	0.007	−0.0755	0.0701	0.0019	−0.002	0.0015
525	−0.0074	−0.0285	0.0447	−0.0027	−0.0016	0.0045
526	0.0039	−0.0167	0.0081	0.0184	−0.0093	0.0043
527	−0.0052	−0.051	0.0493	0.0063	−0.0012	−0.0018
642	0.0045	−0.0579	0.0141	0.0696	−0.0317	−0.0014
701	−1.5093	−6.5756	8.0907	0.0367	−0.0228	0.0197
702	−2.775	−3.3226	6.1008	0.0277	−0.0081	0.0229
703	−0.2499	−0.4344	0.6863	0.0182	−0.0068	0.0134

Note: Average values of decompositions over the interval 2000–2006 for each NACE 3-digit industry.

the PCMs in first differences for the whole time interval, the two distributions almost overlap, as shown in Fig. A.9.

This results suggests that, although countries differ in levels of price cost margins, when considering the dynamics, e.g. the first differences ($PCM_t - PCM_{t-1}$), the results are strikingly similar and thus can be safely aggregated and compared. Indeed, when considering first differences we are implicitly looking at PCMs at a business cycle frequency. This practice allows to filter the data from idiosyncratic components that may give rise to aggregation problems.

We can therefore conclude that pooling together PCMs from different countries does not seem to be fully appropriate, at least in comparative statics exercises, since each country's PCM distribution is determined by a data generating process which is clearly country-specific. Nonetheless,



Notes: Kernel densities for PCM in the interval 2006-2007 in France and Italy. The red line is the "ideal" distribution of PCM obtained assuming that France and Italy are one unique market.

Fig. A.8. Comparison of PCM distributions across different samples.

Table A.3
PCM decomposition in Poland, 2000–2006 averages (NACE 3-digit).

	Within	Reallocation	Interaction	Entry	Exit	Aggregate
Poland (2000–2006)						
Manufacturing						
151	0.0019	−0.0047	−0.0011	0.0074	−0.0010	0.0024
152	0.0021	−0.0014	−0.0005	0.0140	−0.0002	0.0140
153	0.0015	−0.0072	−0.0011	0.0073	−0.0011	−0.0006
154	0.0037	−0.0122	−0.0016	0.0008	−0.0013	−0.0102
155	0.0023	−0.0196	−0.0031	0.0095	−0.0008	−0.0116
156	−0.0007	−0.0073	−0.0014	0.0101	−0.0005	0.0002
157	−0.0005	−0.0030	−0.0026	0.0067	−0.0006	0.0001
158	0.0023	−0.0105	−0.0015	0.0116	−0.0008	0.0010
159	−0.0014	0.0091	−0.0004	0.0041	−0.0207	−0.0093
241	0.0079	−0.0131	−0.0039	0.0207	−0.0004	0.0113
242	−0.0009	−0.0027	0.0000	0.0009	0.0000	−0.0027
243	−0.0023	−0.0024	−0.0003	0.0067	0.0000	0.0016
244	0.0030	−0.0119	−0.0008	0.0170	−0.0001	0.0071
245	−0.0036	−0.0118	−0.0002	0.0272	−0.0043	0.0073
246	−0.0008	−0.0074	−0.0007	0.0079	−0.0002	−0.0012
247	0.0014	−0.0008	0.0001	0.0012	0.0000	0.0017
341	−0.0053	0.0032	−0.0004	0.0006	−0.0001	−0.0019
342	0.0041	−0.0157	−0.0103	0.0181	−0.0004	−0.0042
343	−0.0067	−0.0032	−0.0017	0.0069	−0.0014	−0.0061
Services						
521	−0.0137	−0.0102	−0.0025	0.0328	−0.0033	0.0036
522	0.0057	−0.0052	−0.0012	0.0161	−0.0003	0.0152
523	0.0016	−0.0209	−0.0016	0.0203	−0.0005	−0.0010
524	0.0030	−0.0136	−0.0022	0.0177	−0.0005	0.0044
525	0.0430	−0.0910	0.0319	0.0654	−0.0001	0.0310
526	0.0001	−0.0179	−0.0020	0.0202	−0.0006	−0.0001
527	0.0093	−0.0146	−0.0032	0.0337	0.0000	0.0258
642	0.0081	0.0197	−0.0002	0.0039	−0.0012	0.0302
701	0.0082	−0.0840	−0.0038	0.0829	−0.0025	0.0008
702	0.0165	−0.0175	−0.0148	0.0265	−0.0021	0.0086
703	0.0032	−0.0623	−0.0025	0.0511	−0.0046	−0.0151

Note: Average values of decompositions over the interval 2000–2006 for each NACE 3-digit industry.

Table A.4
PCM decomposition in Sweden, 2000–2006 averages (NACE 3-digit).

	Within	Reallocation	Interaction	Entry	Exit	Aggregate
Sweden (2000–2006)						
Manufacturing						
151	−0.0097	−0.0051	−0.0001	0.0038	−0.0003	−0.0114
152	−0.0068	0.0024	−0.0015	0.0035	−0.0005	−0.0029
153	−0.0025	0.0072	−0.0024	0.0007	−0.0001	0.0029
154	−0.0105	−0.0040	0.0074	0.0000	0.0000	−0.0070
155	−0.0017	−0.0382	0.0006	0.0001	0.0000	−0.0392
156	−0.0024	−0.0111	−0.0005	0.0186	−0.0018	0.0027
157	0.0000	−0.0189	0.0051	0.0002	0.0000	−0.0136
158	−0.0004	−0.0032	−0.0003	0.0041	−0.0005	−0.0004
159	−0.0044	0.0117	−0.0008	0.0000	0.0000	0.0066
241	−0.0016	−0.0046	−0.0002	0.0005	0.0000	−0.0059
242	−0.0168	−0.0122	0.0079	0.0146	0.0000	−0.0064
243	−0.0020	0.0020	−0.0010	0.0038	0.0000	0.0029
244	−0.0002	−0.0007	0.0004	0.0008	0.0000	0.0003
245	−0.0073	0.0002	0.0014	0.0021	0.0000	−0.0036
246	−0.0003	0.0042	−0.0002	0.0062	−0.0007	0.0093
247	0.0016	0.0014	0.0015	0.0029	0.0000	0.0075
341	0.0000	0.0006	−0.0001	0.0000	0.0000	0.0005
342	−0.0033	−0.0003	−0.0010	0.0068	−0.0024	−0.0001
343	−0.0007	−0.0025	0.0004	0.0043	−0.0002	0.0013
Services						
521	−0.0005	−0.0026	0.0002	0.0018	−0.0001	−0.0012
522	−0.0001	0.0008	−0.0001	0.0017	−0.0001	0.0022
523	0.0011	0.0000	0.0000	0.0002	0.0000	0.0013
524	−0.0021	−0.0080	0.0005	0.0076	−0.0003	−0.0024
525	0.0004	0.0029	−0.0001	0.0032	0.0000	0.0065
526	−0.0016	−0.0147	−0.0002	0.0125	−0.0037	−0.0077
527	−0.0101	−0.0080	−0.0002	0.0131	0.0000	−0.0052

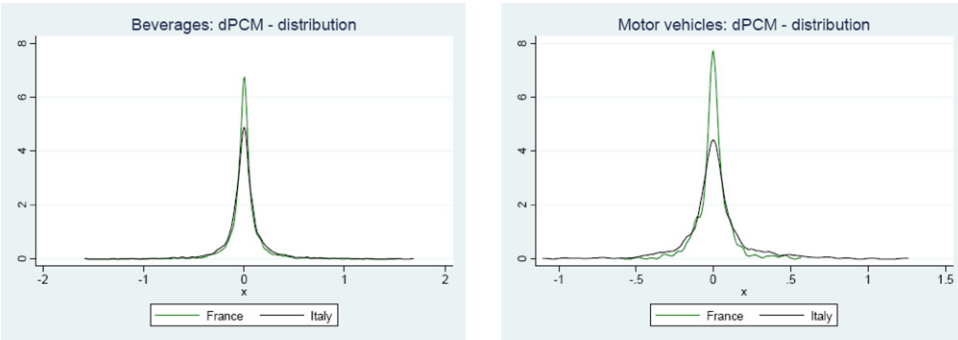
Table A.4 (*Continued*)

	Within	Reallocation	Interaction	Entry	Exit	Aggregate
642	0.0001	0.0002	0.0000	0.0002	−0.0001	0.0004
701	−0.0061	−0.0012	−0.0041	0.0031	−0.0023	−0.0105
702	−0.0013	−0.0050	0.0002	0.0030	−0.0006	−0.0037
703	0.0019	−0.0069	−0.0035	0.0053	−0.0003	−0.0035

Note: Average values of decompositions over the interval 2000–2006 for each NACE 3-digit industry.

Table A.5
Kolmogorov-Smirnov test for equality of distribution of PCM.

	D	*p*-Value	Corrected
Beverages			
France	0.0018	0.975	
Italy	−0.5169	0.000	
Combined K–S:	0.5169	0.000	0.000
Motor vehicles			
France	0.0098	0.910	
Italy	−0.5492	0.000	
Combined K–S:	0.5492	0.000	0.000



Notes: Kernel densities for first differences of PCM in France and Italy. The red line is the "ideal" distribution of PCM obtained assuming that France and Italy are one unique market.

Fig. A.9. PCM changes distribution.

since country dynamics are driven by common factors, as a consequence of EU driven market integration, the distributions of first differences of price cost margins tend to overlap and can thus be aggregated without biases.

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