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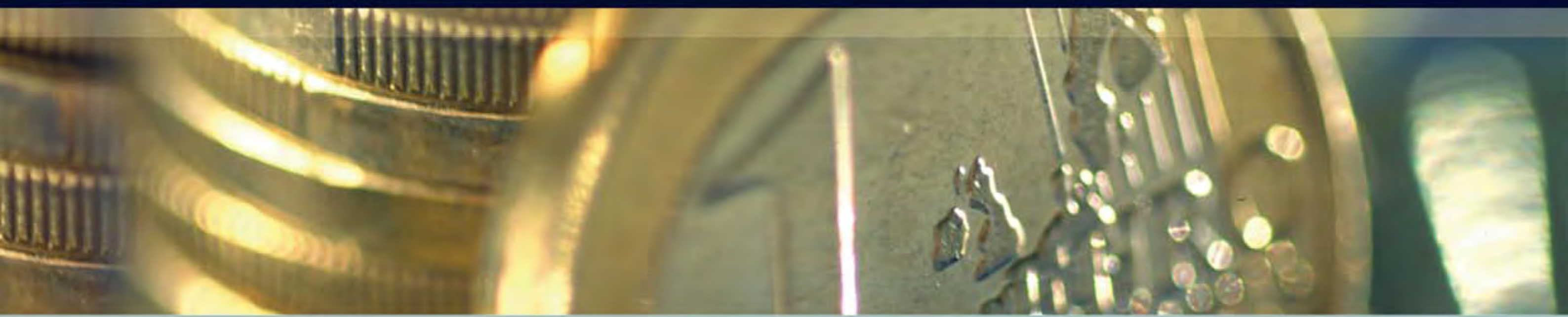

Assessing the Competitive Behaviour of Firms in the Single Market: A Micro-based Approach

Carlo Altomonte, Marcella Nicolini, Armando Rungi
and Laura Ogliari (ISLA-Bocconi University)

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Assessing the Competitive Behaviour of Firms in the Single Market: A Micro-based Approach

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Final Report

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Carlo Altomonte

Marcella Nicolini

Laura Ogliari

Armando Rungi

ISLA-Bocconi University

Contact:

Carlo Altomonte
ISLA-Bocconi University
Via Roentgen 1, 20136 Milano, Italy
carlo.altomonte@unibocconi.it

Marcella Nicolini
FEEM & ISLA-Bocconi University
Corso Magenta 63, 20123 Milano, Italy
marcella.nicolini@unibocconi.it

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Contents

1 Introduction and main results

This paper constitutes the Final Report of the Study on "The measurement of the intensity of competition in goods and services markets". The Report is meant to complement the already ongoing Market Monitoring exercise carried out by the European Commission services within DG ECFIN, whose general aim is to assess the extent of market functioning in goods and services markets, in order to identify those areas in which the potential of the internal market might not have been fully exploited. To that extent, a number of indicators related to the evolution of the competitive conditions in the single market, as derived from firm-level observable data, are constructed and analysed in this Report. The use of firm-level data allows to grasp not only information on the average changes taking place in each industry and across countries, but also the distribution and sources of these changes, in terms of individual firms' pricing behaviour and market shares, an information which is impossible to gather in detail from aggregate, traditional sector-level measures.

Operationally, we have constructed a Pilot database encompassing firm-level observations in a selected number of both manufacturing and services industries (Food, Chemicals, Car Production, Retail services, Telecom, Real Estate) at the NACE 3-digit level in a given number of Member States (Belgium, France, Germany, Italy, Poland, Romania, Spain and Sweden), for an average of around 330,000 firms observed each year over the period 1999-2007. In the final part, the study also evaluates the extent to which aggregate indicators can be constructed for the entire EU, as well as the possibility of extending the entire exercise to all industries/countries in the EU.

Before summarising the main finding of the Report, a general caveat has to be made. Although the Report explicitly aims at measuring the extent of 'product market competition' in the Single Market, it has to deal with the level of statistical aggregation of the industries examined. Such a level, being firm-based, is certainly subtler with respect to the aggregation level of existing indicators of product market functioning, but it does not coincide with the definition of "relevant market" which is normally employed by the European Commission in assessing competition issues. In fact, the level of statistical definition employed in this Report (firms pooled within NACE 3-digit industries) is more aggregate than what would be necessary to identify what a relevant market could be. Nor a change in the aggregation would help to that extent. In fact, most firms in most sectors are multiproduct, with the result that most of the products offered by each firm are very likely to compete in a different relevant market. Our cross-country comparable data, however, consider balance sheet information on the total sales and costs of firms, thus extracting information on the pricing behaviour of firms across their bundle of products, that is across potentially different relevant markets.

As a result, a better definition of what the indicators measure in the context of the present Report is a proxy of profitability. While in the relevant market case profitability is a good proxy of market power, and therefore of the level of competition in the market, analysing profitability by industry across firms, as we do in the present Report, allows to extract information not on the evolution of competition (in the sense described above) but rather on the changes in the competitive behaviour of firms (possibly induced by changes in pricing strategy, quality upgrading, dynamic efficiency, product mix changes, evolution of market shares, entry or exit) within the single market. But the latter, rather than an analysis of competition problems, is precisely one of the ultimate goals of the Market Monitoring exercise, to which this Report hence contributes. It is with this caveat in mind that one has therefore to read the messages of the Report, and its eventual reference to 'competition' issues.

The Final Report is structured as follows. Section 2 describes the source of our firm-level data, the choice of countries and industry that enter in the Pilot study, as well as the shortcomings deriving from our sources of data. In Section 3 we start analysing a simple structural indicator, the Price-Cost Margin (PCM), retrieved from firm-level balance sheet data across industries and time. The use of the latter index allows for an immediate and easy to divulgate introduction to the main results of the study. The analysis also includes the variation over time of the density distribution of the index across firms, a datum which allows observing some features of the changes in the intensity of competition impossible to gather with standard, industry-level indicators.

In Section 4, using a sub-sample of our data, we start assessing the robustness of the PCM as observed from balance sheet data against the methodology proposed by Roeger (1995), where the PCM is estimated as an industry average at the NACE 3-digit level across firms and over time. We discuss the correlation between the observed PCM and the estimated one, as well a comparison between these two measures and the PCM calculated as a weighted average of the firm-level observed PCM. In general, we are able to validate both the observed and the weighted PCM against the Roeger-based estimated one for the various industries and across countries. However, our recommendation is against the use of the Roeger-based estimated PCM as a main instrument of analysis when performing disaggregated studies, as the aggregate PCMs retrieved via the Roeger's approach are very sensitive to the level of aggregation used.

In fact, the implicit assumption in Roeger (1995) is that the estimated PCMs are *common* to all the firms in a given sample. It then follows that a trade-off exists between a progressively finer levels of disaggregation in which the firm-level heterogeneity can be accounted for, and the accuracy of the same estimates (as PCM would be estimated over a smaller number of observations, therefore with higher standard errors). Moreover, a synthetic indicator of PCM as retrieved from the Roeger's approach is such that dynamic efficiency, i.e. efficiency gains due to innovation, a particularly relevant feature in our analysis, can hardly be disentangled from the retrieved estimates, as the individual contribution of each firm to the aggregate PCM is hard to disentangle.

For all these reasons, in the follow-up of the analysis we have chosen to use as the main indicator of competitive pressures a *decomposition* of the (weighted) price-cost margin *changes* at the firm-level. Using the Roeger methodology we have in fact verified that directly observed PCMs can be aggregated without particular distortions with respect to estimated ones, and therefore can be used avoiding computational intensive steps to be undertaken should the analysis be extended or repeated over time. Most importantly, the aggregation from the bottom of directly observed firm-level mark-ups allows to actually exploit firm-level heterogeneity in order to extract information on the evolution of industrial dynamics as competitive pressures in the single market evolve.

To that extent, in Section 5 we perform a Laspeyres-type decomposition of the changes in the PCM index, in order to retrieve 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 the various industries/countries/years. Such an analysis is carried out for three 'prototype' countries: France for the Euro area, Sweden as a EU-15 non Euro area country and Poland, a new member state formerly under transition. The PCM decompositions are reported and discussed for the years 2000 and 2006, in order to grasp the effects of the adoption of the euro and the accession of the new member States to the EU. In general, we find a general trend towards lower PCMs in both manufacturing and (to a lesser extent) services industries in France, a more or less homogeneous pro-competitive effect in Sweden, and interesting catching-up dynamics in Poland. When overlooking the entire range of PCM decompositions for every countries and years[1], we also find a very high deal of heterogeneity across industries and across countries. That points to a situation of industrial dynamics which is still affected to a certain extent by country-specific factors.

[1] Detailed results are reported in the Statistical Annex of the Report, available upon request.

In Section 6 we validate these findings by looking at a novel indicator of competition, the Relative Profit Difference (RPD) as proposed by Boone (2008); the basic idea is that more competition should reallocate profits towards more efficient firms, i.e. relative profit differences should widen following an increase in competitive rivalry. Thus, in general, relatively more efficient firms should make relatively higher profits the more competitive the industry, compressing the profits of relatively less efficient firms. Because of its construction, the RPD measure should be able to overcome some of the shortcomings deriving from the analysis of the PCM decomposition. In particular, when industries are subject to intense reallocation dynamics entailing important changes in market shares, the PCM measure might not be monotonic in competition, while the RPD measure instead increases (decreases) not only for the higher (lower) competition that arises from lower entry barriers, but also for competition that reallocates output to more efficient incumbent firms within the sector, thus ensuring the respect of monotonicity with respect to the direction of the competition shock. An advantage of the RPD measure, moreover, is that it suffers less from problems in the quality of the data (in particular missing observations or outliers), while it can be constructed starting from the same balance sheet data needed to retrieve the price-cost margin at the firm level.

We thus proceed in measuring the standard RPD indicator for our selected countries and industries using costs as a proxy for efficiency, as originally proposed by Boone (2008), again discussing the case of France, Sweden and Poland in detail[2]. Looking at the indicator across countries, we find a prevalence of a reduction of our slope coefficient, thus indicating a general pro-competitive effect, a result especially true for France when comparing the pre and post-euro periods. The situation for Sweden is instead more heterogeneous, while again Poland displays marked improvements in relative profit differences, albeit for different reasons than France. All these findings are consistent with the dynamics detected when analysing the PCM decomposition in the previous section.[3]

After having noted some of the potential drawbacks of the Boone indicator, essentially linked to the fact that the relationship between cost efficiency and profits might be non-monotonic, due to underlying changes in the relevant (unobserved) elasticity of substitution perceived by individual firms, we implement two robustness checks of the RPD indicator. First, following Boone et al. (2007), we run a simple regression evaluating the profit elasticity of each firm to

[2] The RPD for all the countries / industries / years is reported in the Statistical Annex of the Report, available upon request.

[3] Again, all the indexes calculated for every country, industry and year included in the Pilot study are reported in the Statistical Annex of the Report.

its costs, based on the same data we use for the construction of the RPD index. Second, we re-evaluate the RPD measure by using an alternative proxy of efficiency based on the estimation of a stochastic frontier production function model.

In Section 7 we combine the information provided by the PCM decompositions and the latter two RPD-related indicators (RPD frontier-based and profit elasticity) in order to develop, for every industry/country pair, a number of screening tests for market functioning based on the overall divergence of the PCM indicator, its increases and its persistency over time, each time combined with the RDP indicators. As a general finding, we find that Romania and Poland are the countries in which a certain lack of convergence of the PCM indicator to the EU average is also associated to a sluggish relationship between profits and efficiency, as measured by our RPD indexes of changes of competition dynamics. The same finding is true when considering long-term increases in the PCM indicator.

In the Euro area, industries with diverging PCMs are relatively less present and in general concentrated in the services sector, but such features do not tend to be associated to problematic changes in competition dynamics (with Spain displaying however a relatively higher number of controversial cases). When considering long-run increases in PCMs, instead, the feature is quite present across both manufacturing and services industries across all the considered countries. Apart from the already discussed cases of Poland and Romania, the latter could be a potential indication of dynamic efficiency gains (lower costs or quality upgrading) taking place across industries; however, in a number of cases (especially in Sweden and France) the feature tends to be associated also to unclear changes in competition dynamics. Once again, the latter finding does not necessarily entail the existence of a problem of competition (to the extent that firms are repositioning themselves in the product market in order to exploit a lower elasticity of substitution), but certainly signals an evolution in the competitive behaviour of firms which is worth exploring in greater detail.

Finally, very few industries tend to display a persistency in PCM levels, with the majority of them concentrated in Romania.

Based on these general screening tests, we have then performed a detailed analysis of the competitive behaviour of firms in three selected industries across countries: NACE 159 (beverages), NACE 341 (car industry) and NACE 522 (distribution of food), comparing our results with the information obtained through the use of a standard measure of competition, the Herfindahl index. When our combined indicators in a given country highlight a peculiar evolution of the competitive behaviour of firms, we exploit firm-level information and a finer disaggregation of the PCM decomposition in order to discuss in detail the reasons which might be behind the detected dynamics. We feel that such a narrow industry-specific approach, combining different indicators measured starting from firm-level data across countries and over time, is the most suitable complement to be used in future analyses of product market functioning.

In Section 8 we discuss more in general how to aggregate data coming from different country or industry-specific distributions in order to retrieve a EU-wide (or Euro-area wide) indicator of the dynamics discussed above. In order to obtain an unbiased aggregation, PCM-type indicators constructed at the EU level should in fact derive from similar country-specific distributions of prices *and* costs. While the former might be true to a certain extent, as a number of studies report that consumers' price dispersion in Europe has experienced a downward trend since 1996, it could be the case that, within the single market, systematic differences in costs' distribution exist across countries, e.g. due to different employment subsidies, payroll taxes, social security payments, infrastructures, and other country-specific conditions.

An analysis performed comparing data from Italy and France (whose sample composition is similar in terms of firms' sizes and numerosity) has actually revealed important country-specific differences in the distribution of PCM *levels* which make their aggregation potentially biased. On the contrary, we have found that the distribution of PCM *changes* (on which this Report is based) is highly comparable across countries.

Assuming that a pooled distribution of firms is sensible at the European level, we would find that, on average, the PCMs levels across EU industries have displayed an increasing trend over time (at an average annual rate of 1.3 per cent), but their dispersion, as measured by the coefficient of variation, has indeed been decreasing (at an average annual rate of -2.4 per cent). The latter signals that a process of quality upgrading induced by dynamic efficiency considerations is certainly in place across European industries, while at the same time the overall dispersion of the PCMs of these industries is being reduced, in line with the theoretical priors of a functioning internal market where important reallocation forces are at play. When distinguishing between industries operating in eurozone countries vs. other countries, we see that the former have experienced a much smaller increase of their PCM over time (an average increase of 0.8% vs. 2.3% for industries within non-euro area countries), thus ending up with an average PCM over the considered period of 20.8%, that is five points smaller than the PCM of industries operating within non-eurozone countries (25.8%). In terms of dispersion, the coefficient of variation of PCM across industries in the euro area is also significantly smaller (.97 vs. 1.72), and, most interestingly, it displays a clear and significant downward trend (-3.4 %)

which essentially drives the downward trend detected for our full sample (the trend in the PCM dispersion of industries belonging to non-euro area countries is not significant).

Actually, these messages are confirmed when looking at PCM changes (thus using the correct aggregating function): we observe that in a number of industries in the euro area the average PCM change over the period has been negative, while this result does not hold in the non-euro countries. Moreover, the average change in PCM, even when positive, is always lower in euro countries compared to non-euro ones, and this difference is almost always statistically significant. Finally, and most interestingly, when splitting our dynamics before and after the introduction of the euro (2002), we observe that the competitive shock entailed by the single currency has limited the increase in PCM for those countries which were about to enter the single currency, with many industries experiencing a reduction in profitability. Once the euro has been introduced, however, industries in the euro area have started to experience slightly upward changes in PCM, again possibly due to phenomena of dynamic efficiency stimulated by the higher competitive pressures operating in the single market.

In Section 9 we develop a number of technical discussions related to the potential extension of the Pilot study to the entire range of industries and countries in the EU as well as some possible developments of the detected measures of competition as stimulus indicators. In particular, in terms of extension of the database, we discuss the availability and quality of data of other European countries not analysed in this Pilot study, how to deal with different representativeness of data, and the extent to which the NACE 3-digit vs. NACE 4-digit aggregation matters. In order to provide an example of a potential application of the retrieved PCMs in terms of stimulus indicators, we also present the results of an exercise where, for all NACE 3-digit industries of Italy and Germany, we have regressed the PCM at the firm level against different industry-based measures of trade penetration (both horizontal and vertical), in order to provide a first assessment of the impact of trade openness on competition dynamics.

2 Data description

2.1 Sources of firm-level data

A critical starting point of any firm-based measure of competition is clearly related to the availability of reliable firm-level balance sheet data, according to two important dimensions: the coverage of the database and the quality of the data available for each firm.

In terms of coverage, a study as the current one, potentially encompassing all the EU, or the Euro-zone, requires firm-level data to be available across time and across sectors at a relatively fine level of disaggregation (NACE 3-digit) and, most importantly, to be derived from a common informational source, rather than a sum of national ones, in order to avoid possible measurement errors in matching data and thus ensure the maximum level of comparability across the EU-27 Member States. Moreover, in terms of quality of data, it is necessary to have detailed and complete over time balance sheet information for the largest possible number of firms, in order to avoid the aggregation problem typical of micro-data[4].

The only currently available database that satisfies all these characteristics across European firms 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 (2008 version). Other commercially available databases in fact fail to pass the test either in terms of coverage (they do not have coverage of the universe of firms, but include only, for example, large or incorporated or listed companies), or in terms of data (detailed balance sheet data are not available, only some variables related to the firms' activity).

The geographic coverage of AMADEUS encompasses information for all the 27 members of the European Union (albeit with different qualities in terms of national coverage, see infra) as well as other 14 European countries that complete the geographical and political definition of the continent. Another interesting feature of the database is given by the detailed definition of a firm's location, with data available on the region (NUTS2) and the city in which the firm operates. These data could be useful in a competition analysis that would go beyond traditional national frontiers, allowing to explore both disaggregated geographical region and/or broader sub-European markets, progressively relevant in a more and more integrated common market.

In terms of comparable economic and financial firm-level data, the database contains 22 balance sheet items, 25 profit and loss account items and 26 ratios. It is possible to derive

[4] If samples are selected along certain variables (e.g. firms' size) due to the lack of data, the resulting aggregate variables would be biased.

descriptive information on activity codes (NACE 4-digit), which cover both manufacturing and services sector in detail. The recently revised NACE Rev. 2 classification has also been added to the data, thus ensuring full comparability with Eurostat in the future. The database contains also a so-called Ownership Database that permits to retrieve information on the control chain and the ownership type (foreign or domestic; industrial or individual; controlled or independent), information which could be used as an additional control for assessing the extent of competition levels.

Finally, another interesting feature of the AMADEUS database is that it allows a relatively straightforward link between the estimated measures of competition based on balance sheet data and other complementary indicators of conditions conducive to competition (e.g. trade or product differentiation). Apart from NACE Rev. 1 and 2, AMADEUS in fact reports different classifications of economic activities for each firm (NACE 4-digit, NAICS or US SIC). Since it is possible to convert product codes (for example CN 8-digit) into activity codes (for example NACE), these data can then be easily matched with data on international openness of the sector (for example import penetration, intensive and extensive margins of trade), freely available through the Eurostat – COMEXT database, or data on the changes and complexity of the product mix, via the link to the PRODCOM database, also developed by Eurostat.

A major shortcoming of the AMADEUS database is that it records firms as they become available to the national information providers, which then transfer the data to the main database. The database then stores the information on these firms eventually providing also past balance sheets, and keep these firms as long as they continue to update their balance sheets. As a result, 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 if they stay inactive for more than five years. Hence, entry and exit are tricky to measure on these data. We have designed specific routines to deal with these problems, in particular distinguishing entry based on the year of incorporation of a given firm (economic entry) vs. the year in which it appears in the database (database entry). At the same time, we have made sure to measure exit of inactive firms considering as exiting those firms who report two or more blanks in the balance sheet starting from our last available year[5]. However, there is no way we can deal with the potential biases induced, on the entry side, by firms appearing in the data in a given year but active already in previous years, and on the exit side by firms

[5] See the beginning of Section 5 for a detailed discussion of this issue.

which, being inactive for more than five years, have been dropped from the database[6].

An alternative database which could be used to retrieve the same information is ORBIS, provided by the same Bureau van Dijk. The database incorporates the same data as of AMADEUS, extended to world rather than European-only coverage (60M of firms in ORBIS, vs. 11M in AMADEUS). The advantage of ORBIS is that firms are not dropped when inactive, and thus exit can be better measured. However, a crucial issue is which version of these databases is available, as both come in three different version with a different coverage, encompassing respectively large-only, up to medium or the entire universe of firms. For this study, we clearly need to use a version of the database which includes the entire universe of firms.[7]

2.2 Pilot database: choice of countries, industries, years and validation

The choice of the countries in the Pilot study is based on a combination of two criteria: the availability of data providing a good validation with respect to official statistics (see infra), and the significance of the country in terms of its economic size and/or structural characteristics.

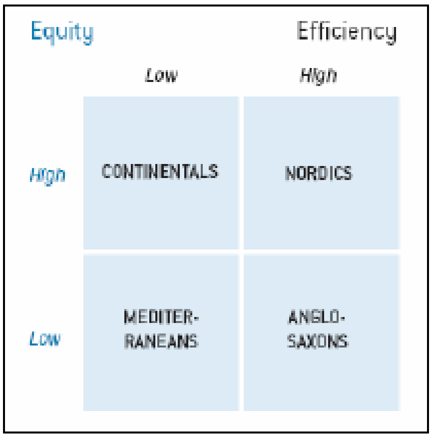
In particular, the countries to be included in the Pilot study have been chosen not only for their economic magnitude, but also because of their structural differences in terms of institutions and labour markets, all factors which might affect the retrieved competition measures. To that extent, we have taken into account 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. As it is well known, the partitioning identifies four heterogeneous groups of countries, as reported in Figure 1.

On the basis of the availability of data, both in terms of number of observations and quality of the balance sheet information, we have thus identified the following countries for each group: Italy and Spain for the Mediterranean; France and Germany for the Continentals; Belgium for the Continentals but with features typical of a small open economy; Sweden for the Nordics and Poland and Romania as a representative of a new member of the European Union, with a model of economic governance still in evolution. Ideally we would have liked to include also data

[6] If a firm appears in the dataset, say, in 2006, but reports an incorporation year of, say, 2002, we cannot consider this firm as entrying in 2006, but rather have to incorporate it among the active firms. Clearly, for those measures who depend on the aggegation property of our data (e.g. total number of firms or total turnover), comparing the data from 2002 to 2005 with the data in 2006 one could get an unobserved variable bias. The bias should be much less severe when considering the PCM (as firms in 2002 to 2005 would already incorporate in their PCM the presence of the 'missing' firm), and non existant for the RPD measure, which by construction is not sensitive to the presence of missing information. As far as exit is concerned, the reader has to consider that exit rates for the early years of our sample might be downward biased.

[7] This version of AMADEUS database was available through Bocconi University.

Figure 1: Taxonomy of countries according to social models (Sapir, 2005)



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 in the Report.

The eight countries included in the Pilot study 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, as reported in Table 1, presenting the number of firms extracted at the time in which we have started the study (January 2009).

Table 1: Pilot countries and number of firms in Amadeus database

Country	*N. of firms*
Belgium	375,779
France	1,062,268
Germany	1,062,524
Italy	690,244
Poland	59,848
Romania	505,428
Spain	980,797
Sweden	280,320

We have downloaded the data on all the firms in a given country in a given year, for all the sectors of economic activity (NACE Rev. 1)[8]. We have then aggregated the available

[8] Note that data in Amadeus have a stratified nature: when a new firm is added to the database, all the balance sheets available for the same firm also in the past years (up to 10) are added. It then follows that the coverage in terms of information for any given year is constant. As a result, the extension of this analysis to any other year is straightforward, without a significant loss in the quality of the data.

firm specific information at the NACE 2-digit level, in order to compare our samples with the Eurostat official statistics. In particular, the Structural Business Statistics of Eurostat allows us to retrieve information for every country and for each NACE 2-digit (with the exclusion of NACE code J – Finance, for some countries) in terms of number of active enterprises and total turnover. Since the last available year in Eurostat data is 2006 we have chosen the latter as a benchmark. For those two measures, we thus present in Table 2 the correlation between the official Eurostat statistics and our measures aggregated from firm-level data, together with information on the total available number of observed firms.

Table 2: Correlations between Amadeus and Eurostat, turnover and number of firms, year 2006

	Correlation by n. of firms	Correlation by turnover	N. of observed firms
Belgium	0.94	0.87	327,366
Germany	0.90	0.59	684,416
France	0.98	0.64	476,802
Italy	0.84	0.78	656,629
Poland	0.72	0.83	51,432
Romania	0.99	0.99	302,486
Spain	0.89	0.89	519,041
Sweden	0.85	0.83	271,226

In particular, correlations in terms of number of firms are calculated comparing the number of firms recorded in the database in each industry with the corresponding official Eurostat statistics, according to the NACE Rev. 1 definition. For those correlations, the year of reference is always 2006. Correlations by turnover have been computed comparing the firm-level balance sheet item 'total sales volume' aggregated within each industry, and are referred to 2006 data[9].

These validations refer to the general quality of the data contained in the AMADEUS database, and leave us quite comfortable as a starting point. However, in our exercise we limit our analysis to certain industries, and require the contemporaneous presence of a number of balance sheet items necessary to calculate our indicators. As a result, we have to explore the quality of the data with which we ultimately will end up working.

To this extent, in this Pilot study we have agreed to analyse at the NACE 3-digit level the Food (15), Chemical (24) and Automotive (34) industries for manufacturing, one network industry, Telecom (642), and two services industries: Retail (52) and Real Estate (70). In terms

[9] Correlations for other EU countries are technically possible to retrieve, but require a fair deal of work, has one has to download all the firms in all the EU countries by NACE 2-digit industries, a task implying around one day of computing time per country.

of years, our data cover the period from 1998/1999 (according to data availability) to 2007, i.e. they are able to address the competitive situation in Europe before and after the introduction of the euro in 2002 and the entry of China into the WTO.

Downloading our firm-specific data in the selected countries, industries and years, and considering only those firms whose information is complete across the required balance sheet items, we then come up with the following figures in terms of number of firms and turnover, always with respect to the official Eurostat data.

Table 3: Degree of coverage of AMADEUS database, number of firms, year 2006

COVERAGE N. of FIRMS

Country	Nace 15	Nace 24	Nace 34	Nace 52	Nace 642	Nace 70
BE	6.2%	37.9%	16.0%	0.9%	4.0%	1.8%
DE	3.0%	17.1%	11.6%	0.9%	200.3%	0.1%
ES	40.2%	67.0%	51.7%	11.6%	146.7%	14.9%
FR	24.7%	56.2%	57.4%	21.9%	16.7%	7.9%
IT	na	56.5%	66.1%	5.5%	24.9%	21.2%
PL	9.9%	22.5%	17.7%	0.6%	5.4%	6.4%
RO	71.9%	71.6%	63.5%	55.4%	61.1%	50.0%
SE	37.7%	32.5%	35.0%	22.1%	17.1%	5.5%

N. of firms in % of official Eurostat data in 2006; na: not available in Eurostat

Table 4: Degree of coverage of AMADEUS database, turnover, year 2006

COVERAGE TURNOVER

Country	Nace 15	Nace 24	Nace 34	Nace 52	Nace 642	Nace 70
BE	91.4%	83.0%	85.9%	33.8%	71.4%	62.1%
DE	59.6%	69.6%	53.5%	38.7%	112.1%	44.3%
ES	88.3%	103.3%	126.1%	67.2%	258.8%	98.6%
FR	na	95.2%	120.9%	71.7%	56.1%	35.3%
IT	na	95.0%	77.7%	40.2%	131.8%	155.9%
PL	46.2%	39.0%	60.4%	29.6%	na	63.9%
RO	86.6%	87.6%	36.3%	82.3%	103.1%	81.7%
SE	na	23.0%	9.1%	48.3%	7.5%	31.5%

Turnover in % of official Eurostat data in 2006; na: not available in Eurostat

Three features of the data are worth noticing. First, in Germany the quality of the balance sheet data (in particular information on the turnover / sales variables) is not perfect especially for small firms, with the result that our working sample of German firms is relatively small with respect to the official number of operating firms (upper table); however, since large firms are comprised in the sample, the coverage with respect to official Eurostat turnover data remains high (bottom table). Second, note that for Poland the database has a limited coverage, as in the AMADEUS database very few small firms are included: in Section 8 we provide a discussion of the extent to which these data limitation might change our results. Third, note that in some cases the primary activity code included in AMADEUS, on the basis of which we attribute the classification of firms to an industry, is such to let us record a higher number of operating firms than those recorded by Eurostat: for example we record 2333 firms operating in the German telecoms industry (642) vs. 1165 recorded by Eurostat. As the official criterion is based on the initial classification of a company at the time of its setup, while the AMADEUS primary activity code is based on the current production of a company, we believe the AMADEUS classification matches more closely the actual product market dynamics of an industry (firms change their primary activity codes over time). In any case, there is no way to reconcile these data; however, to the extent that all these firms operate within the same distribution of data, that should not affect the quality of our estimates.

3 The baseline indicator of competition: PCM

3.1 Retrieving the price-cost margin (PCM) at the firm level

The Price-Cost Margin (PCM) is in general 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 as we do here, the PCM might be considered also as a structural indicator, since 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 that stem from both the structural features of the market in which it operates and the conducts of all the other market players. When measured at the firm-level, thus, the PCM, by combining a structural and a rivalry component, can represent a solid indicator of the intensity of competition. 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 that (e.g. in the Cournot case) 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 is from its marginal cost.

Two different empirical versions of the Lerner Index approach are available in the literature, and both can be directly used at the firm-level of analysis, since they only need the availability of balance sheet data. 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). A similar approach, suggested by Tybout (2003), in which the PCM at the firm level is estimated taking the difference between production value and total variable costs (employment plus material costs) divided by production value, has the same computational advantages, and will be used as our baseline.

As a result, starting from yearly balance sheet data the firm-level PCM can be proxied as:

$$PCM_{it} \simeq \frac{\text{sales}_{it} - \text{variable\_costs}_{it}}{\text{sales}_{it}} = \frac{(p*q)_{it} - (c*q)_{it}}{(p*q)_{it}} = \frac{p_{it} - c_{it}}{p_{it}}$$

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. The latter represents the sum of costs for materials and costs for employees, therefore excluding the cost of capital, which is considered as a fixed cost. The theoretical PCM should take into account the unit marginal cost instead of the variable cost, but the former is not available when considering yearly balance sheet data. While in this study we adopt such an approximation, we will also test competition dynamics on the basis of alternative proxies which do not suffer from the possible biases deriving from such a simplification[10].

Then, for a given NACE industry I we would have that the observed PCM is:

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

and I is the desired level of aggregation.

Alternatively, one could also retrieve the PCM as the weighted average of the individual firms' PCMs, where weights are given by market share. In this case, for a given NACE industry I we would have that the weighted PCM is:

$$\widetilde{PCM}_{It} = \sum_{i \in I} s_{it} PCM_{it}$$

where I is the desired level of aggregation and s_{it} are the market shares of individual firms in a given year, such that $\sum_{i \in I} s_{it} = 1$.

3.2 PCM in the services sector

From a theoretical point of view, the peculiarity of service sectors 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 and constant elasticity of substitution (e.g. the Cobb-Douglas), as factors of production of service firms are likely to be less adjustable than in

[10] As pointed out by Fisher and McGowan (1983), minimizing the biases in retrieving a firm-specific PCM measure would require to include variable costs and other costs that help in increasing efficiency, investment in R&D or in patents, as the depreciation of the stock of the intangibles from one year to the other. This is because 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 manufacturing sector, due to the higher reliance of services on specific labour inputs, and particularly 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, inducing a slower adjustment of the structural competition parameters to the new equilibrium.

However for the calculation of the PCM and all other indexes that involve the definition of marginal/variable costs, and thus not incorporate a measure of productivity, nothing should change between manufacturing and services, but for the evidence of a possible generally higher level of the labor cost component.

Another concern might derive from the quality of the available data. Waldmann (1991), in a comment to the paper by Hall (1988), where a general methodology for calculating price-cost margins is presented (see the next Section), warns that, in some service industries, measurement errors in the construction of real value added might hamper the interpretation of the retrieved PCMs.

Based on these priors, and notwithstanding the lack of detailed firm-specific data for services until very recently, some papers focusing on the manufacturing sector consider nonetheless the possibility of inclusion of services, claiming that it would not be a problem to extend the same methodology to firms in this sector. For example, Martins, Scarpetta and Pilat (1996) from OECD investigate mark-up ratios in manufacturing industries using industry level data sourced from the OECD STAN database. The same authors however claim that "the analysis could be extended to service sectors. It is likely that the degree of competition in many services is considerably lower than in manufacturing." (p.14).

And indeed, the few articles that inspect competition indicators in services industries flawlessly apply the same methodology to both manufacturing industries and services industries. For example, Small (1997) investigates the cyclicality of mark-ups in manufacturing and service industries in United Kingdom. He applies a slightly revised version of the Hall (1988) approach developed by Haskel et al. (1995) to see whether mark-ups are pro or counter-cyclical. He claims that "a major difficulty involved in estimating the mark-up for non-manufacturing industries is the limited amount of disaggregated data available for these industries." "This lack of data for non-manufacturing is why most articles restrict themselves to just looking at manufacturing industries." (p.11) In his case, he only has data at the one-digit level for non-manufacturing industries, as opposed to the two-digit level for manufacturing industries.

Nishimura, Ohkusa and Ariga (1999) estimate mark-ups over marginal cost for a panel of large Japanese firms in 21 industries over 24 years (1971-1994). By virtue of their data source, the Nikkei NEEDS data base, they are able to include some service industries in their analysis, namely trading companies, retailers and land transportation (excluding railroad). They apply the same methodology to manufacturing and service companies without finding structural breaks in their analysis.

Kiyota, Nakajima and Nishimura (2008) estimate firms' mark-ups for a sample of 16,000 Japanese firms in manufacturing and wholesale and retail industries over the period 1995-2002. The authors apply the same methodology to firms belonging to manufacturing and services industries, and highlight that these coverage allows them to draw conclusions which are broader in scope. Data are sourced from an annual survey prepared by the Research and Statistics Department, METI, "which covers mining, manufacturing and wholesale/retail trade firms, although some services industries such as finance, insurance and software services are not included" (p.10). Again, data availability justifies the selection of industries in the analysis: "We focus on manufacturing and wholesale and retail industries because the number of firms in other industries is rather small." (p.10)

Badinger (2007) applies the Roeger (1995) methodology on a sample of 10 European countries over the period 1981-1999 in order to investigate the effect of Single Market Programme. This is the first study on the Single Market to include also service sectors. The author states that the only caveat that should be kept in mind when estimating mark-ups in service industries is that "the available data and standard capital stock measures may be less reliable there" (p. 503). In his analysis, he uses industry level data from the STAN database by OECD.

To this extent, the empirical literature dealing with balance sheet data generally proxies capital with the "tangible fixed assets" voice. Although, to the best of our knowledge, no one has really arisen the issue, it might be the case that the latter proxy could be inappropriate for services industries. Indeed, in these industries intangible fixed assets, such as patents, could be extremely relevant. However, our balance sheet data also have information on intangible fixed assets. Thus, in Section 4 we will investigate whether our competition indicators are sensitive to the inclusion of intangible fixed assets into the definition of capital.

3.3 PCM evolution across countries, industries and time

Figure 2 presents the evolution over time (years reported on the horizontal axis) of the average observed PCM (vertical axis) by the NACE 2-digits industries included in the Pilot study and across our eight countries, here grouped into Euro-area countries (Belgium, France, Germany, Italy and Spain) and others (Poland, Romania and Sweden).

At a first inspection the PCM does not seem to present clear and different trends in the two areas in terms of changes over time. As far as levels are concerned, instead, the Italian PCMs appear constantly lower than the ones of other countries - with the exclusion of the real estate sector (NACE 70), whose PCM dramatically increases over time. France instead is the country that displays the highest margins among the euro-zone countries considered, while the levels of price cost margins are rather homogeneous for Spain, Belgium and Germany. The three non-euro countries included in our analysis are very heterogeneous in the levels of our relevant measure, with Sweden having the highest PCM in four of the six industries taken into consideration.

Such a high degree of heterogeneity in the reported levels of PCM might be attributable to different sample characteristics, e.g. Italy (the country with the lowest PCM in level) might be characterised by a sample in which small and medium-sized firms are relatively more prevalent with respect to France (the country with the highest PCM level). However, after having checked the distribution of the Italian and French samples by firm sizes, we have found the two samples to be rather homogeneous, and thus such a difference must depend on other country-specific (e.g. tax-related) characteristics which are exogenous to the current analysis. Since this finding is important, as it greatly affects the possibility of retrieving synthetic, area-wide indicators of competition, we explicitly discuss the aggregation properties of our data in a specific part of Section 8 of the study, where we show the differences between the observed vs. the weighted PCM.

Examining the PCMs across industries, we find that in the services sectors there seems to be an excalating trend of an already relatively high PCM: in fact, with the exception of Poland, Germany and Belgium in the telecoms industry, all the countries display a persistent or growing average PCM. This tendency is particularly evident in the real estate sector, where the PCM displays a quite significant positive trend. The retail sector is instead characterised by a relatively lower average PCM (between 10% and 30%), smaller with respect to the levels of real estate and telecoms. Moreover, the margin remains almost constant in all the countries, with possibly some exceptions in Italy and, to a lesser extent, France.

In manufacturing industries, the average levels of PCM are lower than the ones in services, with a somewhat less marked tendency at the country level.

An interesting feature of the availability of firm-level PCM is that one can go beyond traditional analyses which look at the average evolution of PCM across industries (as the one described above for the NACE 2-digits level of aggregation), retrieving information from the entire distribution of firms over time. With this respect, we will present in what follows some descriptive statistics on the kernel-density estimated distributions of PCM for all the countries of the Pilot study. In the exercise we have aggregated firms within services and manufacturing, 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 Figure 2. Of course, the reader has to keep in mind that in the present study Manufacturing refers to three industries: NACE 15, 24 and 34, while Services refers to NACE 52, 642 and 70.

In order to track the evolution of PCM distributions over time, we compare the distribution in 2000 with the one in 2007. Also note that in the graphs we bound the PCM distribution between 0 and 1 to increase readability (i.e. avoiding reporting a long, flat left tail), while in the tables below we report percentiles for the entire distribution (i.e. including also negative values of the PCM). However, as it can be seen, negative values represent in general less than 5% of the cumulated density of the reported PCMs.

We use Figure 3, which presents the distribution of PCM for German 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 slightly to the left in time. The shape is consistent with theory: a mass of firms having lower-than-the-average margins, and few firms that, because of their efficiency (lower costs) or because of market power, can extract very high PCM (the potential drivers of this distribution will be explored in Section 4, in which we present the PCM decomposition). In a case like this, characterised by an asymmetric distribution, the median is much more informative than the mean as an indicator. Indeed, the mean value is more driven by extreme observations. This finding would be true, in general, for all 'average' competition indicators developed by the literature.

As for the dynamics, in Germany both average and median PCM decrease over time, and the distribution becomes more skewed to the right, signaling that the number of firms having a PCM lower than the mean of the industry has increased. The direction of the shift is again consistent with the prediction of economic models: due to a shock that changes the market conditions (more integrated markets, the EMU, etc.) incumbent firms have to face higher competition that forces them to lower the prices and leads to some exit. In addition new entrants, having to overcome entry barriers, will have a low PCM, which will contribute to the leftward shift of the distribution.

As expected the PCM in service industries is persistently higher (6 to 4 percentage points if we consider the median) and increasingly dispersed than the one of manufacturing industries[11]; nonetheless, the median PCM decreases more in the services sector (8% vs. 3% of manufacturing) thus hinting at a possible convergence in time.

Instead, a different trend is present in Italy, as shown in Figure 4. The distribution of PCM in the early years of the sample is very skewed to the right, as expected, and fairly concentrated around the median (indeed for both sectors 75% of PCMs are lower than 0.14). However, in both sectors the mean and median PCM increase over time, with the distributions becoming more dispersed.

A possible interpretation of this finding is that firms have reacted to the progressive openings of markets and the increased competition by increasing their product differentiation, thus choosing to target niche markets. The latter is consistent with evidence showing that from 2003 the average unit values of exported products have increased in Italy by more than 10%, a trend different from other European countries, showing a certain quality upgrading of Italian production[12]. In order to provide some preliminary evidence of this claim, in Section 8 we will discuss trade penetration as a stimulus indicator, regressing it against the evolution of the Italian vs. the German PCM.

The PCM distribution in services instead completely changes shape, becoming very irregular. Also the median is no longer a significant indicator, as there is small concentration of firms that actually have a PCM around that value. Instead, we can identify two groups of firms: one that has a lower PCM, more or less consistent with the one of the previous period; and another one for which the PCM increased considerably. In this respect, it is interesting to notice that the value of the 75% percentiles changed moving from a value of the PCM of 0.14 to a much higher value of 0.74; consistently, the kurtosis – a measure of the "peakness" of a distribution – dramatically decreases. Such a dramatic shift in the PCM distribution may be due (especially as far as the right tail is concerned) to a compositional effect: the sample we consider evolves in time and the AMADEUS database progressively includes firms of smaller size after 2002. If this entry is concentrated into new niche products in services, such a composition might explain the higher PCM, since small firms, being unable to spread fixed costs on a large number of products, have higher average costs and might need to charge higher prices to profitably operate in the market. The evidence we have reported in Figure 2 on the increase of the PCM in the real estate

[11] It is well known that services in Europe are much less integrated within the single market, due to technical barriers (non-tradability) or lack of regulation (the EU services directive is supposed to entry into force by the end of 2009).

[12] Altomonte and Barattieri (2007) show how this product upgrading is consistent with an increase in the PCM, and seems to be driven by import competition of low-cost countries.

industry (NACE 70) in Italy is consistent with the above findings.

The development of the PCM distribution in Romania, reported in Figure 5, somewhat mirrors the one in Italy. The PCM initial distributions are very skewed to the right and concentrated around the median. As for Italy, PCM values and their dispersion are increasing over time, although in Romania the dynamics of the two industries seem similar. In the manufacturing industry the average PCM increases by 49% while the median value by 46%; the distribution remains skewed but, in the second period, the right tail weights more if compared to the period 1998-2002. In particular the values for the 3rd quartile shift from .51 to .82 indicating that there is a mass of firms with a very high PCM (between .8 and .9) in the second period. Similar features can be observed for services. The different transition dynamics experienced by Romania across the two periods might be behind this trend.

Finally, it is interesting to notice how the PCM distribution for Poland, shown in Figure 6, evolves over time in the two considered industries. As a caveat, we have however to be aware that the distribution of firms across sizes in Poland is very different from the other countries, as AMADEUS reports data on very few small Polish firms (see Section 4 for a discussion of the extent of the bias).

The PCM in manufacturing, starting from a distribution similar to those of all the other countries, follows the prediction of economic models: after the competition shock which may have occurred following the entry of Poland into the EU, the average and median PCM decrease, due to selection and entry effects, with the curve shifting to the left and an increase in the skewness of the distribution. The services industry is, in the first period, characterised by a very dispersed, non-single-peaked distribution, possibly an heritage of the planned economy system, in which services were under represented in terms of overall distribution of economic activities. In the second period the shape becomes more regular, as expected, and, as in the manufacturing case, the distribution shifts to the left (lower values of mean and median).

Finally, comparing the levels of PCMs across the two groups of industries, we can see that in Poland, like in Germany, there is a wide and persistent gap between values of median PCM in services and in manufacturing. The difference between the two industries is instead somewhat less evident for Romania and Italy in the first period, while it becomes relevant in the second.

All the other countries display PCM dynamics, reported in the following Figures, which are intermediate situations of the cases discussed above.

Figure 2: PCM evolution across countries, industries and years

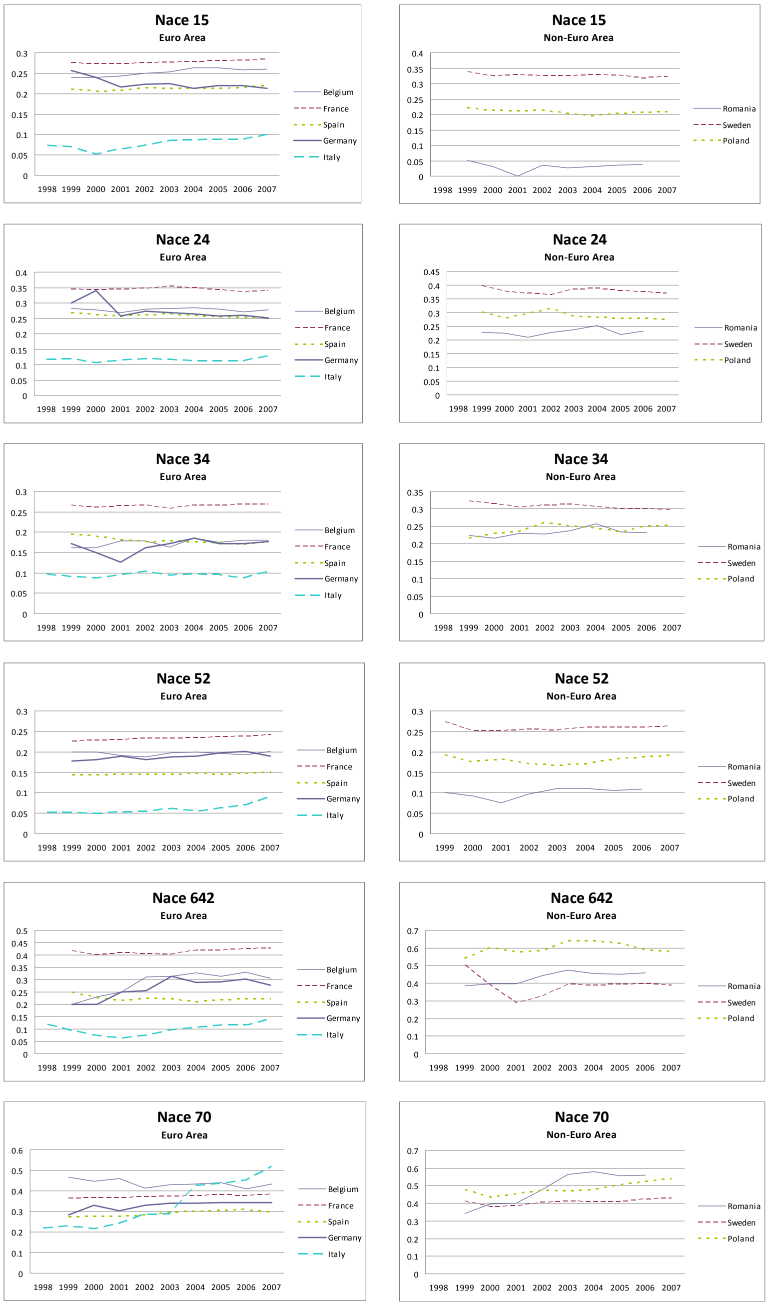
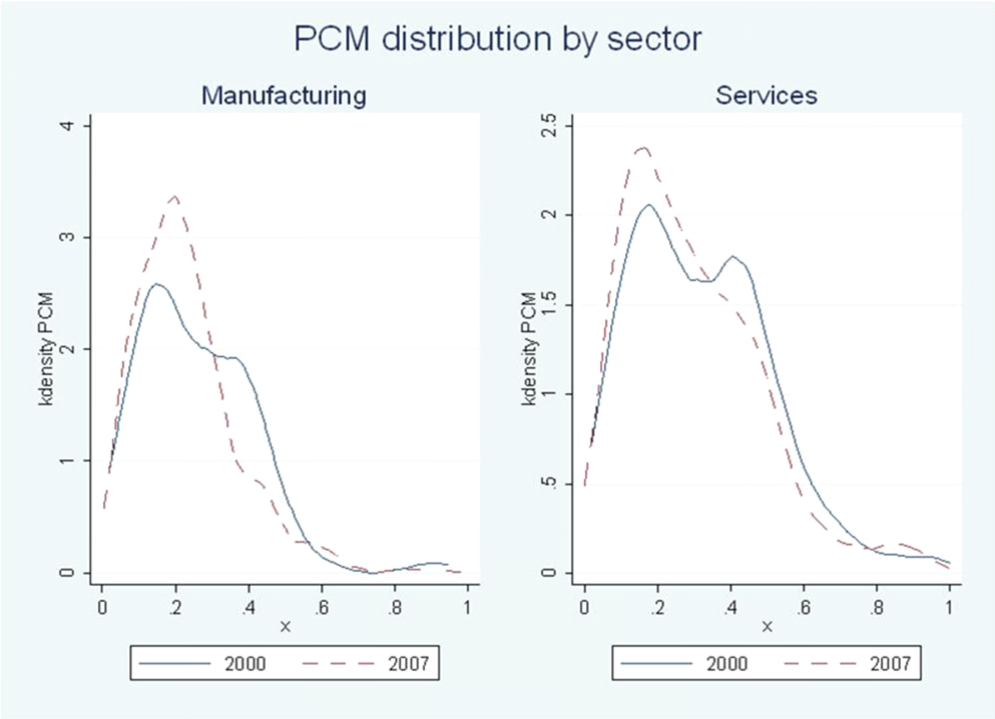


Figure 3: Distribution of observed PCM in 2000 and 2007, Germany



MANUFACTURING year 2000

Percentiles	Values	Obs	132
1%	-0.0074485	Mean	0.253625
5%	0.0490473	Std. Dev.	0.16241
10%	0.0829493		
25%	0.1314051	Skewness	0.957022
50%	0.2239821	Kurtosis	5.623038
75%	0.3626482		
90%	0.4388337		
95%	0.49372		
99%	0.8682458		

SERVICES year 2000

Percentiles	Values	Obs.	437
1%	-0.42378	Mean	0.2865724
5%	-0.046	Std. Dev.	0.2363558
10%	0.049361		
25%	0.143523	Skewness	-0.503013
50%	0.272408	Kurtosis	5.781028
75%	0.437138		
90%	0.54411		
95%	0.654582		
99%	0.898957		

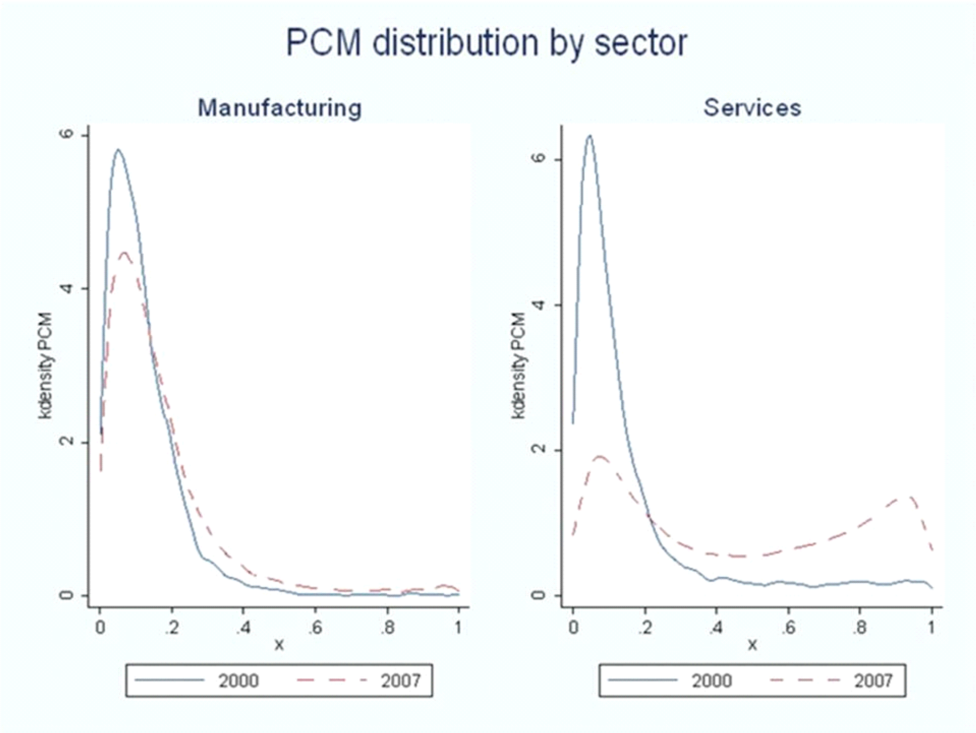
MANUFACTURING year 2007

Percentiles	Values	Obs.	1002
1%	-0.0331258	Mean	0.221199
5%	0.0343851	Std. Dev.	0.152005
10%	0.0632375		
25%	0.1235423	Skewness	0.384044
50%	0.2025208	Kurtosis	7.396804
75%	0.2935924		
90%	0.4214664		
95%	0.4896597		
99%	0.661194		

SERVICES year 2007

Percentiles	Values	Obs	2454
1%	-0.50609	Mean	0.2684253
5%	8.27E-05	Std. Dev.	0.2297717
10%	0.054562		
25%	0.132975	Skewness	-0.499289
50%	0.247481	Kurtosis	7.005443
75%	0.404127		
90%	0.526821		
95%	0.633945		
99%	0.884503		

Figure 4: Distribution of observed PCM in 2000 and 2007, Italy



MANUFACTURING year 2000

Percentiles	Values		Obs.	6718
1%	-0.46319		Mean	0.0717461
5%	-0.15027		Std. Dev.	0.1539216
10%	-0.05964			
25%	0.017833		Skewness	-0.6435872
50%	0.071617		Kurtosis	12.00485
75%	0.138392			
90%	0.215584			
95%	0.27776			
99%	0.478005			

SERVICES year 2000

Percentiles	Values		Obs	12366
1%	-0.6564731		Mean	0.096431
5%	-0.2082861		Std. Dev.	0.246226
10%	-0.0753897			
25%	0.0105838		Skewness	0.725044
50%	0.0620383		Kurtosis	7.617482
75%	0.1402351			
90%	0.3321353			
95%	0.6391893			
99%	0.9369825			

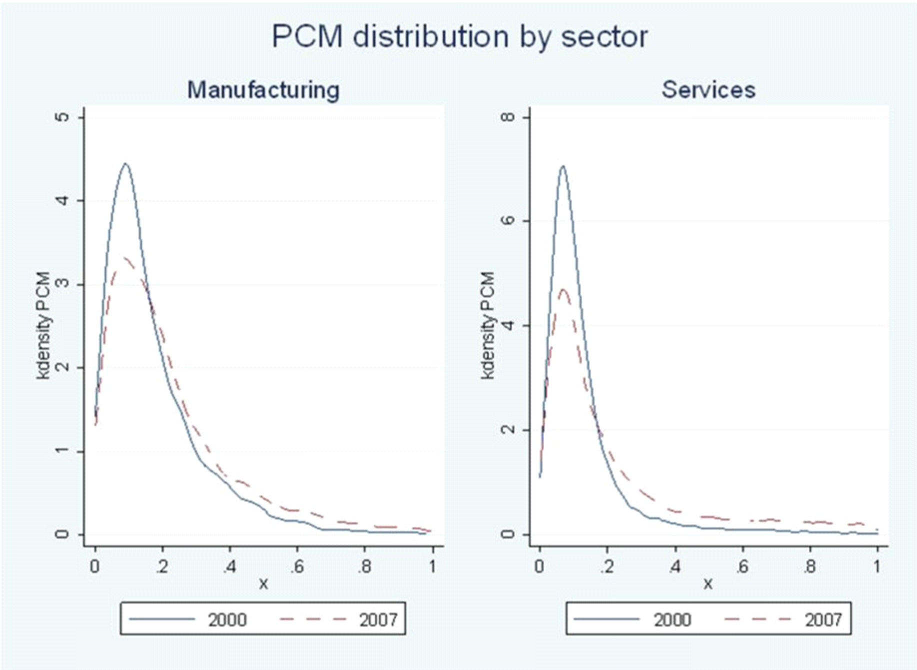
MANUFACTURING year 2007

Percentiles	Values		Obs.	14590
1%	-0.60439		Mean	0.1079035
5%	-0.20304		Std. Dev.	0.2171202
10%	-0.07445			
25%	0.025829		Skewness	0.1003857
50%	0.095617		Kurtosis	8.441032
75%	0.185723			
90%	0.312326			
95%	0.445167			
99%	0.890351			

SERVICES year 2007

Percentiles	Values		Obs	112861
1%	-0.7736329		Mean	0.35209
5%	-0.2947		Std. Dev.	0.414301
10%	-0.0913126			
25%	0.0613322		Skewness	-0.25863
50%	0.2779415		Kurtosis	2.6237
75%	0.7456186			
90%	0.9121914			
95%	0.953106			
99%	0.9894844			

Figure 5: Distribution of observed PCM in 2000 and 2007, Romania



MANUFACTURING year 2000

Percentiles	Values		Obs	5972
1%	-0.7758		Mean	0.0556427
5%	-0.44176		Std. Dev.	0.2539371
10%	-0.26027			
25%	-0.02454		Skewness	-0.8053671
50%	0.083126		Kurtosis	5.464359
75%	0.179635			
90%	0.319728			
95%	0.423647			
99%	0.649378			

SERVICES year 2000

Percentiles	Values		Obs	48049
1%	-0.2975364		Mean	0.105728
5%	-0.0719985		Std. Dev.	0.159665
10%	-0.0080598			
25%	0.0425655		Skewness	1.203354
50%	0.0835232		Kurtosis	11.95008
75%	0.1410503			
90%	0.2431597			
95%	0.3781348			
99%	0.7554264			

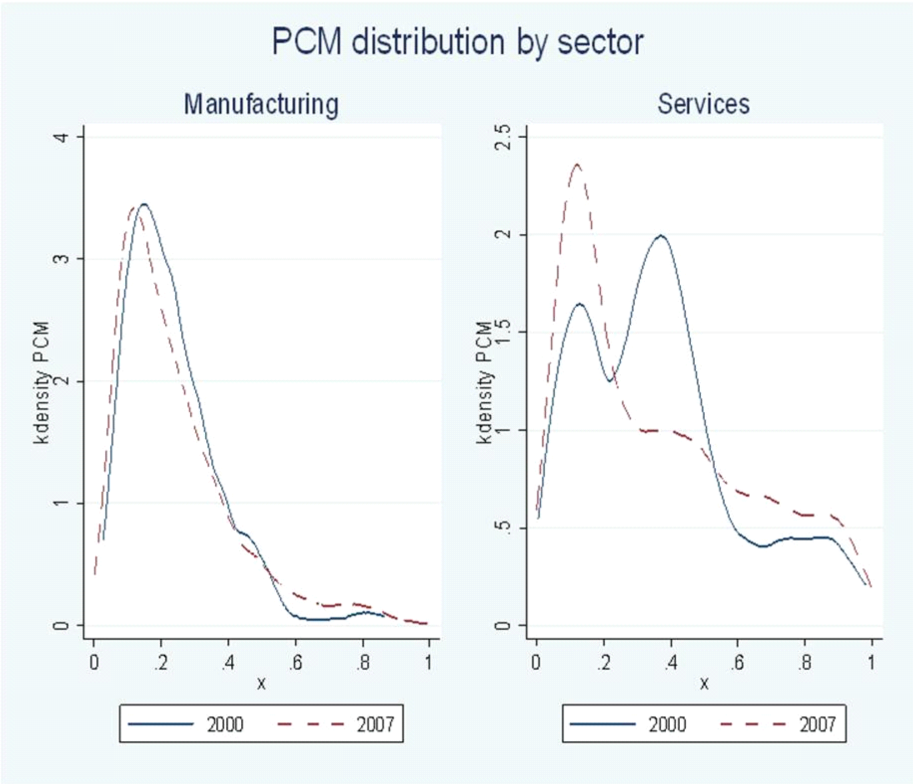
MANUFACTURING year 2006

Percentiles	Values		Obs.	8687
1%	-0.85768		Mean	0.0622083
5%	-0.54607		Std. Dev.	0.3097272
10%	-0.34381			
25%	-0.05967		Skewness	-0.5285264
50%	0.092234		Kurtosis	4.348039
75%	0.220416			
90%	0.401606			
95%	0.542827			
99%	0.823224			

SERVICES year 2006

Percentiles	Values		Obs	82309
1%	-0.5920809		Mean	0.152811
5%	-0.1947253		Std. Dev.	0.266712
10%	-0.0644597			
25%	0.0351063		Skewness	0.512665
50%	0.1002572		Kurtosis	5.511083
75%	0.2297019			
90%	0.5201556			
95%	0.7319581			
99%	0.9393607			

Figure 6: Distribution of observed PCM in 2000 and 2007, Poland



MANUFACTURING year 2000

Percentiles	Values	Obs.	497
1%	-0.048395	Mean	0.229407
5%	0.061460	Std. Dev.	0.146825
10%	0.084759		
25%	0.128248	Skewness	1.055933
50%	0.201511	Kurtosis	6.026418
75%	0.299168		
90%	0.421518		
95%	0.491385		
99%	0.813747		

SERVICES year 2000

Percentiles	Values	Obs	991
1%	-0.099526	Mean	0.360524
5%	0.070967	Std. Dev.	0.247006
10%	0.089363		
25%	0.158292	Skewness	0.369132
50%	0.342733	Kurtosis	3.768219
75%	0.472126		
90%	0.746622		
95%	0.860773		
99%	0.955506		

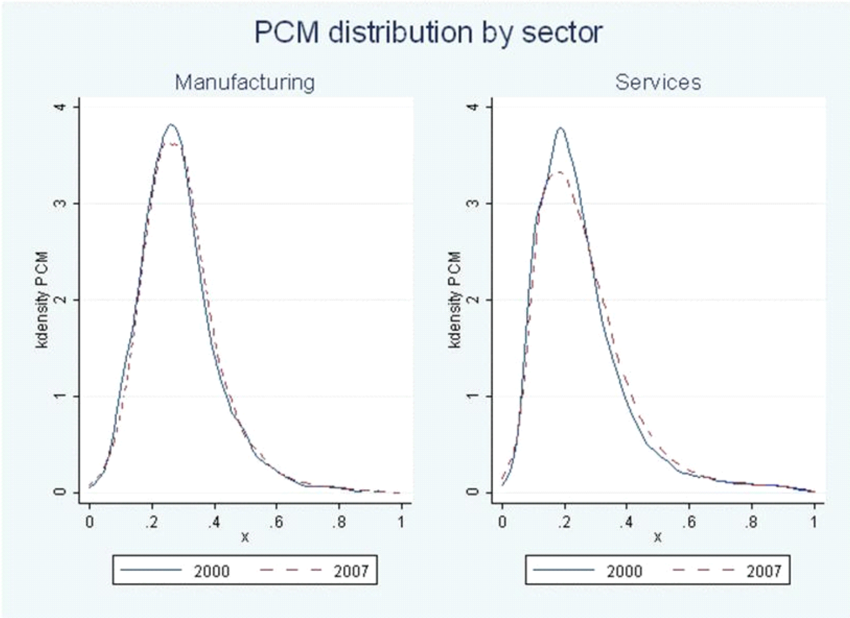
MANUFACTURING year 2007

Percentiles	Values	Obs.	2324
1%	-0.171206	Mean	0.228360
5%	0.038802	Std. Dev.	0.193632
10%	0.064776		
25%	0.108323	Skewness	0.306500
50%	0.189125	Kurtosis	8.076533
75%	0.311207		
90%	0.470127		
95%	0.604607		
99%	0.830163		

SERVICES year 2007

Percentiles	Values	Obs	4727
1%	-0.197616	Mean	0.353325
5%	0.045972	Std. Dev.	0.285371
10%	0.071164		
25%	0.122674	Skewness	0.324638
50%	0.286056	Kurtosis	2.975296
75%	0.554712		
90%	0.799627		
95%	0.887705		
99%	0.964940		

Figure 7: Distribution of observed PCM in 2000 and 2007, France



MANUFACTURING year 2000

Percentiles	Values			
			Obs	12585
1%	0.014307		Mean	0.281793
5%	0.10556		Std.Dev	0.134108
10%	0.139692			
25%	0.20066		Skewness	0.127672
50%	0.269972		Kurtosis	9.120202
75%	0.346535			
90%	0.444444			
95%	0.512885			
99%	0.684211			

SERVICES year 2000

Percentiles	Values			
			Obs	63592
1%	-0.01131		Mean	0.246032
5%	0.076251		Std.Dev	0.156884
10%	0.0993			
25%	0.149343		Skewness	0.887745
50%	0.217982		Kurtosis	8.454266
75%	0.308424			
90%	0.429003			
95%	0.5375			
99%	0.808511			

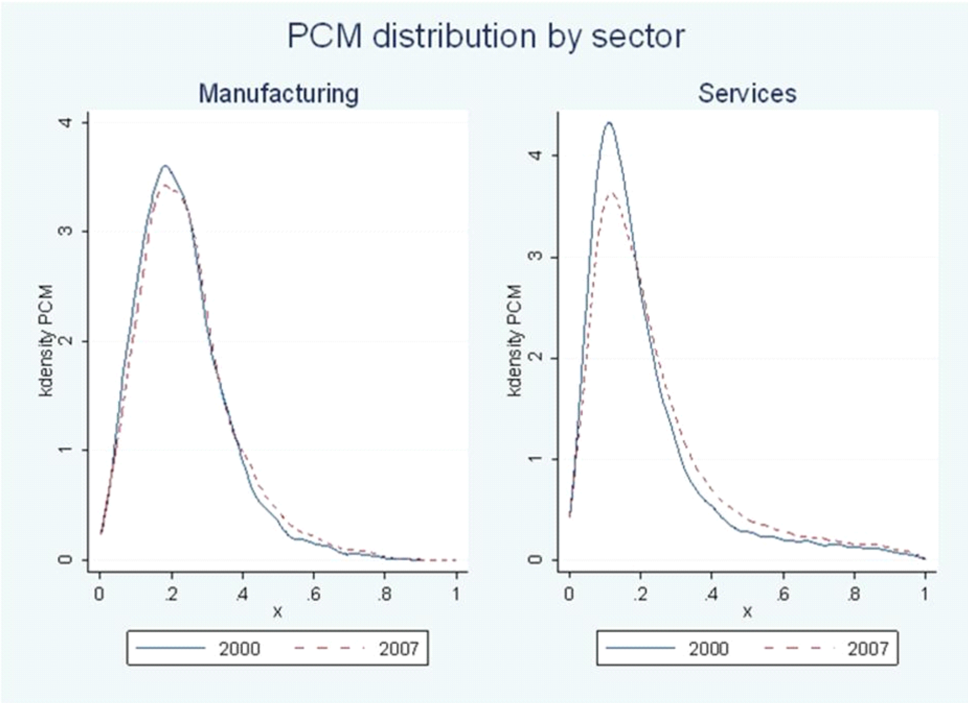
MANUFACTURING year 2007

Percentiles	Values			
			Obs	19850
1%	-0.02165		Mean	0.288106
5%	0.10707		Std.Dev	0.139063
10%	0.146058			
25%	0.206349		Skewness	-0.01982
50%	0.277637		Kurtosis	9.214381
75%	0.356164			
90%	0.45098			
95%	0.525952			
99%	0.701493			

SERVICES year 2007

Percentiles	Values			
			Obs	105822
1%	-0.125		Mean	0.253121
5%	0.066838		Std.Dev	0.169027
10%	0.098162			
25%	0.15		Skewness	0.430099
50%	0.227642		Kurtosis	8.042428
75%	0.329114			
90%	0.452381			
95%	0.556818			
99%	0.821429			

Figure 8: Distribution of observed PCM in 2000 and 2007, Spain



MANUFACTURING year 2000

Percentiles	Values		Obs.	10546
1%	-0.244986		Mean	0.216535
5%	0.037020		Std. Dev.	0.151409
10%	0.072035			
25%	0.132586		Skewness	-0.502713
50%	0.206574		Kurtosis	9.498458
75%	0.290639			
90%	0.389310			
95%	0.466574			
99%	0.643920			

SERVICES year 2000

Percentiles	Values		Obs	40861
1%	-0.450645		Mean	0.181682
5%	-0.030194		Std. Dev.	0.204928
10%	0.035790			
25%	0.085534		Skewness	0.248750
50%	0.148819		Kurtosis	8.310606
75%	0.244616			
90%	0.408859			
95%	0.586083			
99%	0.852999			

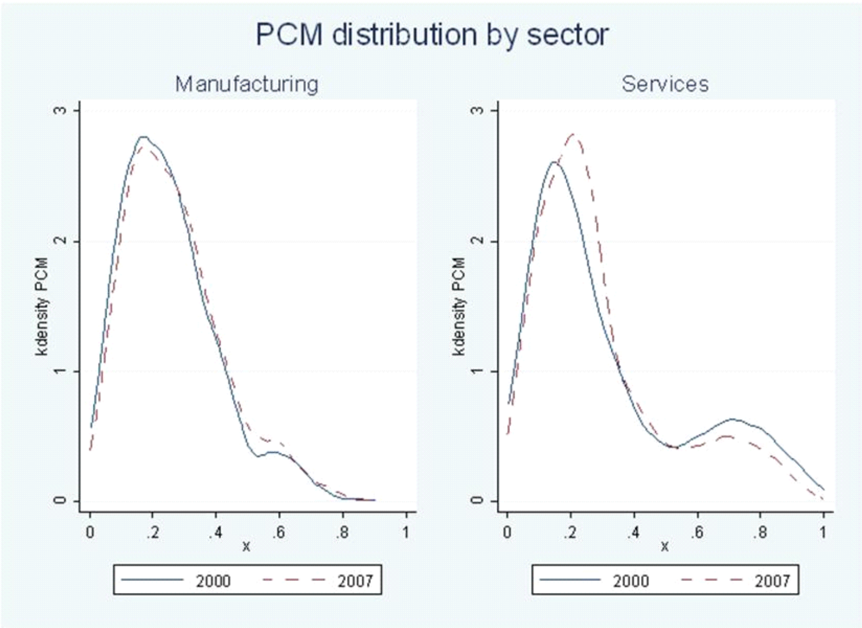
MANUFACTURING year 2007

Percentiles	Values		Obs.	14277
1%	-0.363501		Mean	0.223898
5%	0.020440		Std. Dev.	0.171032
10%	0.070695			
25%	0.137923		Skewness	-0.743967
50%	0.215409		Kurtosis	9.539041
75%	0.303709			
90%	0.418989			
95%	0.503810			
99%	0.685613			

SERVICES year 2007

Percentiles	Values		Obs	80345
1%	-0.609646		Mean	0.194587
5%	-0.122089		Std. Dev.	0.237397
10%	0.014989			
25%	0.088913		Skewness	-0.176781
50%	0.167088		Kurtosis	6.873538
75%	0.283983			
90%	0.476846			
95%	0.643749			
99%	0.879042			

Figure 9: Distribution of observed PCM in 2000 and 2007, Belgium



MANUFACTURING year 2000

Percentiles	Values		Obs	735
1%	-0.055		Mean	0.245982
5%	0.041808		Std.Dev	0.160441
10%	0.069403			
25%	0.133607		Skewness	0.583019
50%	0.223008		Kurtosis	4.290336
75%	0.328831			
90%	0.447336			
95%	0.571705			
99%	0.691901			

SERVICES year 2000

Percentiles	Values		Obs	734
1%	-0.42049		Mean	0.283742
5%	-0.04203		Std.Dev	0.28064
10%	0.045711			
25%	0.118014		Skewness	0.300026
50%	0.206094		Kurtosis	3.80237
75%	0.409824			
90%	0.736722			
95%	0.823865			
99%	0.90973			

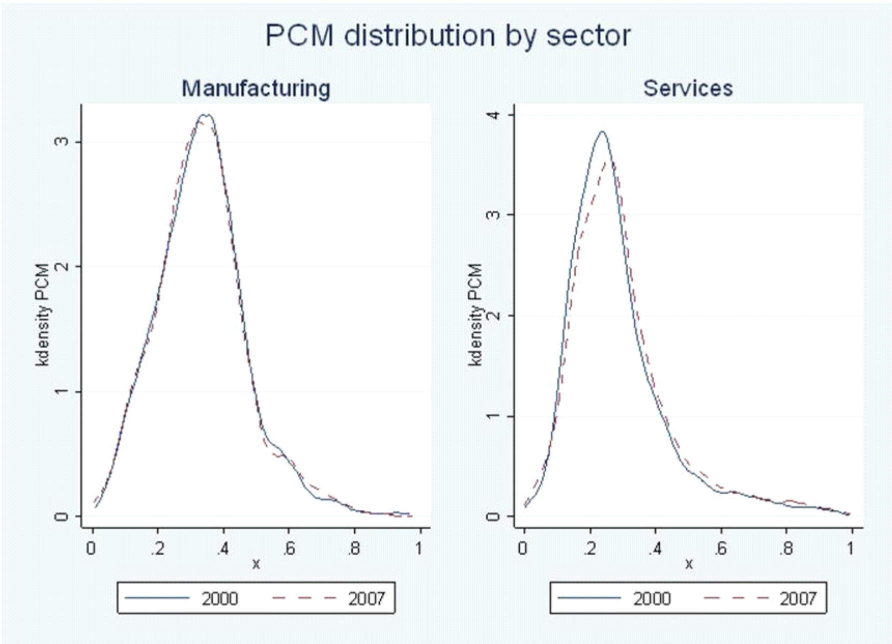
MANUFACTURING year 2007

Percentiles	Values		Obs	839
1%	-0.04573		Mean	0.258705
5%	0.042254		Std.Dev	0.173013
10%	0.083789			
25%	0.14573		Skewness	-0.05993
50%	0.238298		Kurtosis	6.550797
75%	0.350273			
90%	0.477828			
95%	0.582782			
99%	0.718211			

SERVICES year 2007

Percentiles	Values		Obs	990
1%	-0.50491		Mean	0.266984
5%	-0.005		Std.Dev	0.25372
10%	0.056938			
25%	0.12733		Skewness	0.024853
50%	0.22849		Kurtosis	5.369669
75%	0.362858			
90%	0.661885			
95%	0.773565			
99%	0.887446			

Figure 10: Distribution of observed PCM in 2000 and 2007, Sweden



MANUFACTURING year 2000

Percentiles	Values		Obs	1386
1%	0.031202		Mean	0.3310212
5%	0.112568		Std. Dev.	0.1459276
10%	0.150583			
25%	0.240859		Skewness	0.1827992
50%	0.330432		Kurtosis	5.83104
75%	0.408135			
90%	0.495497			
95%	0.586184			
99%	0.745705			

SERVICES year 2000

Percentiles	Values		Obs	11059
1%	-0.1037832		Mean	0.274784
5%	0.0890694		Std. Dev.	0.168503
10%	0.1244191			
25%	0.1806506		Skewness	0.540728
50%	0.2493462		Kurtosis	8.168343
75%	0.3366942			
90%	0.4679542			
95%	0.6090226			
99%	0.8434442			

MANUFACTURING year 2007

Percentiles	Values		Obs.	1912
1%	-0.09574		Mean	0.3249186
5%	0.100605		Std. Dev.	0.1577185
10%	0.144187			
25%	0.238066		Skewness	-0.4377398
50%	0.325565		Kurtosis	7.782753
75%	0.406541			
90%	0.499277			
95%	0.593835			
99%	0.741632			

SERVICES year 2007

Percentiles	Values		Obs	16187
1%	-0.1428571		Mean	0.285881
5%	0.0772472		Std. Dev.	0.180546
10%	0.123947			
25%	0.1860098		Skewness	0.310252
50%	0.2627283		Kurtosis	8.01337
75%	0.3543184			
90%	0.4983256			
95%	0.6367432			
99%	0.8689655			

4 Estimated vs. observed PCM

4.1 The Roeger (1995) methodology

In order to validate the measure of PCM computed using balance sheet data, which has been presented in the previous section, we adopt the following methodology, which is the same introduced by Roeger (1995), who built on the work of Hall (1988). These authors start from a standard production function:

$$Q_{it} = A_{it} \cdot F(N_{it,} M_{it,} K_{it}) \tag{1}$$

where Q_{it} is the output of firm i at time t, $N_{it,}M_{it}$ and K_{it} are respectively the labour, material and capital inputs and A_{it} is the firm's productivity.

Starting from an expression for the marginal cost in presence of technical progress analogous to the specification used by Hall (1988), it is possible to express the output growth rate as follows:

$$\frac{dQ_{it}}{Q_{it}} = \frac{P_n N_{it}}{c_{it} Q_{it}} \frac{dN_{it}}{N_{it}} + \frac{P_k K_{it}}{c_{it} Q_{it}} \frac{dK_{it}}{K_{it}} + \frac{P_m M_{it}}{c_{it} Q_{it}} \frac{dM_{it}}{M_{it}} + g_{it} \tag{2}$$

where g_{it} is the productivity growth, c_{it} is the marginal cost and P_J (with $J = N, M, K$) is the unit cost of input factor J. The weights, hence, are the shares of each input in total costs.

Since under constant return to scale (CRS) the cost shares sum to one, it is possible to rewrite equation (2) as:

$$\frac{dQ_{it}}{Q_{it}} - \frac{dK_{it}}{K_{it}} = \frac{P_n N_{it}}{c_{it} Q_{it}} \left(\frac{dN_{it}}{N_{it}} - \frac{dK_{it}}{K_{it}} \right) + \frac{P_m M_{it}}{c_{it} Q_{it}} \left(\frac{dM_{it}}{M_{it}} - \frac{dK_{it}}{K_{it}} \right) + g_{it} \tag{3}$$

If now we introduce imperfect competition, with a mark-up over marginal cost defined as $\mu_{it} = \frac{P_{it}}{c_{it}}$, equation (3) may be written as:

$$\frac{dQ_{it}}{Q_{it}} - \frac{dK_{it}}{K_{it}} = \mu_{it} \left[\alpha_{Nit} \left(\frac{dN_{it}}{N_{it}} - \frac{dK_{it}}{K_{it}} \right) + \alpha_{Mit} \left(\frac{dM_{it}}{M_{it}} - \frac{dK_{it}}{K_{it}} \right) \right] + g_{it} \tag{4}$$

where now the α are shares in the value of production. If we now divide both sides by $\mu_{it} = \frac{1}{1-\beta_{it}}$ and rearrange, we get:

$$\frac{dQ_{it}}{Q_{it}} - \alpha_{Nit} \frac{dN_{it}}{N_{it}} - \alpha_{Mit} \frac{dM_{it}}{M_{it}} - (1 - \alpha_{Nit} - \alpha_{Mit}) \frac{dK_{it}}{K_{it}} = \beta_{it} \left(\frac{dQ_{it}}{Q_{it}} - \frac{dK_{it}}{K_{it}} \right) + (1 - \beta_{it}) g_{it} \tag{5}$$

with the expression now written in terms of $\beta_{it} = \frac{P_{it} - c_{it}}{P_{it}}$, the Lerner Index or price-cost margin

(PCM) of firm i at time t[13].

The left hand side of Equation (5) is the Solow residual expressed in real variables, now decomposed, on the right hand side, into two terms: a pure technology component g_{it} and a mark-up factor (1$-\beta_{it}$). The problem in estimating equations (3) or (5) as in Levinsohn (1993) is that unobserved productivity shocks g_{it} may be correlated with the input factors.

The latter is the traditional critique to the Hall's (1998) approach for estimating mark-ups, which is difficult to overcome since instrumental variables are hard to find at the firm-level. However, the potential endogeneity of the error term can be overcome following Roeger (1995), who is able to decompose the price-based (or dual) Solow residual according to the following expression, comparable to equation (5):

$$\alpha_{Nit}\frac{dP_{Nit}}{P_{Nit}}+\alpha_{Mit}\frac{dP_{Mit}}{P_{Mit}}+(1-\alpha_{Nit}-\alpha_{Mit})\frac{dP_{Kit}}{P_{Kit}}-\frac{dP_{it}}{P_{it}}=-\beta_{it}\left(\frac{dP_{it}}{P_{it}}-\frac{dP_{Kit}}{P_{Kit}}\right)+(1-\beta_{it})g_{it} \quad (6)$$

where P_J (with $J = N, M, K$) is again the unit cost of input factor J and the αs are the shares in value of production. Subtracting eq. (6) from eq. (5), one ends up with:

$$\left(\frac{dQ_{it}}{Q_{it}}+\frac{dP_{it}}{P_{it}}\right)-\alpha_{Nit}\left(\frac{dN_{it}}{N_{it}}+\frac{dP_{Nit}}{P_{Nit}}\right)-\alpha_{Mit}\left(\frac{dM_{it}}{M_{it}}+\frac{dP_{Mit}}{P_{Mit}}\right)-$$

$$-(1-\alpha_{Nit}-\alpha_{Mit})\left(\frac{dK_{it}}{K_{it}}+\frac{dP_{Kit}}{P_{Kit}}\right)=\beta_{it}\left[\left(\frac{dQ_{it}}{Q_{it}}+\frac{dP_{it}}{P_{it}}\right)-\left(\frac{dK_{it}}{K_{it}}+\frac{dP_{Kit}}{P_{Kit}}\right)\right] \quad (7)$$

Again, on the left hand side of Equation (7) one finds the Solow residual, this time expressed as a function of the nominal, rather than real or dual (price) variables. On the right hand side the Solow residual is now decomposed in two variables, that is the Lerner Index multiplied by the variable cost component (the difference between the revenues and the cost of capital) of the firm.

Note how in Equation (7) the unobserved productivity shock g_{it} is canceled out and therefore the simultaneity bias previously discussed disappears. The Lerner index can thus be estimated consistently. Moreover, Equation (7) implies that estimating the price-cost margin requires information about the growth rates of production value, wage bill, material costs and the value

[13] In the remaining of the study we will use indifferently the terms markup and price-cost margin, although, we will be referring to the latter.

of capital. Since no deflation is required, also the omitted price variable bias is not a source of trouble[14].

Note that, following Konings et al. (2005), we may label the LHS of eq. (7) as DY and the RHS as DX, thus obtaining a very synthetic notation for the equation adopted for the estimation of the price-cost margins:

$$DY_{it} = \beta_{it} DX_{it} + \epsilon_{it} \tag{8}$$

4.2 Literature review and main critical issues

A first relevant issue in the measurement of mark-ups via the Roeger's method is linked to productivity: since the productivity shock is now excluded from the estimation, dynamic efficiency, i.e. efficiency gains due to innovation, are particularly hard to disentangle from the retrieved PCM estimates. In other words, firms experiencing a positive shock in productivity, e.g. because of product innovation leading to higher quality or process innovation leading to lower costs, will show-up in the data with a higher price-cost margin affecting the industry-average.

It would be therefore necessary to validate the retrieved PCM with alternative indicators which could provide information on the sources of the margin, i.e. whether it derives from higher prices or lower costs.

A way to handle this problem has been suggested by Klette (1999). He estimates a production function in logarithmic deviations from the representative firm, which is the median firm within industry for each year:

$$\hat{q}_{it} = \hat{a}_{it} + \sum_{j \in M} \bar{\alpha}^j_{it} \hat{x}^j_{it}$$

where a lower case letter with a hat is the logarithmic deviation from the point of reference of the corresponding upper case variable (e.g. $\hat{q}_{it} \equiv \ln(Q_{it}) - \ln(Q_t)$), where Q_t is the level of output for the representative firm at time t. By changing reference point from year to year, he is allowing for unrestricted technical change, and additionally is avoiding the problem of obtaining proper deflators. He is assuming that a firm's productivity relative to the reference firm $\hat{a}_{it}$ can be decomposed into a fixed effect a_i and a random error term u_{it}: $\hat{a}_{it} = a_i + u_{it}$.

By treating a_i as a fixed effect he is allowing cross-sectional differences in productivity

[14] Tybout (2003) points out that, lacking specific information on firms' prices, which is common, it could be the case that firms that rapidly increase their inputs tend to drive down their output prices more rapidly than the industry averages, yielding a downward bias in the estimated markups. Klette and Griliches (1996) have been the first to discuss a similar omitted price variable bias in production functions estimation. De Loecker (2007) discusses the problem within semi-parametric estimations of TFP.

between firms to be correlated with the explanatory variables in the equation. Then, to eliminate fixed effects, he estimates the model in first differences. Notice however that this methodology, as Kettle recognizes, is not able to solve the problem of correlation between productivity differences u_{it} and the differences in firms' choices of factor inputs: "to the extent that a firm experiences *changes* in productivity over time relative to the average firm, a productivity shock might be correlated with changes in factor inputs to the extent that the shock is anticipated before the factor demands are determined."

More recently, De Loecker and Warzynski (2009) propose an alternative framework which fully takes into account the problem induced by firm's productivity. They suggest to enrich Hall (1988) specification by modelling unobserved 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 this estimation does not require the user cost of capital. Moreover, they show that this methodology can be adapted to take into account the selection process. However, their method requires the deflationing of nominal, balance sheet variables in order to retrieve the 'real' figures for output and input.

A second problem to be taken into account is the role of capital and, in particular, the proper measurement of the rental price of capital. Forsman et al. (1996) discuss this issue extensively. In general, the standard Roeger estimates do not introduce any bias if measurement errors in the levels of variables are sufficiently constant, which means that they disappear in differences. While this is generally the case with the measurement of capital stock, the situation is different when facing the measurement of rental *price* of capital, which is not directly observable. The customary way to measure it is through its definition: $((i_{it} - \pi_t) + \delta_{it}) * P_I$, where i_{it} is the nominal interest rate, π_t is the inflation rate, δ_{it} is the depreciation rate and P_I is the price of capital goods. This definition is subject to a number of shortcomings.

A long bond yield may be not a sufficient proxy to describe the nominal cost of capital for a single firm: indeed, firms' sources of finance are firm-specific, and agency costs create a wedge between nominal long rates and the true cost of capital. Secondly, Forsman et al. (1996) note that changes in corporate taxation, such as investment deductions, are almost impossible to capture in practice. Third, the correct deflator is not an aggregate price index, but the expected behaviour of the price of the particular capital good over the full life of the investment. Finally, they note that the rate of depreciation varies from one capital good to another, and changes in the composition of investments affect the true rate of depreciation.

Additionally, Boulhol (2005) shows that Roeger's overestimation of mark-ups cannot be attributed entirely to measurement errors, but a component is due to the technical nature attributed to the capital measure. Indeed, Roeger's equation is derived from a specification treating capital as a variable factor, but capital is often found to be truly fixed in the data. The methodology may thus overestimate mark-up levels to the extent that the returns to scale on the variable costs are decreasing. The suggested way to tackle this issue will be discussed in the next paragraphs.

A radical way to totally avoid the problems related to the measurement of capital is to follow Hall's, rather than Roeger's, approach, as the former does not require any computation of the rental price of capital. For example, Siotis (2003) adopts Hall's approach (1988, 1990), more precisely the extension suggested by Domowitz et al. (1998), thus neglecting the problem. He estimates the following specification:

$$\triangle q = \frac{p}{c}(s^L \triangle l + s^M \triangle m) + \vartheta$$

where $\triangle q = \log(\frac{Q}{K}) = \frac{\triangle Q}{Q} - \frac{\triangle K}{K}$, $\triangle l = \log(\frac{L}{K}) = \frac{\triangle L}{L} - \frac{\triangle K}{K}$ and $\triangle m = \log(\frac{M}{K}) = \frac{\triangle M}{M} - \frac{\triangle K}{K}$, s^L and s^M denote labour and materials shares, as usual, and ϑ is the rate of Hicks-neutral technological progress. By reordering the terms, Siotis obtains:

$$\triangle q - s^L \triangle l - s^M \triangle m = (1 - \delta)\vartheta + \delta \triangle q$$

where δ is the Lerner index, and corresponds to $\frac{p-c}{p} = 1 - \frac{1}{p/c}$. As Klette (1999), he estimates the model in first differences. Again, this allows him to clean from any firm-specific effect that may be related to productivity in levels.

Once again, the latter methodology implies the use of real, rather than nominal, variables, and thus the distortions induced in deflationing. To that extent, DeSouza (2009) shows, assuming monopolistic competition, that the use of an industry-specific price deflator leads to spurious mark-up estimates as price dispersion is not taken into account. Indeed, when firm-specific prices are not available, and we deflate using industry-specific deflators, we are actually estimating the following equation:

$$dr_{it} - dp_t = \beta \sum_j \alpha_{ijt} dx_{it}^j + dw_{it}$$

where dr_{it} is revenue growth, dp_t is the industry-specific price deflator, α_{ijt} are revenue share of input j, dx_{it}^j is the growth in input j and dw_{it} accounts for productivity growth. If there is not price dispersion ($dp_{it} = dp_t$), the dependent variable is a perfect measure of firm's output. Otherwise, we are introducing an unobserved term in the equation, which implies that the omitted variable bias is present. As a result, De Souza (2009) suggests an alternative specification that, departing from Hall (1988) and imposing more structure on the model, is able to properly control for unobserved price dispersion:

$$dr_{it} - dp_t = \sum_j \alpha_{ijt} dx_{it}^j + \frac{1}{\sigma}(dr_t - dp_t) + \frac{\sigma - 1}{\sigma} dw_{it}$$

where σ is the elasticity of substitution between any two varieties and $\frac{\sigma-1}{\sigma}$ is the inverse of the price-cost ratio. This methodology is perfectly suitable in order to estimate mark-ups within a given industry, but might be ill-suited to retrieve mark-ups across industries and countries, as for our goals, since the latter would strongly rely on our assumptions on the (exogenous) estimates of elasticity of substitution.

As already discussed, another problem related to the use of capital derives from the fact that capital may be both fixed and variable, while the information on the amount of the two different types of capital cannot be retrieved from the data. The share of fixed (or sunk) capital is firm-specific, and may vary systematically with the level of economic activity over time, as well as with respect to firm size. However, Roeger and Warzynski (2004) show that it is possible to estimate this share: using cost weights instead of revenue weights to obtain the primal and dual Solow residual, one avoids the bias inflicted by imperfect competition on the measurement of the rate of technical progress, as suggested by Hall (1990). However, the presence of fixed costs creates a measurement problem which is analogous to the presence of mark-ups for the measurement of Solow residuals when revenues are adopted as weights. The difference between primal and dual residual is roughly proportional to the size of the mark-up, when revenue weights are adopted, and to the share of fixed capital, when using cost weights. Therefore, the use of cost weights allows to retrieve the share of fixed capital, in the same fashion as the size of mark-up is retrieved from residuals obtained with revenue weights.

A third problem has been highlighted by several authors, namely the fact that Roeger's approach assumes constant returns to scale, while Hall's allows for the identification of both mark-up and returns to scale. Several solutions have been proposed in the literature.

Klette's (1999) specification allows him to jointly estimate PCMs and returns to scale. He notes that the output elasticities for factor j, $\bar{\alpha}_{it}^j$, evaluated at an internal point, are defined as $\bar{\alpha}_{it}^j = \mu_{it}\bar{s}_{it}^j$, where μ_{it} is the ratio between price and marginal cost, and $\bar{s}_{it}^j$ is the cost share of input j relative to total revenue. As various rigidities affect capital, it is dubious to assume that this definition holds for this input. Thus, he removes the hypothesis of constant returns to scale, defines the elasticity of scale in production as the sum of output elasticities for factors ($\bar{\eta}_{it} = \sum_{j \in M} \bar{\alpha}_{it}^{j}$), and obtains the output elasticity for capital as: $\bar{\alpha}_{it}^{K} = \bar{\eta}_{it} - \mu_{it} \sum_{j \neq K} \bar{s}_{it}^{j}$. Therefore, he takes the following equation and estimates it in first differences (to eliminate fixed effects):

$$\hat{q}_{it} = \hat{a}_{it} + \mu_{it} \sum_{j \neq K} \bar{s}_{it}^{j} (\hat{x}_{it}^{j} - \hat{x}_{it}^{K}) + \eta_{it} \hat{x}_{it}^{K}$$

In this way, he is able to obtain both an estimate of returns to scale, η_{it}, and of PCM, μ_{it}. Additionally, he notes that "It is likely that the price-cost margins and scale coefficients vary, perhaps substantially, within each of the industries analyzed. Consider a well known example from the US; concerns about market power in the software industry is focused on Microsoft rather than on the average software producer". The proposed solution is a random coefficient framework, which allows for differences in market power and scale economies across firms within each industry. Interestingly, he finds more variation in market power and scale economies within an average industry, as compared to variations between industries. A similar approach is used in the already discussed paper by De Loecker and Warzynski (2009).

Additionally note that a possible way to attenuate the bias due to non-constant returns to scale is to take into account size dispersion when computing PCM. In other words, an observed PCM may be computed as an industry- and year-specific weighted average, where the weights account for the presence of larger and smaller firms. In our analysis, we choose sales as weights.

Finally, a shortcoming of these models is that they assume perfect competition in labour markets. However, ignoring labour market imperfections may imply an underestimation of the estimated mark-up. Indeed, the part of the firm's rent captured by workers is omitted. Moreover, the hypothesis of perfect competition in labour markets is not realistic, especially in European countries.

The latter issue has been raised by Crépon, Desplatz and Mairesse (2007). They extend Hall (1988) model by assuming that wages and employment are jointly determined according to an efficient bargaining scheme between the firm and its workers. This boils down to an extension of the Hall's (1988) specification that includes a term for the bargaining power. Formally, Hall's estimating equation may be written as follows:

$$\Delta(q_{it} - k_{it}) = \mu_{it}(\alpha_{L,it}\Delta(l_{it} - k_{it}) + \alpha_{M,it}\Delta(m_{it} - k_{it})) + \lambda_{it}\Delta k_{it} + \Delta a_{it}$$

where the variables q_{it}, k_{it}, l_{it}, m_{it} and a_{it} are expressed in logarithms, and returns to scale are equal to $1 + \lambda_{it}$.

This expression may be written also as:

$$SR_{it} = \beta_{it} LER_{it} + \frac{\lambda_{it}}{\mu_{it}}\Delta k_{it} + (1 - \beta_{it})\Delta a_{it}$$

where $SR_{it} \equiv \Delta(q_{it} - k_{it}) - \alpha_{L,it}\Delta(l_{it} - k_{it}) - \alpha_{M,it}\Delta(m_{it} - k_{it})$, $LER_{it} \equiv \Delta(q_{it} - k_{it})$ and β_{it} is the Lerner index. The proposed extension modifies the model as follows:

$$SR_{it} = \beta_{it} LER_{it} + \frac{\lambda_{it}}{\mu_{it}}\Delta k_{it} + \frac{\Phi_{it}}{1 - \Phi_{it}} BAR_{it} + (1 - \beta_{it})\Delta a_{it}$$

where $BAR_{it} \equiv (\alpha_{L,it} - 1)\Delta(l_{it} - k_{it})$ and Φ is the union bargaining power, which is $0 \leq \Phi \leq 1$.

This extended approach has been tested by Crépon, Desplatz and Mairesse (2007) on 1026 manufacturing firms in France over the period 1986-1992, by Dobbelaere (2004) on the entire population of Belgian manufacturing firms over the period 1988-1995 and by Abraham, Konings and Vanormelingen (2009) on 6125 Belgian manufacturing firms over the period 1996-2004.

4.3 Variables definition and robustness checks

We now turn to the description of how variables have been constructed in order to implement the Roeger (1995) estimation of mark-ups, as well as the robustness checks we have implemented in order to attenuate some of the previously described shortcomings. As above, DY_{it} is defined as $\left(\frac{dQ_{it}}{Q_{it}} + \frac{dP_{it}}{P_{it}}\right) - \alpha_{Nit}\left(\frac{dN_{it}}{N_{it}} + \frac{dP_{Nit}}{P_{Nit}}\right) - \alpha_{Mit}\left(\frac{dM_{it}}{M_{it}} + \frac{dP_{Mit}}{P_{Mit}}\right) - (1 - \alpha_{Nit} - \alpha_{Mit})\left(\frac{dK_{it}}{K_{it}} + \frac{dP_{Kit}}{P_{Kit}}\right)$ where:

- $\left(\frac{dQ_{it}}{Q_{it}} + \frac{dP_{it}}{P_{it}}\right)$ is constructed as $\frac{SALES_{it} - SALES_{it-1}}{SALES_{it-1}}$, where the variable $SALES_{it}$ is the level of sales expressed in nominal terms, which has been declared by each firm in its balance sheet;
- $\left(\frac{dN_{it}}{N_{it}} + \frac{dP_{Nit}}{P_{Nit}}\right)$ is defined as $\frac{WB_{it} - WB_{it-1}}{WB_{it-1}}$, where WB_{it} is the ratio of wage bill to the cost of employees sourced from balance sheets;
- $\left(\frac{dM_{it}}{M_{it}} + \frac{dP_{Mit}}{P_{Mit}}\right)$ is equal to $\frac{MAT_{it} - MAT_{it-1}}{MAT_{it-1}}$, where MAT_{it} is the official amount spent in the purchase of material inputs and services;

Balance sheet information on output, labour and materials are reported in nominal terms, thus corresponding to the product of quantity times price. As regards capital, we have already noticed that the definition of the rental price of capital is not straightforward and is debated in the literature. Being aware that the correct treatment of capital costs is crucial in estimating mark-ups (Boulhol, 2005) we propose three alternative definitions, which we have tested in our validation.

1) We define K_{it} as the sum of tangible and intangible fixed assets as reported in balance sheets. We define P_{Kit} as the $(r_t + \delta_{it}) * P_I$, where:

- r_t, real interest rate, is obtained as a difference between the long term interest rate (government bond yields, 10 year-maturity) and the inflation rate (all-items HICP) in a given year t, both sourced from Eurostat;

- δ_{it} is defined as $\frac{DEP_{it}}{K_{it-1}}$, where DEP_{it} is the amount of depreciation of tangible and intangible assets declared in balance sheets, which has been limited to the $(0, 1)$ interval. Thus, we retrieve a firm specific measure of depreciation;

- P_I is an investment good price index retrieved from the EU AMECO database.

This is our "baseline" specification.

2) We define K_{it} as the sum of tangible and intangible fixed assets as reported in balance sheets; we define P_{Kit} as the $(r_{it} + \delta_{it}) * P_I$, where:

- r_{it}, real interest rate, is obtained using balance sheet data and is defined as the firm-specific nominal interest rate, obtained as the ratio of the interest paid to total debt, minus the inflation rate (defined as above). Note that this definition entails a reduction in the number of observations, either because the information on the interest paid and/or the total debt is not available, or because the ratio may yield some implausible results (r_{it} has been limited to the $(0, 1)$ interval);

- δ_{it} is defined as above;

- P_I is defined as above.

3) We define K_{it} as the sum of tangible fixed assets as reported in balance sheets, thus neglecting intangible fixed assets. We define P_{Kit} as the $(r_{it} + \delta_{it}) * P_I$, where:

- r_t, real interest rate, is obtained as a difference between the long term interest rate (government bond yields, 10 year-maturity) and the inflation rate (all-items HICP) in a given year t, both sourced from Eurostat;

- δ_{it} is defined as $\frac{DEP_{it}}{K_{it-1}}$, where DEP_{it} is the amount of depreciation of tangible assets declared in balance sheets, which has been limited to the $(0, 1)$ interval. Thus, we retrieve a firm specific measure of depreciation;

- P_I is an investment good price index retrieved from the EU AMECO database.

Note that the distinction between tangible and intangible fixed assets is available for Italy only.

Finally, assuming perfect competition in both product and factor markets and constant returns to scale, we can replace the elasticities with factor shares. Therefore, α_{Nit} and α_{Mit} have been constructed as the ratio of the wage bill over sales and materials over sales, respectively. We are aware that is a potential source of problems, as described in previous section. Nonetheless, this is a straightforward implication of Roeger's approach, followed among others by Konings et al. (2005).

Moving to the RHS, we know that DX_{it} is defined as $\left(\frac{dQ_{it}}{Q_{it}} + \frac{dP_{it}}{P_{it}}\right) - \left(\frac{dK_{it}}{K_{it}} + \frac{dP_{Kit}}{P_{Kit}}\right)$, where the first term in the sum is defined as above, and the second term is constructed using the three alternative definitions involving the price of capital described above.

Before moving to the estimation, the samples of firms have been preliminary cleaned from implausible observations, in order to minimise measurement errors which, as we have seen, may affect the results. Specifically, we have removed all those observations for which any of the following variables was reported with a negative sign: total assets, sales, wage bill, number of employees and materials. Moreover, we have checked the values of the remaining variables of interest, replacing with a missing observation negative values reported for depreciation, interest paid and total debt. Finally, consistently with the assumptions of the theory, we have removed from our database those observations showing a negative observed PCM. Negative observed PCM constitute 18.7% of observations in the three manufacturing sectors, and 24.8% of observations in the service industries considered[15]. The latter allows us to reduce the variance of our estimated coefficients and retrieve significant PCM estimates which are ex-ante consistent with the theoretical setup from which our structural estimators are derived, although at the cost of missing potentially relevant mechanisms of market adjustment.

[15] This difference reflects the better quality of balance sheet data available for manufacturing sectors versus service sectors.

4.4 Results

4.4.1 Choice of DX and estimating technique

After having constructed our dependent and independent variables, we regress DX on DY using alternative econometric specifications.

First, we estimate equation (8) for each NACE 3-digit industry, using our three alternative definitions of the capital term and pooling together observations across years[16]. Since the distinction between tangible and intangible assets is available for Italy only, this is the only country for which we have run this type of exercise.

Table 5 reports the correlations between the estimated PCM obtained with the three alternative definitions of capital and price of capital. We can observe that our "baseline" definition is strongly correlated (0.8) with the second definition (the one adopting firm level interest rates). On the other hand, the third definition, which considers only tangible fixed assets and their depreciation, is poorly correlated with both other definitions (0.5 and 0.4 vs. 0.8). This highlights the role of intangible fixed assets, which we suspect is particularly relevant for services firms.

Table 5: Correlations between different estimated PCM measures - OLS

	definition 1	definition 2	definition 3
definition 1	1.00		
definition 2	0.81	1.00	
definition 3	0.50	0.41	1.00

All correlations are significant at 1% level

To this extent, Badinger (2007) applies the Roeger (1995) methodology on a sample of 10 European countries over the period 1981-1999 in order to investigate the effect of the Single Market Programme. The latter is the first study on the Single Market to include also service sectors. The author warns that when estimating mark-ups in service industries data and standard capital stock measures may be less reliable.[17] In his analysis, he uses industry level data from the STAN database by OECD. Nonetheless, when dealing with balance sheet data, the proxy generally used for capital is “tangible fixed assets”; although to the best of our knowledge no one has really arisen the issue, it might be however the case that the latter proxy could be inappropriate for services industries. Indeed, in these industries intangible fixed assets, such as

[16] Notice that, given our approach closely linked to Roeger (1995), we have to address the issue of the rental price of capital. As discussed in the literature review, other authors (e.g. Siotis, 2003) can avoid this problem by estimating a markup via a methodology closer to the original Hall (1998) approach, which on the other hand involves a proper estimation of the TFP term.

[17] See page 22 of this Study.

patents, could be extremely relevant.

To further explore this issue, we have thus re-run our specification separating the manufacturing industries from services. As it can be seen in Table 6, controlling or not for intangibles is clearly important for services: when applied to services industries, our third definition including only tangible assets correlates more poorly with the baseline (0.43 vs. 0.54) with respect to the case of manufacturing. On the contrary, our first two definitions are very much correlated in services (0.9).

Table 6: Correlations between different estimated PCM measures - manufacturing vs. services

Manufacturing

	definition 1	definition 2	definition 3
definition 1	1.00		
definition 2	0.55	1.00	
definition 3	0.54	0.34	1.00

All correlations are significant at 1% level

Services

	definition 1	definition 2	definition 3
definition 1	1.00		
definition 2	0.93	1.00	
definition 3	0.43	0.43	1.00

All correlations are significant at 1% level

The fact that the two measures report a different behaviour when the sample includes services is therefore a first general result of our analysis. Clearly, an implication of this result is that in the subsequent analysis on the countries included in the sample it may be worth estimating the PCM using only definition 1 and definition 2 of $\left(\frac{dK_{it}}{K_{it}} + \frac{dP_{Kit}}{P_{Kit}}\right)$, i.e. including intangibles. Moreover, the distinction between tangible and intangible fixed assets as well as their depreciation is in general not available in balance sheet data (e.g. it is available in the AIDA sub-database for Italy, but not in AMADEUS), and therefore the third definition might not be replicable in other countries. This is not a problematic issue, since we have shown that the inclusion of intangible fixed assets gives us a more complete picture of capital, and is especially relevant when considering services.

In terms of estimating technique, we have also addressed the time dimension of our data. First, we have estimated the same baseline equation with the inclusion of a set of time fixed effects, which however did not alter the overall correlation reported in Table 5. Then we have estimated our specification interacting the time dummies with our DX term, in order to retrieve yearly PCM measures. The results, reported in the Table 7, have yielded very similar measures of estimated PCMs.

Finally, since the use of first differences introduces a form of serial correlation of the error term, we have taken the latter into account, by means of a generalized method of moments (GMM) estimation technique. Following Siotis (2003), we adopt an Arellano Bond (1991) one-step estimation technique. Siotis (2003) presents results using three, four and five lags,

Table 7: Correlations between different estimated PCM measures - OLS and time dummies

	definition 1	definition 2	definition 3
definition 1	1.00		
definition 2	0.76	1.00	
definition 3	0.61	0.43	1.00

All correlations are significant at 1% level

nonetheless, given our shorter time period (10 year, from 1998 to 2007), we are forced to limit our analysis to a three lags specification. We observe that results are extremely sensitive to the number of lags included in the analysis. Additionally, we find that the correlation between the estimated PCM is highly sensitive to variables definition using this methodology, and generally much less robust, as shown in Table 8.

Table 8: Correlations between different estimated PCM measures - GMM

	definition 1	definition 2	definition 3
definition 1	1.00		
definition 2	0.43**	1.00	
definition 3	0.68***	0.09	1.00

*** significant at 1% level

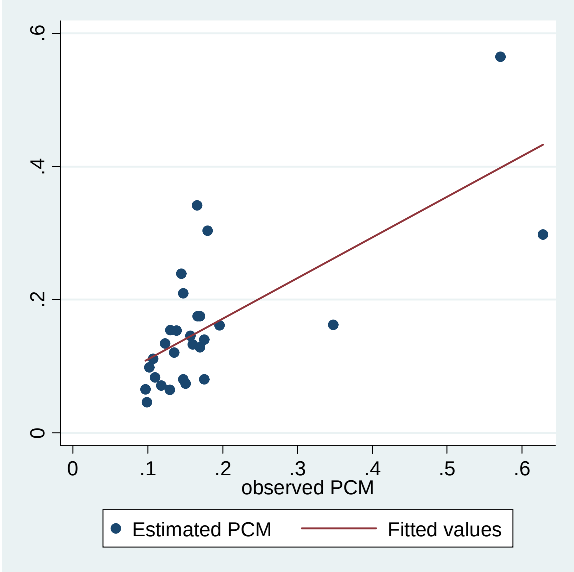
** significant at 5% level

Therefore, in the remaining of the analysis we have chosen to adopt an OLS specification, with controls for the time dimension of our data. We are aware that GMM would be a proper estimation technique, but the short time period (ten years) considered in the analysis, and the extremely high sensitivity of the estimates to the choice of the model specification do not allow significant PCM estimates to be obtained at the required level of disaggregation.

4.4.2 Estimated vs. observed PCM

Once having identified our baseline specification in terms of measurement of the rental price of capital (definition 1 and role of intangibles), and the appropriate estimating technique (OLS vs. GMM), in this section we show how and to what extent the estimated PCM fits the observed PCM using alternative specifications which control in different ways for the time dimension. For consistency with the results derived above, we keep on using the Italian data for this exercise. First, we estimate eq. (8) for each NACE 3-digit industry, over the whole sample of Italian firms in the industries included in the project, i.e. pooling all data across time (Figure 11). Then, we estimate the same equation, but this time splitting the sample into two periods: 1998-2002 and 2003-2007 (Figure 12).

Figure 11: NACE 3-digit estimated (v. axis) vs. observed PCM, pooled sample - Italy



Finally, in order to assess the evolution over time of the price cost margins, we interact the explanatory variable with time dummies. Thus, we are able to retrieve time-specific estimates for the PCM at NACE 3-digit level. In Figure 13 we thus plot the observed PCM and the estimated one (always using our baseline definition in terms of DX and OLS). The fit is generally good: the slope coefficient of the red line is 0.65, with a t statistic equal to 9.61. Overall, there are only few outliers, while for most industries there is a close correspondence between the estimated and the observed PCM.

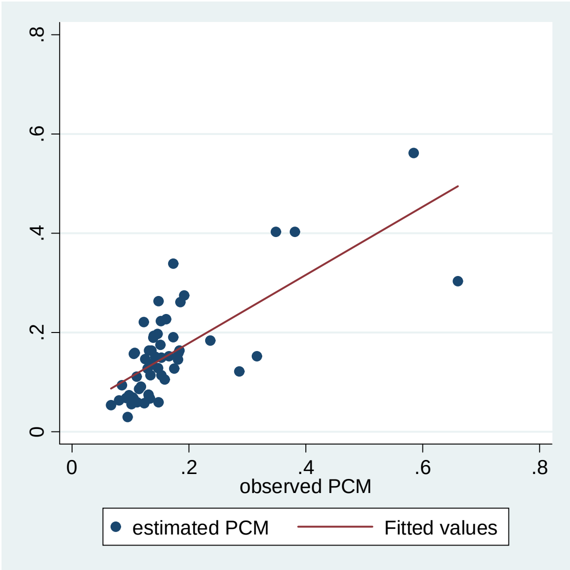
As a result, we choose this specification which controls for individual time dummies as our preferred one for the remaining of the analysis.

4.4.3 Italy vs. Germany

Once having chosen the baseline methodology (choice of DX, estimating technique, treatment of the time dimension), we are now able to further investigate these estimates by disentangling results for manufacturing industries versus services industries and by comparing the outcome across countries. To this extent, we report here the comparison between Germany and Italy, based on the whole sample of Italian and German firms belonging to the industries included in the project. First, we consider the relationship between the estimated vs. the observed PCM, as above.

A number of features already emerge from Figure 14. First of all, looking at the overall fit of the regressions it is clear that, especially for Germany, the Roeger methodology tends to

Figure 12: NACE 3-digit estimated (v. axis) vs. observed PCM, 1998-02 vs. 2003-07 samples - Italy



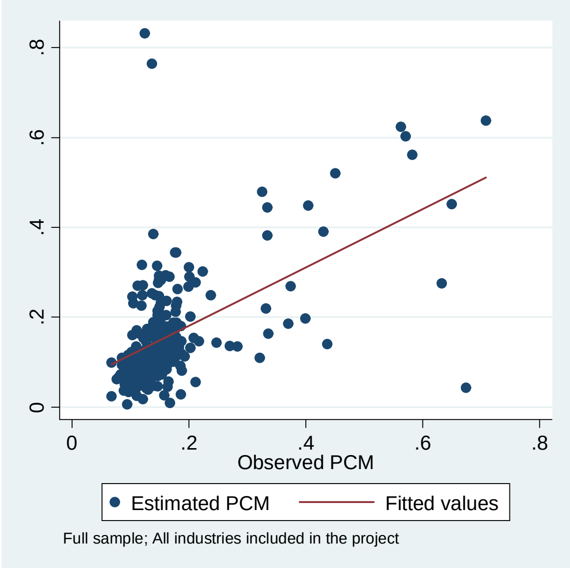
Estimated vs. Observed PCM: 1998-02 vs. 2003-07

generate an upper bias in some of the estimated mark-ups (estimated PCMs tend to be larger than the corresponding observed PCM), consistently with the results reported in the literature. On a more positive note, instead, the fit does not deteriorate when looking at services. Rather, at least for Italy, the estimated mark-ups track fairly well the observed ones in these industries.

We then focus on the relationship between the estimated PCM and the weighted PCM, where the market shares of each firm (based on sales) have been used as weights. The idea is to overcome the other critique associated to the Roeger methodology which imposes constant returns to scale. The intuition is as follows: larger firms might benefit from higher plant-level economies of scale, thus leading to lower total average costs; at the same time, in our measure of PCM, marginal costs are proxied by the average *variable* costs, not affected by economies of scale, as discussed in the previous section. As a result, in a oligopolistic market where firms have some market power (e.g. deriving from product differentiation), small firms might need to cover the higher average fixed costs induced by their smaller size by charging higher prices, thus resulting in a potentially higher PCM (given the way we measure them) with respect to large firms[18]. On the contrary, large firms might decide in equilibrium to exploit their scale economies in order to lower their prices (thus keeping the PCM constant), or possibly to gain

[18] For example, in a product-life cycle model, small firms entering the market with a new differentiated product might benefit from a higher market power.

Figure 13: NACE 3-digit estimated (v. axis) vs. observed PCM, year-specific sample - Italy



higher profits (in which case the PCM would also increase) if competition is not strong enough. The weighting of PCM would thus partially attenuate the potential upward bias induced by small firms operating in some market niches on the observed average price-cost margin.

And in fact, when comparing the observed vs. weighted PCM we can clearly see, for both Germany and Italy, and across industries, a tendency to lower averages for the weighted PCM (with few exceptions, weighted PCMs, on the vertical axis, tend to be smaller than the corresponding unweighted PCM, on the horizontal axis, or, in other words, the slope of the fitting line is smaller than 1), as reported in Figure 15.

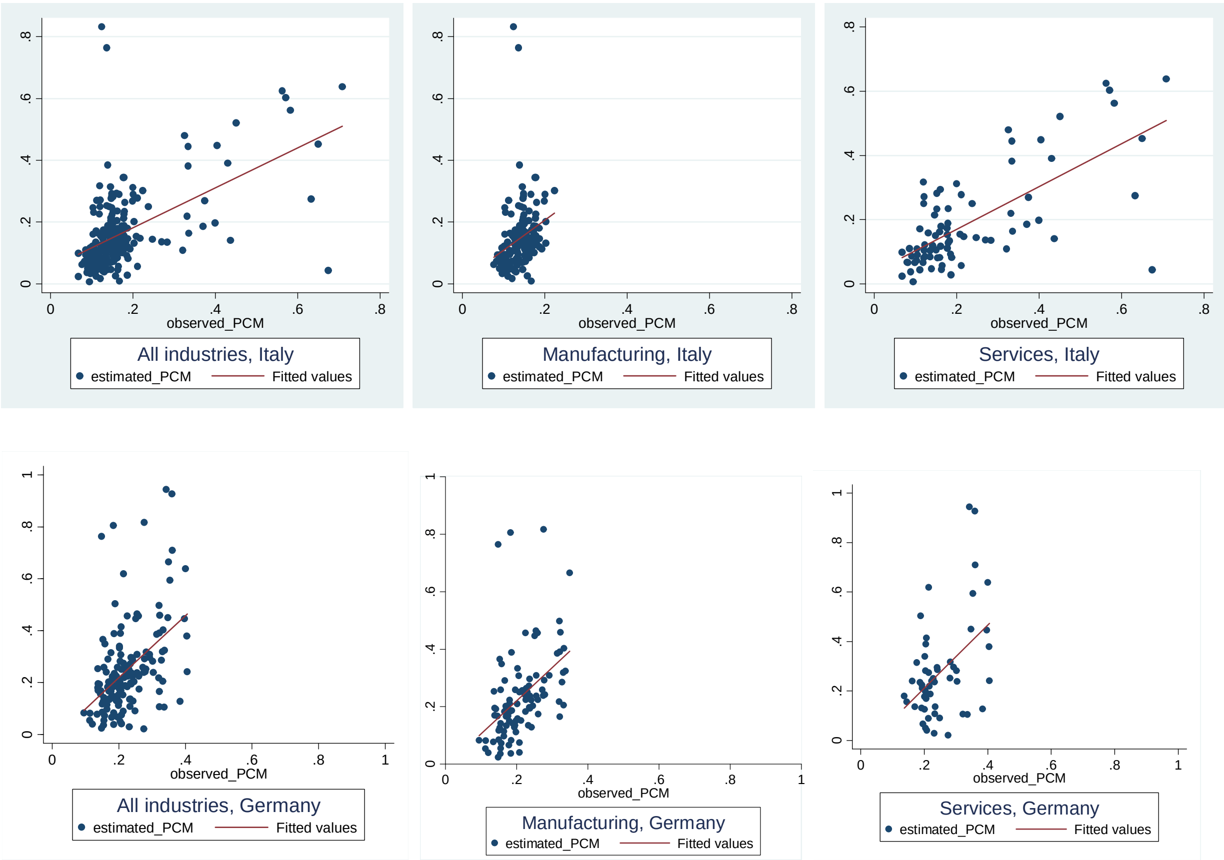
Finally, we show the relationship between the weighted observed PCM (on the horizontal axis) and the estimated one (on the vertical axis). Not surprisingly, since both measures entail a correction with respect to the observed unweighted PCM, but in different directions, the overall goodness of fit worsens significantly.

4.4.4 Robustness of results across different samples

As a final robustness check, we have performed an analysis of compositional effects, estimating the PCM over different samples.

A first check restricts the analysis to all those firms with more than 10 employees. In this way, we are neglecting small firms, which may induce a lot of noise in the estimates, while poorly contributing to the overall value added of the sector. Figure 17 shows that the correlation between observed PCM and estimated one. Focusing on Italy, we can compare this graph with

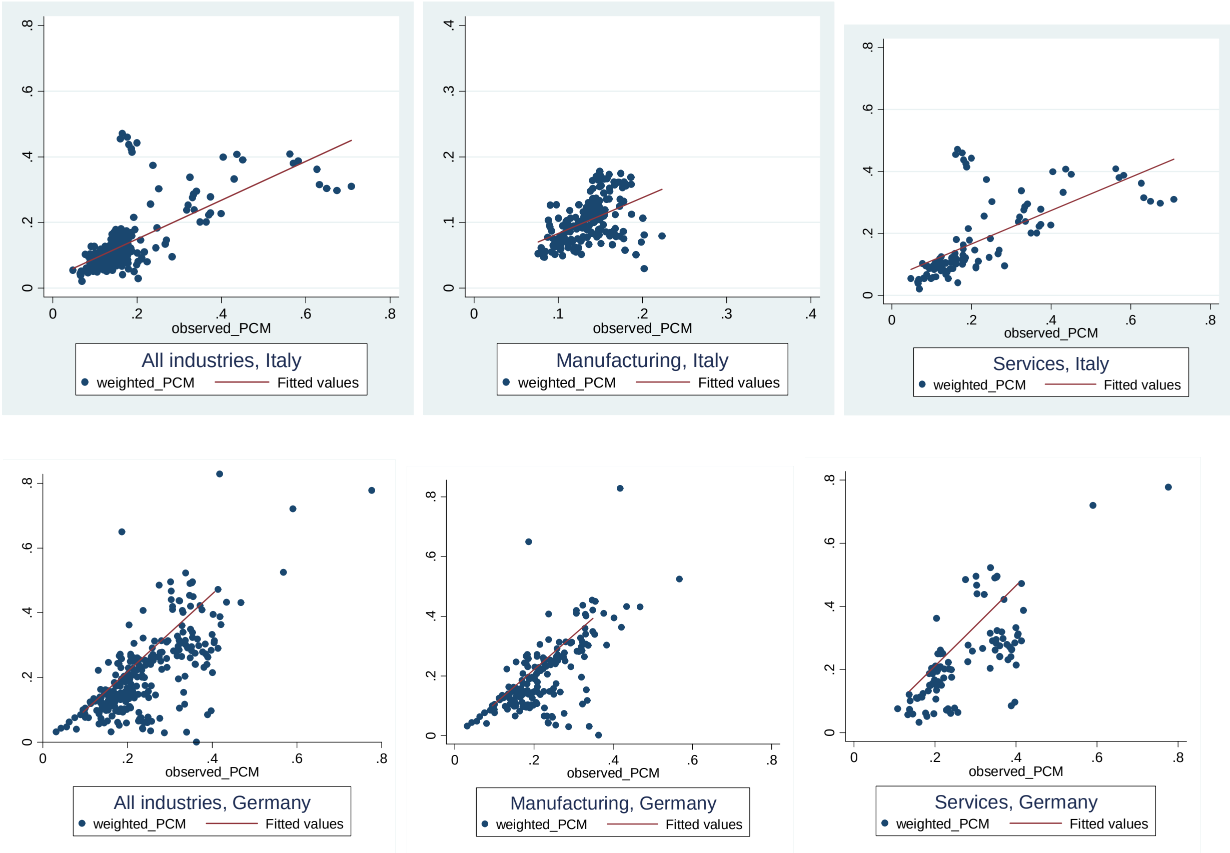
Figure 14: Estimated (v. axis) vs. observed (unweighted) PCM - Italy vs. Germany



the scatterplot obtained on the full sample. Two differences emerge: first, the overall fit improves as the slope coefficient is now 0.72 (t-stat=10.48); secondly, due to the reduction in the number of observations, the estimates may be more imprecise in those industries in which there were already few observations, thus leading to possible outliers, e.g. the estimated PCM close to 1 (the point estimate is 0.96) corresponds to NACE 703 for year 2006, and is obtained on a sample including 1711 observations. In the full sample, the estimated PCM for that industry in 2006 is 0.38, much closer to the value of 0.33 for the observed PCM. This estimate is computed on a sample of 3183 observations. Notice that similar dynamics are present when analysing the German sample. Evidently, in those industries in which small firms are abundant, this type of sample restriction may be detrimental, and thus once again we have a confirmation of the high sensitivity of the estimated PCM to the chosen level of disaggregation.

Finally, we repeat our exercise on a balanced sample, i.e. we exclude those firms that enter or exit the sample during the time period considered (see Section 5 for the description of the routine). Results are presented in Figure 18.

Figure 15: Weighted (v. axis) vs. (unweighted) observed PCM - Italy vs. Germany



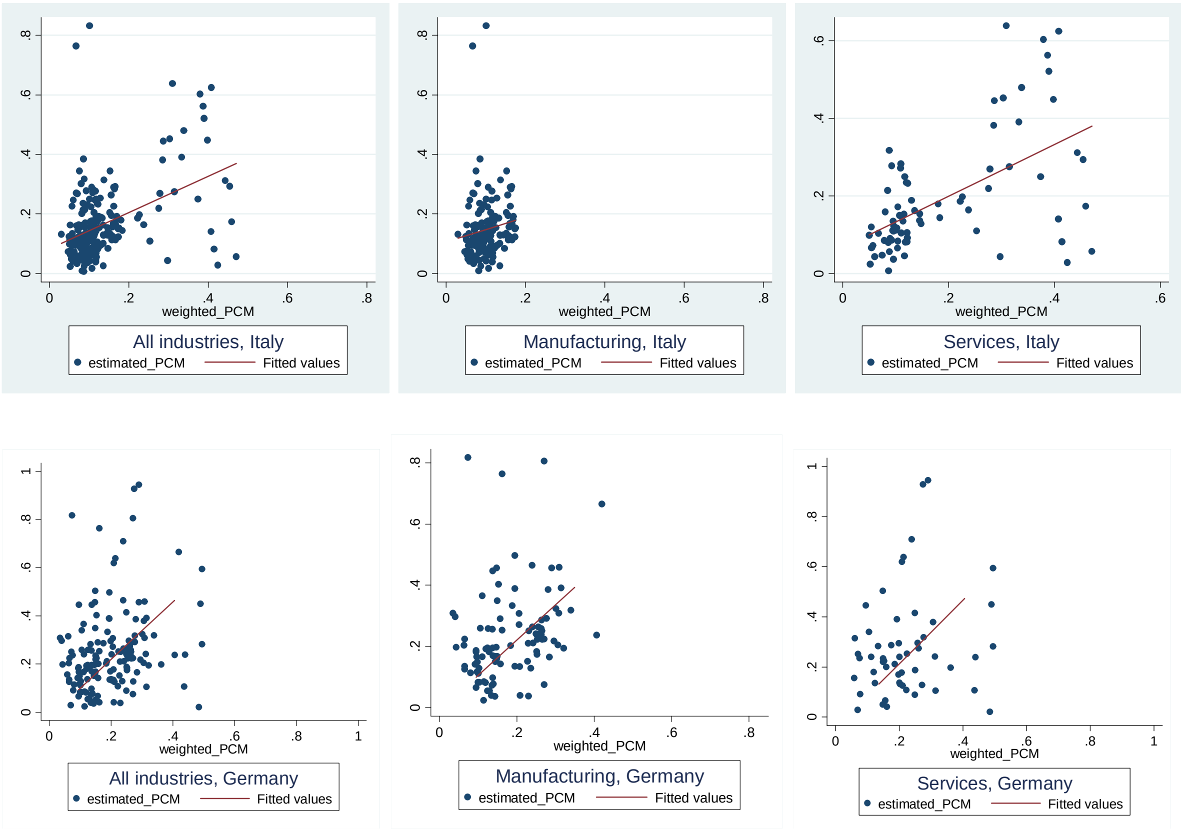
Again, the fit of the estimated PCM is rather good: the estimated slope for Italy is equal to 0.65 (t-statistic=8.79), while for Germany it is 1.13 (t=6.08). The two outliers on the top left part of the graph on Italy corresponds to NACE 155 in year 2003 and NACE 154 in year 2002. These results are obtained on 2193 and 521 observations respectively, while in the full sample the observations are 2740 and 724, with a drop in the number of observations equal to 20% and 28% respectively.

Thus, once again those industries which present more pronounced dynamics are subject to a larger drop in the number of observations, which negatively affects the preciseness of the estimates.

4.5 Conclusions

The Roeger methodology discussed in this section has been widely used, and refined, in the literature in order to retrieve consistent estimates of the price-cost margins. However, as for the Hall approach, both methods have been originally conceived for their use on industry-level

Figure 16: Estimated (v. axis) vs. weighted PCM - Italy vs. Germany

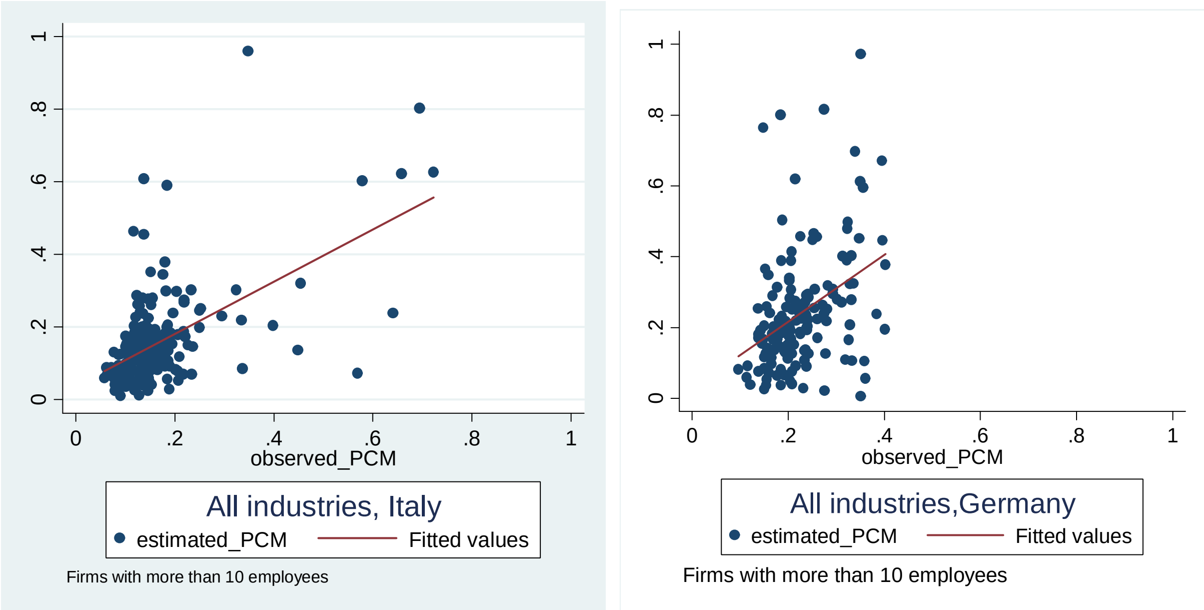


data, while the goal of this study is to specifically take into account firm-specific information. Moreover, the exercise undertaken here has to maintain comparability across industries and countries, thus introducing further constraints on the analysis.

All these issues have led us to start our analysis sticking to the original Roeger (1995) approach for retrieving mark-ups since, as the latter is based on nominal balance sheet information, it ensures immediate comparability across countries. Moving to the Hall's approach, and all the subsequent refinements of this methodology, would in fact imply the use of relatively aggregate industry and country-specific deflators which are likely to introduce a systematic error component in our cross–European comparisons. Moreover, the use of industry-level price deflators would also further exacerbate the problem of unobserved firm heterogeneity (as individual firms' prices are unobserved) which instead this Report tries to tackle as much as possible.

Clearly, as pointed out in this section, the Roeger (1995) approach suffers itself from a number of shortcomings, in particular related to the assumption of constant returns to scale, which we have evaluated by comparing observed, weighted and estimated PCMs across sectors (manufacturing and services) and countries (Italy and Germany). The analysis has revealed that an

Figure 17: Estimated (v. axis) vs. observed PCM, firms with more than 10 employees - Italy vs. Germany

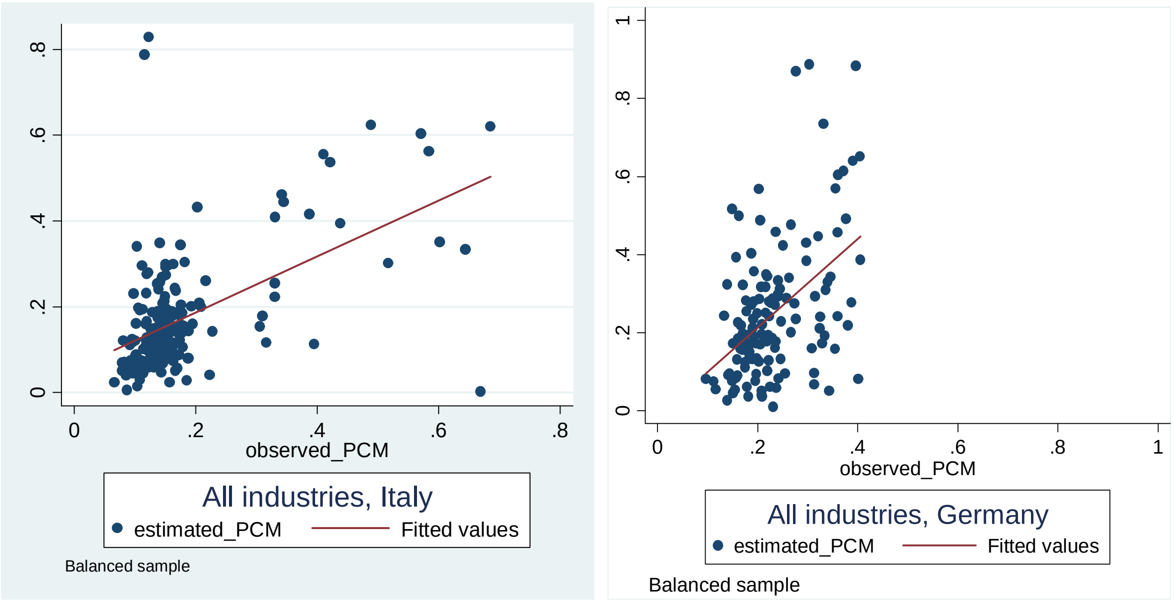


aggregation of observed firm-level PCMs vs. those estimated through the Roeger methodology, with appropriate corrections for the role of intangibles in order to take into account the case of services, tend to move along a similar direction in the countries and industries considered. It then follows that observed firm-level PCMs, when aggregated, do not convey a distorted message with respect to a theoretically sound econometric estimation structurally derived from first-order conditions (the Roeger method), which is reassuring.

However, being the Roeger methodology based on the assumption of constant returns to scale, it correlates less well with weighted (by size) PCM measures, which instead correct for economies of scale at the firm level, a feature we ideally want to consider in the analysis.

Moreover, the retrieved aggregate PCMs via the Roeger approach are very sensitive to the level of aggregation used: since the implicit assumption in Roeger is that the estimated PCMs are *common* to all the firms in a given sample, a detailed analysis of industrial dynamics clearly implies a progressively finer levels of disaggregation (e.g. by NACE 3-digit industry, country and year) in order to attenuate the firm-level unobserved heterogeneity bias implicit in common assumptions of mark-ups across industries. However, the finer the level of disaggregation (and thus the lower the unobserved heterogeneity bias), the lower the number of available observations and thus the higher the standard errors of the estimated coefficients. As a result, the researcher is faced with a trade-off between accuracy of the estimates and usefulness of the estimated

Figure 18: Estimated (v. axis) vs. observed PCM, balanced samples - Italy vs. Germany



values. According to our experience in this Pilot study, Roeger-(or Hall-) type of estimates are accurate at the NACE 2-digits level of disaggregation (incidentally, the latter is the level of disaggregation generally employed in the literature), but at this level the usefulness of the retrieved mark-ups is limited for the purposes of this study. Finally, a synthetic indicator of PCM as retrieved from the Roeger approach is such that dynamic efficiency, i.e. efficiency gains due to innovation, a particularly relevant feature in our analysis, can hardly be disentangled from the retrieved estimates, as the individual contribution of each firm to the aggregate PCM is hard to measure.

For all these reasons, in the follow-up of the analysis we have chosen to use as the main indicator of competitive pressures a *decomposition* of the (weighted) price-cost margin *changes* at the firm-level. As directly observed PCMs can be aggregate without particular distortions with respect to estimated ones, we believe the use of the former is more straightforward and does not imply computational intensive steps should the analysis need to be extended or repeated over time.

Most importantly, the aggregation from the bottom of firm-level mark-ups allows to actually use firm-level heterogeneity in order to extract information on the evolution of industrial dynamics as competitive pressures in the single market evolve. In particular, by decomposing the same PCM changes according to a number of specific features, as it will be clear in the next section, such an approach allows us to derive some conjectures also on changes in dynamic efficiency (i.e. quality improvements) undertaken by firms in the market.

5 PCM Decomposition

5.1 Methodology

After having discussed the validation of our directly observed PCM, in this Section we depart from the analysis of average PCMs measured at industry-level in order to exploit the potentialities of firm-level data. To this extent, we calculate the first difference of the (weighted) PCM and decompose the latter in five components, with the aim of catching three different possible responses to competitive pressures: the classical reduction of the PCM firms have to face in order to maintain the same level of demand through time; the shift of some firms towards production of goods with a higher content of value-added (niche markets or product differentiation); the effects deriving from the demography of firms entering and exiting the markets, resulting from the lowering of institutional and technological barriers.

To that extent, we calculate at the NACE 3-digit level a weighted change of the PCM as:

$$PCM_{t+1} - PCM_t = \sum_{i \in t+1} msi_{i\ t+1}\ pcm_{i\ t+1} - ms_{i\ t}\ pcm_{i\ t}$$

where I is a given NACE 3-digit industry, PCM_{it} is the price-cost margin of a given firm i and ms_{it} is its market share, at time t and $t+1$. The components of the weighted average are disentangled as follows, according to a Lespeyres decomposition[19]:

$$\begin{aligned} PCM_{t+1} - PCM_t \quad = \quad & \sum_{i \in I} \left[\overbrace{ms_{i\ t}(pcm_{i\ t+1} - pcm_{i\ t})}^{within\ effect} + \overbrace{pcm_{i\ t}(ms_{i\ t+1} - ms_{i\ t})}^{reallocation\ effect} \right] + \\ & \sum_{i \in I} \left[\overbrace{(pcm_{i\ t+1} - pcm_{i\ t})(ms_{i\ t+1} - ms_{i\ t})}^{interaction\ effect} \right] + \\ & \underbrace{\sum_{i \in I_{t+1} \setminus I} ms_{i\ t+1}\ pcm_{i\ t+1} - \sum_{i \in I_t \setminus I} ms_{i\ t}\ pcm_{i\ t}}_{entry-exit\ effect} \end{aligned}$$

We begin our analysis of the decomposition by considering the effects that involve incumbent firms, i.e. firms that we consider as operating in time t, for which the elements of the

[19] Note that the latter decomposition is also discussed by Boone et al. (2007) as the starting point of the indicator of competition, suggested by him, the Relative Profit Difference (RPD), which we will employ in the next section of the study.

decomposition take the following meaning:

- the *within effect* is the change attributable to the pricing behaviour of the incumbents given their market share: a negative sign would show a more aggressive pricing policy;
- the *reallocation effect* accounts for the redistribution of market shares among incumbents, holding the PCM constant;
- the *interaction effect* gives information about the underlying market dynamics: a negative sign would show that PCMs and market shares are moving in different directions, either because their activity is expanding thanks to a reduction in PCM or because their importance in the sector is decreasing after an increase in the PCM; a positive sign, instead, would indicate that shares and margins are moving in the same direction showing a non-standard effect due to competitive pressures;
- the *effects of entry and exit* are instead indicative of the market dynamics that follow after the removal of both technological and institutional barriers, fostering entry, and the exogenous shocks (e.g. the increased competitive pressures from China) that can oblige some firms to exit.

As already discussed in Section 2, an important limitation of the AMADEUS database is in its ability to record exit and entry, as 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 if they stay inactive for more than five years. In order to cope with these shortcomings, we will 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 two years before that given year. We consider indeed that there can be a lag from the legal incorporation of a firm to the beginning of its economic activities. That firm will be considered as an incumbent from the year following the entry year, even if there are missing values for some years in the analysis, because in that case we assume the missing values are due to lack of coverage of the database.

On the other hand, a firm will be considered as exiting from the same market when it is considered inactive in the last available year of our database (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. Here as well we assume that there can be a lag from the end of the legal entity and the effective presence on the market (a firm could be considered as legally active also if not operating any more in the market). Note that, since our data start in 1999, the latter implies that there will be no exit data recorded before 2001.

A first implementation of this routine, without the correction for the date of incorporation, has been made by Altomonte and Colantone (2008), who analyse firm-level data for Romanian firms, where the demography of the firm-level sample has been confronted with official data of the Romanian statistics office, revealing that the method was a good proxy for what happened in census data. The inclusion of the date of incorporation, an improvement of the routine adopted in Altomonte and Colantone (2008), would allow us to clean entry data especially for firms located in countries with poorer quality of the sample coverage. Actually, Romanian balance sheet data can be considered strongly representative in terms of number of firms, while in other countries, after controlling for any selection bias due to size or other characteristics of the firms observed, we may have less observational units in the sample.

One important problem of this routine is the treatment of balance sheet data of exiting firms: often, firms displaying negative PCMs, as costs exceed sales, end up in exiting from the database. However in the decomposition algorithm this implies that the contribution of exiting firms would enter the routine with a positive sign. Although we have very few cases of these firms (less than 1% of our sample), sometimes the effect might be large enough to change the sign of the overall exit component, from negative to positive. In what follows, we have decided not to clean our data from these firms, to avoid introducing a selection bias in our sample, leaving the problem up for discussion in the cases in which it should eventually become relevant.

Another potential issue with this routine is that if the firm changes legal entity from one year to the other (i.e. name of the firm or form of incorporation) it will be considered as an entry even if the economic activity has never stopped or if that firm was already on the market but was not obliged before to present balance sheets because of national regulations. A qualitative check, even using the previous identity codes contained in Bureau van Djik, can help in solving this problem, whose magnitude has to be assessed.

As a result, due to these methodological issues, in this Pilot study entry and exit data related to the decomposition have to be interpreted with some caution[20].

5.2 PCM decomposition across countries

We present here the results for three countries that in our opinion can be considered as prototype of their group: France as model for countries belonging tho the EMU, Sweden as a representative

[20] Incidentally, notice that the RPD measure introduced in the next Section is not affected by this problem.

of EU countries that do not have the single currency and Poland as an example of new EU country that should have completed a process of transition towards a market economy before entering the Single Market[21]. In terms of timing, we have calculated the decomposition year by year in order to catch the industry dynamics and control for the competitive pressures deriving from the introduction of the euro as a single currency in 2002 and the entry of China into WTO in 2001. As 2007 is the last year in the sample we do not observe exit for this year. We report in what follows the PCM decomposition for the years 2000 and 2006, since PCM changes for 2007 might be slightly upward biased.[22]

5.2.1 EMU Countries - France

We can see that the selected manufacturing industries (NACE 15, NACE 24 and NACE 34) show different dynamics in competition in the two different subperiods once looking at 3-digit level of disaggregation, as reported in Tables 9 and 10. For example, in the first period there is a certain tendency to increase in margins, while this trend is reverted when we consider the year 2006. The trend is evident for the services sectors which seem to suffer from lack of competitive pressures, which in turn leads to increased PCMs, consistently with the PCM distribution graphs previously analysed.

Overall, the main contributors to a downward pressures of PCM in 2000 are the within- and the reallocation effects, indicating that, on average, margins are decreasing and market shares of firms with higher margins are reducing. It is interesting to note that the interaction effect in both periods shows non-standard results as a response to competitive pressures, since it tends to remain positive for a certain number of industries. The latter implies that PCMs and market shares are moving in the same direction, indicating that either there are some firms that are able to gain market power after moving towards the production of goods with a higher content of value added (a higher PCM that implies a higher market share) or rather some firms are not able to detain market power even after lowering their prices (lower PCM and lower market share).

Also, we see that the entry effect displays (as it should) a positive sign, whose magnitude tends to be sizeable with respect to the other terms of the decomposition especially for the real

[21] Poland has become part of the European Union in the first wave of accession in May 2004.

[22] The tables for all the countries and years covered by the Pilot database are reported in the Statistical Annex of the Report, together with the decompositions at the NACE 2-digits level, in order to develop initial indicators which are consistent with the level of aggregation of the Market Monitoring exercise. Results are available upon request.

estate industry (NACE 70). As previously discussed, entering firms, which are generally small in size, have not only to reach a minimum efficiency scale but also to cover a higher average fixed cost with a lower volume of production, whereas big incumbent firms can smooth the fixed cost of capital on larger volumes of production. Given the possibility to differentiate the product, a start-up may fix a higher price and still gain market power once entering the market. Finally, the negative contribution to the PCM induced by the exit effect is more relevant in the second period, consistently with the increase in competition possibly induced by the introduction of the euro and the higher international competitive pressures[23].

Table 9: PCM decomposition, 2000, France

FRANCE

MANUFACTURING			2000			
NACE 3-digit	Within	Reallocation	Interaction	Entry	Exit	Aggregate
151	-0.0048289	-0.0176701	-0.0010319	0.0236908	0	0.0001599
152	-0.0084646	-0.0842725	0.0017843	0.1060485	0	0.0150957
153	-0.0070425	-0.0775497	0.015109	0.0965517	0	0.0270685
154	0.0204	-0.0363468	-0.0038718	0.0436661	0	0.0238475
155	0.0062842	0.0125132	0.0004809	0.0043705	0	0.0236488
156	0.0040402	-0.077493	-0.001209	0.0747641	0	0.0001023
157	-0.0107553	-0.0554208	0.0014811	0.0462072	0	-0.0184878
158	0.0015008	-0.0242495	0.0031532	0.0300745	0	0.010479
159	-0.0147292	-0.0269765	0.001171	0.0237766	0	-0.0167581
241	-0.0275736	-0.0254231	0.0019097	0.0276924	0	-0.0233946
242	-0.0877777	-0.0113365	-0.0005787	0.0132889	0	-0.086404
243	-0.0153603	-0.0013227	0.00094	0.0099883	0	-0.0057547
244	0.0235682	-0.0081626	-0.003812	0.0149446	0	0.0265382
245	0.0078996	-0.0102011	0.0007306	0.0221421	0	0.0205712
246	-0.0054618	-0.0187801	0.0019224	0.0131031	0	-0.0092164
247	-0.0732339	-0.0018619	-0.0014955	0	0	-0.0765913
341	1.88E-03	0.0001089	1.56E-05	0.0003314	0	0.0023389
342	-0.0032065	-0.0425674	0.0036699	0.0404924	0	-0.0016116
343	-0.0126151	-0.0010102	0.000666	0.0079478	0	-0.0050115
SERVICES						
521	0.0028334	-0.020817	-0.0007307	0.0276793	0	0.008965
522	-0.0001493	-0.0303264	0.0000478	0.0295099	0	-0.000918
523	0.0045463	-0.0494966	-0.000666	0.082906	0	0.0372897
524	-0.0025834	-0.0418782	0.0008556	0.0568708	0	0.0132648
525	0.0103128	-0.0247194	-0.0026932	0.0381475	0	0.0210477
526	0.0012239	-0.0184735	0.001797	0.036511	0	0.0210584
527	-0.0039395	-0.0171778	-0.0004886	0.0258043	0	0.0041984
642	0.0051452	-0.0027687	0.0012255	0.0975824	0	0.1011844
701	0.0005285	-0.0348707	0.0370192	0.0224877	0	0.0251647
702	-0.0031146	-0.0188557	-0.0019356	0.027371	0	0.0034651
703	0.0000568	-0.0210543	-0.0011359	0.0565617	0	0.0344283

[23] Remember that, due to the coverage of AMADEUS database, it is very likely that the exit effect could be underestimated. In fact, firms that have not reported balance sheet data for more than five years are excluded from the database.

Table 10: PCM decomposition, 2006, France

FRANCE

MANUFACTURING	2006					
NACE 3-digit	Within	Reallocation	Interaction	Entry	Exit	Aggregate
151	0.0033481	-0.0085897	0.0004703	0.0043934	-0.0089919	-0.0093698
152	-0.0046701	-0.0191713	0.0010908	0.0150001	-0.0057224	-0.0134729
153	0.0074701	0.0501134	0.0063002	0.0002805	-0.0425572	0.021607
154	0.0043417	-0.0005656	-0.0002125	0.0000708	-0.0012416	0.0023928
155	-0.0146269	0.0259815	-0.0009648	0.0005788	-0.0318067	-0.0208381
156	-0.0008201	0.0036733	-0.00067	0.0007462	-0.0025746	0.0003548
157	-0.0002186	-0.0229649	-0.0000717	0.0865075	-0.0098575	0.0533948
158	0.0019814	0.0175829	0.0017172	0.0086675	-0.0164771	0.0134719
159	0.0013498	0.0022307	0.0017292	0.002892	-0.0194647	-0.011263
241	-0.0121632	-0.016901	0.0032168	0.0016873	-0.0117707	-0.0359308
242	0.0377492	-0.0073005	-0.0017027	0	-0.0003561	0.0283899
243	0.0002925	0.0015462	0.0005032	0.0015446	-0.0061294	-0.0022429
244	0.0047249	0.015503	0.0000127	0.0052952	-0.0060821	0.0194537
245	0.0025533	0.0148744	0.0001602	0.0009411	-0.0245315	-0.0060025
246	-0.0148856	-0.0181063	0.0088646	0.0063282	-0.0012225	-0.0190216
247	0.0260701	-0.0448745	0.027782	0.0000326	0	0.0090102
341	-4.74E-03	0.001603	-2.66E-05	0.0000108	-0.0000288	-0.003181
342	0.0066456	0.0152562	0.0033984	0.0026071	-0.0181074	0.0097999
343	-0.0175988	-0.0023294	-0.0020577	0.0015256	-0.0003976	-0.0208579
SERVICES						
521	-0.0081428	-0.0112748	0.0080597	0.01462	-0.0019613	0.0013008
522	-0.0016251	-0.000879	0.0008675	0.0106281	-0.0102685	-0.001277
523	-0.003667	-0.0277609	0.0008979	0.0142135	-0.0067337	-0.0230502
524	-0.0032938	-0.0028129	0.0008851	0.0077744	-0.0059954	-0.0034426
525	0.0020008	0.0012341	-0.0027235	0.0138847	-0.0075051	0.006891
526	-0.0024106	-0.0013583	0.0050504	0.0044434	-0.0069223	-0.0011974
527	-0.0038187	0.0032946	0.000762	0.0071899	-0.0107289	-0.0033011
642	0.0022533	-0.0003229	0.0005326	0.0004017	-0.0015962	0.0012685
701	-0.0018956	-0.0074288	0.0045347	0.0107911	-0.0243256	-0.0183242
702	0.0013839	0.0327762	-0.0159612	0.012846	-0.005201	0.0258439
703	-0.0011655	-0.0111408	0.0010185	0.0052221	-0.0213157	-0.0273814

5.2.2 Non-euro Countries - Sweden

The Swedish case is slightly different from the French one, since there is no clear-cut difference observed between the two periods. In the first period, we see that there is a number of 3-digit industries in which competition has enhanced with decreasing PCMs across both manufacturing and services industries. In particular, it is noteworthy that the within effect, the reallocation effect and often also the interaction effect hint to the existence of pro-competitive dynamics in the country.

In the second period, the dynamics remain similar, with possibly less market dynamics in the services sector, as confirmed by the PCM distribution graphs reported in the previous Sections. More in general, these dynamics are consistent with a lack of a pro-competitive effect induced by the euro in the country, although in a context of fairly healthy competition.

Results are reported in Tables 11 and 12.

Table 11: PCM decomposition, 2000, Sweden

SWEDEN

MANUFACTURING	2000					
NACE 3-digit	Within	Reallocation	Interaction	Entry	Exit	Aggregate
151	-0.055262	-0.0061969	-0.0004928	0.0107496	0	-0.0512021
152	-0.0427841	0.0113614	-0.0084464	0.0063022	0	-0.0335669
153	-0.0015776	0.0280569	-0.0063395	0.001505	0	0.0216448
154	0.0142361	-0.0028655	0.0005168	0.0000651	0	0.0119525
155	-0.0058097	-0.2517863	0.0050152	0	0	-0.2525808
156	0.0297184	-0.058103	-0.006902	0.1151336	0	0.079847
157	0.0026635	-0.0023971	0.001242	0	0	0.0015084
158	-0.0050285	-0.0290103	0.0014604	0.0053454	0	-0.027233
159	-0.0124064	0.0247542	-0.0015071	0.0000543	0	0.010895
241	-0.0161271	-0.022756	0.0029222	0.0003282	0	-0.0356327
242	0.0103685	-0.0008598	0.0068951	0	0	0.0164038
243	-0.0051981	0.0186961	-0.0053414	0.0002257	0	0.0083823
244	-0.0036183	0.0010681	0.0002044	0.0014909	0	-0.0008549
245	-0.0376507	-0.0112486	0.0117565	0.0030395	0	-0.0341033
246	0.0012165	-0.0248751	-0.001035	0.0011577	0	-0.0235359
247	-0.0043273	-0.0000832	0.0001639	0	0	-0.0042466
341	-7.97E-06	0.0000799	9.16E-07	0.000026	0	0.000098846
342	-0.0149192	0.0012789	-0.0080096	0.012772	0	-0.0088779
343	-0.0020047	0.0027331	0.0003237	0.0015466	0	0.0025987
SERVICES						
521	-0.0061342	0.0006209	-0.0004687	0.0009569	0	-0.0050251
522	-0.0014434	0.0017023	-0.0002025	0.0018759	0	0.0019323
523	-0.0167557	0.0003445	-0.0001046	0.0001586	0	-0.0163572
524	-0.0187514	-0.0172521	0.0007464	0.0086034	0	-0.0266537
525	-0.0070973	-0.0015797	0.000899	0.0007864	0	-0.0069916
526	0.0094202	0.0010551	-0.0042681	0.0060172	0	0.0122244
527	-0.0440626	-0.0269304	0.0081427	0.0373193	0	-0.025531
642	0.0001601	0.0001144	0.0002981	0.0001074	0	0.00068
701	-0.0249181	0.0121808	0.0004207	0.0001084	0	-0.0122082
702	-0.0070447	-0.0030172	0.0001254	0.0042311	0	-0.0057054
703	-0.0048506	-0.0057973	-0.0015492	0.004749	0	-0.0074481

Table 12: PCM decomposition, 2006, Sweden

SWEDEN

MANUFACTURING	2006					
NACE 3-digit	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**
151	-0.0027645	-0.0008452	0.0000909	0.0012267	-0.0016544	-0.0039465
152	-0.0013653	0.0020695	0.0009806	0.0007401	-0.0036027	-0.0011778
153	-0.0026833	0.0146302	-0.001661	0.0010084	-0.0006522	0.0106421
154	-0.0030466	-0.0039401	0.001342	0	0	-0.0056447
155	-0.0008848	-0.036715	0.0005185	0.0001663	0	-0.036915
156	-0.0392304	-0.0027977	0.0017952	0	-0.0127791	-0.053012
157	-0.0004373	-0.0080826	0.0002833	-0.0004286	0	-0.0086652
158	-0.000874	-0.0023284	-0.0014326	0.0011582	-0.0031758	-0.0066526
159	-0.0010459	-0.0154923	-0.0001159	0	0	-0.0166541
241	-0.00136	-0.0004615	-0.0012297	0.0001592	0	-0.002892
242	-0.0227596	-0.0559257	0.0011315	0.0717455	0	-0.0058083
243	-0.0008192	0.0043247	-0.0007882	0.0019354	0	0.0046527
244	-0.0004183	0.0010972	0.0002583	0.0017884	-0.00000143	0.00272417
245	0.0062877	-0.0107597	-0.0018729	0.0021279	0	-0.004217
246	-0.0036293	0.0351502	0.0010275	0.0000577	-0.0045696	0.0280365
247	-0.0145101	0.004409	0.0004834	0	0	-0.0096177
341	-7.44E-05	0.0040547	-8.79E-04	0.0000298	0	0.0031315
342	0.0002114	0.0113564	0.0010133	0.0038759	-0.0165962	-0.0001392
343	-0.0018698	0.0026469	-0.0002861	0.0004185	-0.0009964	-8.69E-05
SERVICES						
521	0.000639	-0.0033985	0.0003419	0.0009265	-0.0005894	-0.0020805
522	0.0004405	-0.0001905	-0.0005823	0.0028246	-0.0004927	0.0019996
523	0.0077944	-0.0004163	-0.0000506	0.0004114	0	0.0077389
524	0.0004478	-0.0060498	-0.0001267	0.0095638	-0.0019574	0.0018777
525	-0.0058518	-0.0190409	-0.0001392	0.0043808	0	-0.0206511
526	-0.0038209	-0.0009431	-0.0012553	0.0308609	-0.0261142	-0.0012726
527	-0.002812	0.0107649	-0.0023335	0.0013077	0.0000309	0.006958
642	-0.0000691	0.00191	-0.0002562	0.0000126	-0.00000977	0.00158753
701	-0.0090041	-0.0280458	0.0051839	0.0005945	-0.0152355	-0.046507
702	-0.0006412	-0.001513	0.0003663	0.0033547	-0.0040428	-0.002476
703	0.0004375	0.0082934	-0.0007891	0.0045535	-0.0016743	0.010821

5.2.3 New Member States - Poland

Poland is a representative case of a new member of the European Union that has undertaken a process of transition towards a market economy. The aggregate PCMs at sector level displayed in Table 13 show a certain persistency in year 2000, as only few industries experience negative changes, while the situation improves in 2007, as reported in Table 14. The latter is consistent with the process of transition ongoing in Poland over the period considered. In particular, we may expect a catching-up process in terms of productivity (the so called Balassa-Samuelson effect) in the early years of transition, in which firms experience tightening budget constraints leading to a renewed attention in terms of cost-efficiency, as well as a differentiation of products (in that helped by the increasing presence of multinational corporations) meeting an increasingly sophisticated demand of consumers. All these factors are consistent with relatively sustained PCM in the early 2000s. However, the progressive adoption of the acquis communautaire, and in particular the implementation of the EU competition policy is likely to lie behind the reduction of PCMs experienced by the country in the latest years.

Table 13: PCM decomposition, 2000, Poland

POLAND

MANUFACTURING	2000					
NACE 3-digit	Within	Reallocation	Interaction	Entry	Exit	Aggregate
151	0.0061102	-0.0014153	-0.0013904	0.0055906	0	0.0088951
152	-0.0017704	0.0052003	-0.00000185	0.0112349	0	0.01466295
153	0.006973	-0.0158657	-0.0029978	0.0106314	0	-0.0012591
154	0.0044527	0.0156333	.	0	0	0.020086
155	0.0119223	-0.104723	-0.01772	0.0397013	0	-0.0708194
156	0.0102921	0.0075774	-0.000165	0.0084961	0	0.0262006
157	-0.0041385	0.0108057	-0.0005525	0.0041623	0	0.010277
158	-0.0010717	-0.0208783	-0.0016027	0.0242436	0	0.0006909
159	-0.0039544	0.0469843	-0.0007591	0.0034292	0	0.0457
241	-0.0045793	0.0094141	-3.29E-07	0.0850311	0	0.089865571
242	-0.0020732	-0.007154	0	0	0	-0.0092272
243	-0.0025379	0.0006914	-0.00000485	0.0085815	0	0.00673015
244	0.008669	0.0166311	-0.0017578	0.0167522	0	0.0402945
245	-0.0136882	-0.0444075	-0.0001143	0.1457994	0	0.0875894
246	-0.009698	-0.0091715	0	0.002087	0	-0.0167825
247	-0.003263	-0.0084329	.	0	0	-0.0116959
341	-2.43E-03	0.0068782	-1.79E-06	0.0008634	0	0.00531281
342	-0.0213157	-0.008001	0	0.022722	0	-0.0065947
343	-0.0585502	-0.0154323	-0.0010701	0.0213613	0	-0.0536913
SERVICES						
521	0.0052788	-0.026148	-0.0037764	0.0311481	0	0.0065025
522	0.0013125	-0.0063144	-0.0004861	0.075711	0	0.070223
523	-0.0241902	-0.0208363	-0.0002125	0.0265581	0	-0.0186809
524	-0.0025188	-0.0340824	-0.0070859	0.0492621	0	0.005575
525	0	0	.	0.2207395	0	0.2207395
526	-0.0086462	-0.0859847	-0.0000474	0.0489327	0	-0.0457456
527	0.0137302	-0.0015462	-0.0003114	0.005449	0	0.0173216
642	0.0052048	0.0072876	-0.0002808	0.0006767	0	0.0128883
701	0.022975	-0.1042895	-0.0131178	0.2277641	0	0.1333318
702	-0.0020672	-0.0107466	-0.0023284	0.0490832	0	0.033941
703	-0.0165461	-0.3631657	-0.0071301	0.2560501	0	-0.1307918

Table 14: PCM decomposition, 2006, Poland

POLAND

MANUFACTURING	2006					
NACE 3-digit	Within	Reallocation	Interaction	Entry	Exit	Aggregate
151	0.0025561	-0.0128836	-0.0009766	0.0080919	-0.0060616	-0.0092738
152	0.0076998	-0.006305	-0.0015525	0.0055161	-0.0011155	0.0042429
153	0.0026583	-0.0187369	0.000571	0.0085385	-0.0055322	-0.0125013
154	-0.0000398	-0.0442876	0.0000407	0.0007378	-0.0094498	-0.0529987
155	0.0000191	-0.0227563	0.00033	0.0016119	-0.0006443	-0.0214396
156	0.0171908	-0.0126995	-0.0050805	0.0064494	0	0.0058602
157	-0.0006913	-0.0079478	-0.0010813	0.0029286	-0.0041551	-0.0109469
158	-0.0127611	-0.0290054	0.0035058	0.0129997	-0.0035337	-0.0287947
159	-0.0000887	0.0443533	0.0006945	0.0041831	-0.1414027	-0.0922605
241	0.0584696	-0.0297672	-0.0160347	0.003476	-0.0024977	0.013646
242	-0.000219	0.0020882	0.0001587	0.0002887	0	0.0023166
243	-0.0041444	0.0036767	0.000332	0.0041155	0	0.0039798
244	0.0027116	-0.0027279	0.0026634	0.0017964	-0.0008167	0.0036268
245	0.0126743	0.0321672	0.0015933	0.0070431	-0.0298982	0.0235797
246	-0.0002489	-0.0173956	0.000054	0.0043076	-0.0010623	-0.0143452
247	-0.0174045	-0.0048086	0.0014197	0.0014987	-0.000267	-0.0195617
341	-9.35E-03	0.0043611	2.64E-04	0.0002536	-0.0004881	-0.0049563
342	0.0030866	-0.0148556	0.0006205	0.0329425	-0.000404	0.02139
343	-0.0046053	-0.0076291	0.0002818	0.0018728	-0.0100097	-0.0200895
SERVICES						
521	0.0043499	-0.033609	-0.001462	0.0089309	-0.0154076	-0.0371978
522	0.0073063	-0.0192921	-0.0021172	0.012006	-0.0019018	-0.0039988
523	-0.0019865	-0.0444515	-0.0023782	0.034695	-0.0029867	-0.0171079
524	0.0002439	-0.0107263	0.0005626	0.0178666	-0.0025664	0.0053804
525	-0.1312698	-0.4490885	0.1154489	0.0867966	0	-0.3781128
526	0.0082604	-0.0642213	-0.0020974	0.0133969	-0.0032662	-0.0479276
527	0.0215486	-0.1309511	-0.00738	0.0333867	0.0001088	-0.083287
642	0.0014446	0.0002516	0.0003989	0.0050496	-0.0086476	-0.0015029
701	-0.0052574	-0.22637	0.0085097	0.1201575	-0.0154669	-0.1184271
702	0.0141606	-0.0394405	-0.0006196	0.0363591	-0.0141771	-0.0037175
703	0.0035825	-0.1059697	0.0005152	0.0170777	-0.0299644	-0.1147587
704	-0.017484	-0.5588343	0.0123654	0	0	-0.5639529

6 The RPD index

6.1 Methodological approach

The "Relative Profit Differences" (RPD) measure, proposed by Boone (2008) is useful to overcome the problems of heterogeneity, aggregation and attrition that could have arisen in the previous sections. Moreover, this variable may be constructed using the same firm-level data necessary to calculate the PCM, without any additional data requirements. It could be the case that more efficient firms would report lower costs (then having a higher firm-level PCM) whereas less efficient ones would show higher costs (therefore lower firm-level PCM). Given a competition shock in the sector due to a more aggressive behaviour of the incumbents (e.g. a lower elasticity of substitution among products) with consequent lower prices, less efficient firms would exit and their market shares would be redistributed among more efficient ones, hence eventually increasing the aggregate PCM.

That is a case where a positive competition shock determines a higher sector-level PCM, implying that, under particular circumstances, the PCM measure is not monotonic in competition. The RPD measure instead increases (decreases) not only for the enhanced (lower) competition that arises from lower entry barriers, but also for competition that reallocates output to more efficient incumbent firms within the sector, thus ensuring the respect of monotonicity with respect to the direction of the competition shock[24].

The firm-level measure is constructed as follows:

$$RPD_{it} = \frac{\pi_t(i_U) - \pi_t(i_L)}{\pi_t(i) - \pi_t(i_L)}$$

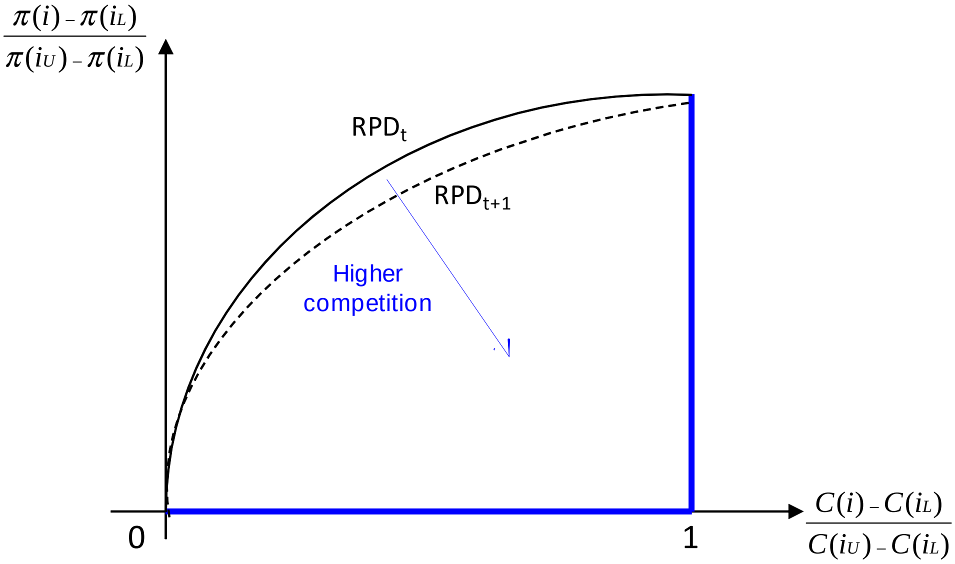
where π_t is profit at time t, i is the firm whose RPD is measured and $[i_L, i_U]$ is the set of firms belonging to a given industry and ranked by cost-efficiency, from the less efficient i_L to the more efficient i_U.

The graphical intuition is provided in Figure 19 below, where the inverse of normalized profits is plotted against the inverse of normalized efficiency $RCE_{it} = \frac{C(i_U)-C(i_L)}{C(i)-C(i_L)}$, measured in terms of the inverse of costs for a sector k at time t[25].

[24] Boone (2008) demonstrates that RPD is monotone in competition both if aggressiveness of incumbent firms changes and if more efficient firms enter into the market. Aggressiveness here can be modeled also as an increased elasticity of substitution within a sector, whereas decreased elasticity of substitution would mean defense by firms that can enter into market niches with less elastic consumers' demand. See Boone (2008) for further details.

[25] Following Boone (2008), the measure is plotted as inverse in the graph to take into account the possibility to have $i_L = 0$.

Figure 19: Relative Profit Differences in a given sector



In this case, the more competitive a sector, the more the dotted line would be pulled to the bottom right. From the graph, then, levels of competition within a sector can be computed as the area below the RPD curve. The smaller the area below the curve, the higher it is the level of competition within a sector. In the extreme case of Bertrand competition, homogenous good and constant marginal costs, the area below the line would be zero and the curve would collapse on the bold axis.

One advantage of the RPD measure is that one does not need to observe all firms in an industry to calculate it properly, since the result holds for any subset of firms sampled: increasing competition would in any case pull down the whole curve.

Another interesting feature of the RPD measure is that it is also strongly correlated with the within effect of the PCM decomposition previously analysed (Boone et al., 2007). The latter allows to further assess the robustness of the within effect as a selection indicator. As the within effect is not affected by construction by the reallocation effect, it is a better measure of competition in principle. In practice, however, there are two problems that arise when using the within effect as a measure of competition. First, to correctly measure competition, the within effect has to be computed on a balanced panel (Boone, 2008). If one wants to measure competition using the within effect consistently over a period of, say, 10 years one can only use data on the firms that are in the panel for all 10 periods. Alternatively, one can calculate the within effect for consecutive years from t to t + 1 and then with a new sample from t + 1 to t + 2 etc. In this way, fewer observations are lost. The disadvantage of this approach is that the reallocation effect plays a role in the comparison of competition between t and t + 2 as the base year changes. In this way, the within effect is not a consistent measure over the whole period. The second problem is the lack of micro-firms in the balance sheet database. The incompleteness of the database, in this sense, can bias the analysis of PCM in previous sections, while this problem is solved by the RPD algorithm as the behaviour of observed firms takes into account the behaviour of the (unobserved) competitors, and thus the measure is relatively unaffected by the sample selection bias or the attrition bias induced by the appearance of active firms in the available balance sheet data.

In order to translate the previous theoretical setup into a workable empirical tool of analysis, one has to deal with the high heterogeneity of firms in terms of their efficiency vs. profits relationship, often yielding incomplete orderings of curves over the (0,1) support. As a result, it might be appropriate to proxy the relationship depicted above with a log-linear one, in which the slope of the log-linearised variables can be estimated through the following OLS equation for each of the two sub periods:

$$\ln(RPD_{ik}) = \beta_0 + \beta_1 \ln(RCE_{ik}) + \varepsilon_{ik} \quad (9)$$

where RPD is the firm-level Relative Profit Difference for firm i in sector k, RCE is the firm-level relative cost-efficiency for firm i in sector k, while β_1 would be the estimated slope of the relationship linking (relative) profit elasticity to (relative) cost-efficiency of the sector. The evolution along the two periods of this slope would give us a proxy of the evolution of the shape of the RDP curve for every sector k.

Given our firm-specific balance sheet data, the configuration of profit that will be taken as dependent variable (RPD) has been based on each firms' EBITDA (Earnings Before Interests Taxes Depreciation and Amortization), while in terms of costs (RCE) we will use firm-specific variable costs as already constructed for the PCM measure (essentially cost of materials and costs of employees). In order to avoid a distortion induced by size effects, we consider unitary profit and cost, namely we divide both costs and EBITDA by sales, thus using unit-based sales relative measure[26]. We estimate the coefficient β year by year and, in order to identify the possible changes in competition, we consider the difference between the mean coefficient of years 2006-2007 vs. the years 1999-2000, that is we report $(\hat{\beta}_{06-07} - \hat{\beta}_{99-00})$ as well as its percentage change. We have decided to employ averages of the initial and end periods in order to avoid

[26] Notice that controlling for size allows to directly link the cost measure of the RPD algorithm to the PCM.

possible distortions generated by year-specific shocks to the estimated coefficients.

6.2 Results for prototype countries

The analysis of the RPD index is reported in the following Tables for our prototype countries.[27] In particular we report the average estimated (log-linear) slope coefficient for a given NACE 3-digit industry and country as retrieved from Equation 9. The reported βs are significant at the 1 or 5 per cent level, while we do not report coefficients that are non-significant for that particular industry/period (generally this might be due to a lack of observations).

In terms of interpretation, as from the graph discussed above a lower β indicates a flatter slope of the RPD line, and thus a more intense competition in the market. We report in the third column of our Tables the difference between elasticities estimated in 2006-2007 vs. 1999-2000 and in the last column the percentage variation. In this way, a negative value would indicate a change in the industry towards higher competition.

Although the percentage variation might be large at times, what is important to recall is that the reported coefficients measure the slope of the (log-linearised) relationship between RPD and RCE. To the extent that the absolute value of the coefficients tends to zero, as it does in many cases, that is an indication of a quasi-Bertrand competition in the market. Clearly, given the low absolute magnitude of the coefficients, the percentage changes tend to be relatively large. This is mostly evident in those cases in which the slope coefficient increases (see Table 15).

In relative terms, we observe a prevalence of decreasing slope coefficients across countries. This result is apparent for France when comparing the pre and post-euro periods. The situation for Sweden is instead more heterogeneous, with some of the estimated βs not significant in the first period, presumably due to limitations in the initial number of observations, while again Poland displays marked improvements in competition, albeit for different reasons than France. All these findings are consistent with the increase in competition detected when analysing the PCM decomposition in the previous section. Clearly, however, some degree of heterogeneity across industries and across countries remains, together with some possible shortcomings of our estimation strategy, which we now proceed to validate.

[27] Results for all the countries of the study are reported in the Statistical Annex of the Report, which is available upon request.

Table 15: RPD Index, France

FRANCE

nace 3-digits	β_{99-00}	β_{06-07}	β_{06-07} - β_{99-00}	%change
MANUFACTURING				
151	0.05040625	0.01739185	-0.0330144	-65%
152	0.1446282	0.0540404	-0.0905878	-63%
153	0.0413578	0.05274855	0.01139075	28%
154	0.31452255	0.0414881	-0.27303445	-87%
155	0.1731161	0.0427685	-0.1303476	-75%
156	0.1085096	0.047346	-0.0611636	-56%
157	0.0339926	0.0442807	0.0102881	30%
158	0.02913055	0.01750345	-0.0116271	-40%
159	0.0368316	0.0154927	-0.0213389	-58%
241	0.06204355	0.00864085	-0.0534027	-86%
242	0.26436125	0.06843935	-0.1959219	-74%
243	0.1823482	0.1808918	-0.0014564	-1%
244	0.01922485	0.0358875	0.01666265	87%
245	0.0628532	0.00166405	-0.06118915	-97%
246	0.00792395	0.1206689	0.11274495	1423%
247	0.0394107	0.1404822	0.1010715	256%
341	0.03237855	0.0052286	-0.02714995	-84%
342	0.0905296	0.01590635	-0.07462325	-82%
343	0.0427801	0.02529335	-0.01748675	-41%
SERVICES				
521	0.0133141	0.0121215	-0.0011926	-9%
522	0.0348562	0.0081235	-0.0267327	-77%
523	0.0316418	0.00631235	-0.02532945	-80%
524	0.00448815	0.0027059	-0.00178225	-40%
525	0.0171643	0.00542745	-0.01173685	-68%
526	0.00005195	0.0025196	0.00246765	4750%
527	0.05489745	0.0218502	-0.03304725	-60%
642	0.00333845	0.00032335	-0.0030151	-90%
701	0.000078	0.00005565	-0.00002235	-29%
702	0.0004349	0.0004792	0.0000443	10%
703	0.00065615	0.00022475	-0.0004314	-66%

6.3 Limits of the RPD index and robustness checks

Given its properties, and the advantage of being based on firm-level data avoiding at the same time some of the shortcomings typical of micro data, the RPD index is a good candidate to be used as a tool for the subsequent analysis of competition. However, also this indicator suffers from certain limits.

In particular, from a theoretical point of view, the indicator is constructed for a given parameter ω measuring the 'aggressiveness' of firms' conduct in the market, e.g. the substitution elasticity between goods from different producers or the type of competition (Cournot or Bertrand) played by firms (see Boone, 2008). It then follows that, in the application of the theoretical measure, some limitations can be encountered, essentially due to the availability of firm-level data. First of all, in the model described before we would need to control for the

Table 16: RPD Index, Sweden

SWEDEN

nace 3-digits		β_{99-00}	β_{06-07}	β_{06-07} - β_{99-00}	%change
MANUFACTURING					
	151	0.09033755	0.0914587	0.00112115	1%
	152	0.0604708	0.04872895	-0.01174185	-19%
	153	0.05322915	0.18070325	0.1274741	239%
	154		0.000466	0.000466	
	155		0.2462598	0.2462598	
	156	0.11786715	0.0255115	-0.09235565	-78%
	157	0.0651785	0.0368819	-0.0282966	-43%
	158	0.0641154	0.0490203	-0.0150951	-24%
	159		-0.00014735	-0.00014735	
	241	0.01547115	0.05474015	0.039269	254%
	242		0.45872465	0.45872465	
	243	0.07538935	0.15963635	0.084247	112%
	244		0.06481785	0.06481785	
	245	0.05907095	0.00485585	-0.0542151	-92%
	246		0.0015748	0.0015748	
	247		1.382468	1.382468	
	341	0.1407857	0.01199595	-0.12878975	-91%
	342	0.00558345	0.1350418	0.12945835	2319%
	343	0.0192772	0.0369181	0.0176409	92%
SERVICES					
	521		0.00441175	0.00441175	
	522		0.01630445	0.01630445	
	523		0.03222065	0.03222065	
	524	0.00480405	0.0104673	0.00566325	118%
	525		0.0699123	0.0699123	
	526	0.00830105	0.02228545	0.0139844	168%
	527				
	642		0.00711585	0.00711585	
	701		0.00935815	0.00935815	
	702	0.0009282	0.00155125	0.00062305	67%
	703	-0.0038605	0.001951	0.0058115	-151%

elasticity of substitution ω between goods. However, when pooling firm-level data at the NACE 3-digit level, which is still a relatively aggregated industry-measure, we are treating equally firms with different product mixes and, therefore, different elasticities of substitution among the goods they produce. Since we do not have information on the demand faced by each firm, in our measure we would be neglecting an individual variation in the elasticity of substitution ω perceived by a given firm. It can therefore happen that, following a competition shock, in which price-cost margins should in theory decrease, less efficient firms react by changing their product mix towards products characterized by a lower elasticity of substitution; the latter would result in increased mark-ups, on average, and therefore in an underestimation of the actual degree of competition, if judged solely on the basis of this indicator. In this context, in other words, a

Table 17: RPD Index, Poland

POLAND

nace 3-digits		β_{99-00}	β_{06-07}	β_{06-07} - β_{99-00}	%change
MANUFACTURNIG					
	151	0.40454355	0.02629325	-0.3782503	-93.5%
	152	2.173445	0.0349816	-2.1384634	-98.4%
	153	0.30060045	0.118144	-0.18245645	-60.7%
	154		0.0318346	0.0318346	
	155	0.5648449	0.0413849	-0.52346	-92.7%
	156	0.4825457	0.4115101	-0.0710356	-14.7%
	157	0.2522424	0.1961858	-0.0560566	-22.2%
	158	0.0933219	0.0710253	-0.0222966	-23.9%
	159		0.20201865	0.20201865	
	241	0.0726672	0.08306975	0.01040255	14.3%
	242		0.9239229	0.9239229	
	243	0.7335599	0.30574135	-0.42781855	-58.3%
	244	0.15432795	0.05854605	-0.0957819	-62.1%
	245	0.38544465	0.0329501	-0.35249455	-91.5%
	246		0.12802655	0.12802655	
	247		0.2116221	0.2116221	
	341	0.3875224	0.4376077	0.0500853	12.9%
	342	0.4722459	0.43539625	-0.03684965	-7.8%
	343	0.1117702	0.24204815	0.13027795	116.6%
SERVICES					
	521		0.13344225	0.13344225	
	522		0.1876647	0.1876647	
	523		0.1915129	0.1915129	
	524	0.08712265	0.0416849	-0.04543775	-52.2%
	525		0.1335417	0.1335417	
	526	0.27234375	0.08931765	-0.1830261	-67.2%
	527				
	642	0.0738742	0.031208	-0.0426662	-57.8%
	701		0.0008115	0.0008115	
	702	0.0906623	0.00480025	-0.08586205	-94.7%
	703	0.0714207	0.0987718	0.0273511	38.3%

less aggressive pricing policy by firms would not imply the loss of market shares because the products these firms are selling are perceived as rich in value added[28].

Once we do not rule out the case of heterogeneous firm-specific elasticities of substitutions within a given industry, it then follows that the ranking of firms according to the cost efficiency as in our previous Graph would not necessarily correspond to a monotonic ranking in profits on the vertical axis since, as already stated, firms whose elasticity of substitution has dropped might increase their profit for the same level of costs. On the other hand, an effect usually associated with competitive pressures, namely surviving laggards improving their cost efficiency more than leaders, might also generate a non-monotonic relation between costs and profits: to the extent that laggards are such because they face a higher elasticity of substitution on their product mix,

[28] The latter case would yield a positive interaction term in the PCM decomposition generated by both a positive change in PCM and a positive change in market share.

an increase in their cost efficiency would not necessarily be associated to a relatively higher share of profits.

In addition, the same business cycle might influence over time the shape of the relationship between RPD and RCE. For example in a period of crisis, where a generalized decrease in the propensity to spend prevails, consumers might move their preferences from quality and/or varieties to the variation of prices. In this case, it would be again necessary to correct for the price elasticity of the firm-level demand, if data are available to test a structural model.

Finally, as recognised by Boone et al. (2007), the non-linearities might derive from changes in the ranking of firms over time as induced by entry and exit or by accounting issues relative to the imputation of costs to balance sheets, a problem which has to be assessed.

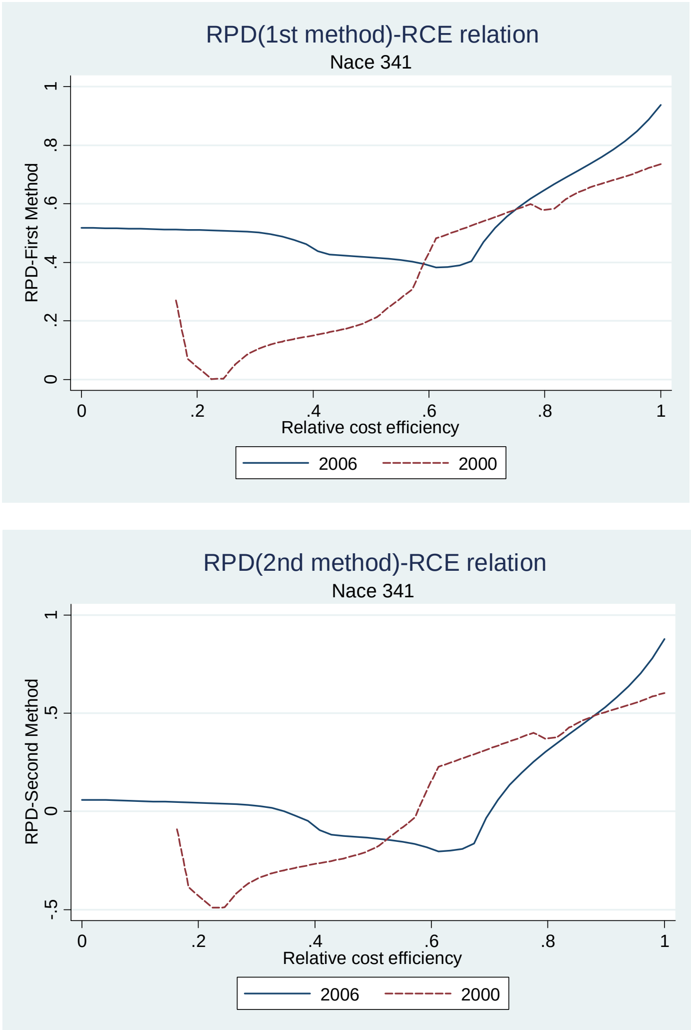
To show the extent to which these non-linearities might affect the data, we have tested the relationship between RPD and RCE through a non-parametric third-order polynomial operator. In what follows, as a matter of example we report the relationship calculated for the car industry (NACE 341) across the eight countries in our study for two given years, 2000 and 2006.

The two graphs have been calculated throughout two different methodologies. In the first case, we relate the relative profit difference of a given firm i as associated to the cost efficiency of the same firm i (first method). In the second case, we do not restrict the data to a biunivocal correspondence between RPD and RCE of a given firm, but simply relate the (ranked) RPD firm-level measures with the (ranked) RCE measures. To the extent that the relationship between RPD and RCE is by and large monotonic, the two measures should coincide. In case of non-monotonic behaviours, which we cannot control given the lack of firm-specific measures on the elasticity of substitution, the second methodology, by imposing monotonicity, allows to minimize distortions induced by unobserved firm-level heterogeneity and thus calculate a more conservative average relationship at the industry level[29]. By comparing the two graphs, however, we derive two simplifying messages, that hold through our observed industries. First of all, the choice of the methodology (firm-specific correspondence or general ranking) has little effect on the shape of the relationship between RPD and RCE; second, a log-linear approximation of the relationship does not impose too much distortion on the data.

To better control for these potential limits of the RPD indicator, and derive more robust results, in what follows we have implemented a number of related additional tests.

[29] For example, if the few less efficient firms in a given NACE 3-digit industry enjoy some form of market protection (e.g. because they are niche-producers or quasi-monopolists), they might benefit from higher than normal relative profits which, in our theoretical relationship, would imply a positive, rather than zero, intercept, biasing the entire estimation of the shape parameter.

Figure 20: RPD vs. RCE: non parametric relationship



First of all, the interpretation of the retrieved coefficient is not obvious, as in Equation 9 the regressors are weighted in terms of the relative efficiency/profitability of the industry (recall that a firm i is assessed with respect to the less efficient / profitable firm i_L and the more efficient / profitable one, i_U). An alternative specification, suggested by Boone et al. (2007) is to regress in a panel model the (log) profit of a given firm i vs. its (log) costs, controlling for time- and individual firm-fixed effects, in order to retrieve the estimated elasticity of profits to costs. To the extent that firm-specific measurement errors are time-invariant, and that time dummies are able to adequately control for cyclical effects, the methodology would yield a result equally valid as the RPD (in which the normalisation for the relative efficiency in a given year essentially achieves the same goal), with a clearer interpretation.

Second, the analysis has revealed for a limited number of countries/industries a negative or (more often) non-significant slope of the estimated RPD coefficient. As it can be seen, the non-significance of the coefficients tends to be concentrated in the early years of the analysis, and as such it is likely due to the relatively fewer number of observations available in those years (as firms have been added to the database over time). However, as already discussed we are imposing a log-linear specification for the slope coefficient, while the relationship between RPD and RCE might be relatively non-linear for certain industries, for the reasons previously stated. As a result, our first order approximation might be not adequate.

In order to evaluate the sensitivity of our results to the latter problem, we have recalculated the RPD measure based on a proxy for the relative cost efficiency (RCE) which derives from the estimation of a stochastic production efficiency frontier, rather than from our direct observation of firms' costs.

In what follows we discuss the construction of these robustness checks.

6.3.1 Profit Elasticity

Profit elasticities (PE) are retrieved from the same Equation 9 employed for the calculation of the RPD measure, with the only difference that in this case we do not normalize profits and costs with respect to the less/more efficient firms, but rather use these variables in their absolute (log) values, albeit always controlling for firm size by dividing our regressors for firms' sales[30]. We thus estimate the average (log-linear) slope coefficients for a given NACE 3-digit industry and country as retrieved from Equation 9, for each year.

The analysis of the PE index is reported from Table 18 to 20 for our prototype countries.[31] As before, in order to identify the possible change in competition, we consider the difference between the mean coefficient of years 2006-2007 vs. the years 1999-2000, that is we report $(\hat{\beta}_{06-07} - \hat{\beta}_{99-00})$ as well as its percentage change. The reported βs are significant at the 1 or 5 per cent level, while we do not report coefficients that are non-significant for that particular industry/year (generally this might be due to a lack of observations at the firm level).

In terms of interpretation, in this case a higher β (in absolute values) indicates a higher elasticity of profits to costs, and thus a more intense competition in the market. Since the interpretation is slightly different with respect to the RPD, we report in what follows three

[30] Using a 'pure' measure of unitary cost as a regressor we incur of course in the same type of approximation error discussed for the PCM.

[31] The Statistical Annex of the Report presents this measure for all the countries / industries / years included in the study. Results available upon request.

Tables for France, Sweden and Poland in which we show the difference between elasticities estimated in 2006-2007 vs. 1999-2000, together with the percentage variation. In this tables, a positive value would indicate a change in the industry towards higher competition.

As a general finding, it can be seen that this indicator reports a stronger degree of heterogeneity across industries but also across countries with respect to the RPD. In particular, the food industry and in general the services sector in France seem to display a lower elasticity of profits to cost. The situation is more homogeneous in Sweden, where profits in most industries have become over time more sensitive to costs, while the opposite is in general true for Poland.

Clearly, these findings need to be further explored comparing them with others RPD-related measure, as well as through a comparison with the within-effect component of the PCM decomposition reported in the previous section, an exercise carried out in the next Section.

6.3.2 RPD and stochastic frontier

Insofar, we have used an inverse measure of firms' variable costs (normalised by sales) as a first proxy of efficiency, as suggested by the same Boone (2008). However, such an approach might suffer from measurement error, to the extent that not all costs of a firm are correctly reported in the balance sheet, or from an idiosyncratic component, to the extent that firms in a given sub-sector might be subject to shocks in terms of costs which affect their ranking in terms of efficiency.

To partly overcome these problems, we have recalculated the RPD measure using as a proxy for firms' relative efficiency the ranking in terms of efficiency frontier in production. In particular, the stochastic frontier production function has been independently proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977). Since then, there has been considerable research to extend and apply the model[32]. The approach starts from a general production function:

$$y_i = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ji} + \varepsilon_i$$

where y_i is the logarithm of output and x_{ji} are the inputs. The stochastic frontier production function assumes the existence of technical inefficiencies of production of firms involved in producing a particular output: each firm potentially produces less than it might due to a degree of inefficiency. This implies that the error term is actually defined as $\varepsilon_i = v_i - u_i$, where v_i is a

[32] Useful reviews of research in this area are provided in Forsund, Lovell and Schmidt (1980), Schmidt (1985), Bauer (1990), Battese (1992) and Greene (1993).

Table 18: Profit Elasticity Index, France

FRANCE

nace 3-digits		β_{99-00}	β_{06-07}	β_{06-07} - β_{99-00}	%change
MANUFACTURING					
	151	-2.4980125	-2.0301995	-0.467813	-19%
	152	-3.011539	-2.206296	-0.805243	-27%
	153	-1.5261405	-1.598132	0.0719915	5%
	154	-1.5571225	-1.105288	-0.4518345	-29%
	155	-2.543783	-1.733969	-0.809814	-32%
	156	-1.4409255	-2.0201015	0.579176	40%
	157	-1.5103645	-1.8606475	0.350283	23%
	158	-2.455455	-2.406425	-0.04903	-2%
	159	-1.272048	-1.046702	-0.225346	-18%
	241	-1.098896	-1.134743	0.035847	3%
	242	-1.0085617	-1.610797	0.6022353	60%
	243	-2.027023	-2.263884	0.236861	12%
	244	-0.812381	-0.69052305	-0.12185795	-15%
	245	-1.0950978	-1.2030255	0.1079277	10%
	246	-1.4985545	-1.605572	0.1070175	7%
	247			1.31481965	
	341		-0.68062455	0.14913165	
	342	-1.397143	-1.596704	0.199561	14%
	343	-1.7182525	-1.828953	0.1107005	6%
SERVICES					
	521	-4.1825075	-2.6641	-1.5184075	-36%
	522	-3.606085	-2.8326045	-0.7734805	-21%
	523	-1.930969	-1.7408585	-0.1901105	-10%
	524	-2.3671915	-2.0077645	-0.359427	-15%
	525	-1.1770505	-1.1677925	-0.009258	-1%
	526	-1.691253	-1.3929725	-0.2982805	-18%
	527	-2.0460695	-1.6715955	-0.374474	-18%
	642	-0.7325132	-0.403122	-0.3293912	-45%
	701	-0.1607785	-0.2158786	0.0551001	34%
	702	-1.0299695	-0.88671375	-0.14325575	-14%
	703	-0.55154555	-0.45737035	-0.0941752	-17%

random shock, and u_i is a measure of the inefficiency of the firm, which tells us the distance from the production frontier. We assume that the inefficiency terms are independently half-normally $N^+(0, \sigma_u^2)$ distributed[33].

An advantage of this methodology is the possibility to build a measure of inefficiency without imposing much structure on this term, as these technical inefficiency effects do not need to be explicitly modelled within the theoretical stochastic production frontier, although the methodology can include some explanatory variable for the same inefficiency (see Pitt and Lee (1981)

[33] $u_i = -\ln(\xi_i)$, where ξ_i is the level of efficiency for firm i, and is defined for the interval $(0, 1]$. Therefore, restricting $u_i \geq 0$ implies that $0 < \xi_i \leq 1$

Table 19: Profit Elasticity Index, Sweden

SWEDEN

nace 3-digits		$\beta_{99\text{-}00}$	$\beta_{06\text{-}07}$	$\beta_{06\text{-}07} - \beta_{99\text{-}00}$	%change
MANUFACTURING					
	151	-2.58823	-2.1143215	-0.4739085	-18%
	152		-2.570868	2.570868	
	153	-1.75482	-1.838271	0.083451	5%
	154				
	155	-1.750223	-1.943458	0.193235	11%
	156	-2.470744	-2.0398875	-0.4308565	-17%
	157	-1.393774	-1.710112	0.316338	23%
	158	-1.330099	-1.884747	0.554648	42%
	159	-1.344597	-1.683144	0.338547	25%
	241	-0.9312809	-1.390992	0.4597111	49%
	242	-5.212907	-1.383546	-3.829361	-73%
	243	-2.50539	-1.47931	-1.02608	-41%
	244	-1.758168	-1.093642	-0.664526	-38%
	245	-1.056031	-0.3159106	-0.7401204	-70%
	246	-1.6447275	-1.863278	0.2185505	13%
	247		-9.017731	9.017731	
	341	-1.868419	-1.5857685	-0.2826505	-15%
	342	-2.063671	-2.2879455	0.2242745	11%
	343	-1.493171	-1.6711775	0.1780065	12%
SERVICES					
	521	-1.4712139	-2.360234	0.8890201	60%
	522	-1.1903073	-2.2003465	1.0100392	85%
	523	-1.71296	-1.495707	-0.217253	-13%
	524	-1.22735635	-1.6520825	0.42472615	35%
	525	-1.30618	-1.023107	-0.283073	-22%
	526	-0.64805445	-1.3934955	0.74544105	115%
	527	-1.409773	-1.146049	-0.263724	-19%
	642	-0.5168751	-0.7778938	0.2610187	50%
	701	-1.550706	-0.8606618	-0.6900442	-44%
	702	-0.79487205	-0.68137655	-0.1134955	-14%
	703	-0.6143531	-0.7215485	0.1071954	17%

and Kalirajan (1981)).

In terms of estimation, the early literature has suggested to adopt a two-stage approach, in which the first stage involves the specification and estimation of the stochastic frontier production function and the prediction of the technical inefficiency effects, under the assumption that these inefficiency effects are identically distributed. The second stage involves the specification of a regression model for the predicted technical inefficiency effects. However, note that the second stage regression contradicts the assumption of identically distributed inefficiency effects in the stochastic frontier. Thus, more recent contributions propose a model for the technical inefficiency in which the parameters of the stochastic frontier and the inefficiency model are estimated simultaneously, given appropriate distributional assumptions associated either with cross-sectional data (Kumbhakar, Ghosh and McGuckin (1991), Reifschneider and Stevenson (1991) and Huang and Liu (1994)) or panel data (Battese Coelli 1992, 1995).

Given our purposes, that is to derive a ranking of firms in terms of efficiency in alternative

Table 20: Profit Elasticity Index, Poland

POLAND

nace 3-digits	β99-00	β06-07	β06-07 - β99-00	%change
MANUFACTURING				
151	-4.7468405	-1.641704	-3.1051365	-65%
152		-2.0644115	2.0644115	
153	-4.077299	-1.505407	-2.571892	-63%
154		-2.651091	2.651091	
155	-3.2037805	-1.923053	-1.2807275	-40%
156	-3.668217	-2.07369	-1.594527	-43%
157	-4.937613	-2.3155305	-2.6220825	-53%
158	-3.374577	-0.9972255	-2.3773515	-70%
159				
241	-3.101024	-1.659538	-1.441486	-46%
242		-4.833598	4.833598	
243	-6.313168	-1.4877005	-4.8254675	-76%
244	-2.230865	-1.707014	-0.523851	-23%
245	-1.01478	-1.3216505	0.3068705	30%
246	-4.009096	-1.508305	-2.500791	-62%
247	-4.897038	-2.890292	-2.006746	-41%
341	-7.033611	0	-7.033611	-100%
342	-2.099953	-1.819687	-0.280266	-13%
343	-2.796987	-1.6632675	-1.1337195	-41%
SERVICES				
521	-2.703096	-2.3938255	-0.3092705	-11%
522	-10.6788975	-1.16550285	-9.51339465	-89%
523		-1.0665161	1.0665161	
524	-0.78456755	-1.0541244	0.26955685	34%
525		-1.114932	1.114932	
526	-3.362952	-1.1554875	-2.2074645	-66%
527	-13.8117	0	-13.8117	
642	-0.6457568	-0.4286585	-0.2170983	-34%
701		-0.5530675	0.5530675	
702	-0.81260275	-0.5441782	-0.26842455	-33%
703	-0.98381825	-1.078754	0.09493575	10%

to the one retrieved by the observation of costs, in our robustness analysis we adopt the simplest stochastic frontier specification, as we are not interested in developing a model to define technical inefficiency. Therefore we estimate:

$$y_{it} = \beta_0 + \beta_1 k_{it} + \beta_2 l_{it} + \beta_3 m_{it} + v_i - u_i$$

where y_{it} is the log of sales, k_{it} is the log of total assets (both tangible and intangible), l_{it} is the log of the wage bill and m_{it} is the log of material costs.

We estimate a stochastic frontier using firm-level data by NACE 2-digit and country for every year. We prefer to estimate the stochastic frontier at the NACE 2-digit level instead of NACE 3-digit level as a larger number of observations is crucial for the convergence of the maximum likelihood estimator. From the estimation we are able to retrieve a firm-specific term of technical efficiency (TE) based on the distance of each firm observed in a given country/year from the industry frontier. Notice that the extension to a multi-country setting of this approach is straightforward: as far as we believe that firms in the same industry in different EU countries operate with the same technology in a given year, we can in fact assume that they share the same frontier. Therefore, we could simply pool together the observations from different countries.

After obtaining a time-varying firm-specific efficiency term at the NACE 2-digits level of aggregation, we create as before the term of normalized efficiency $RTE_{it} = \frac{TE(i_U)-TE(i_L)}{TE(i)-TE(i_L)}$ where $[i_L, i_U]$ is the set of firms belonging to a given NACE 3-digit industry and ranked by technical efficiency, from the less efficient i_L to the more efficient i_U. Such a ranking of firms is then used as an alternative proxy for the independent variable employed in Equation 9. Clearly, in terms of interpretation, nothing changes with respect to the standard RPD measure previously discussed, i.e. a lower β indicates a flatter slope of the' RPD line, and thus a more intense competition in the market.

Therefore we have proceeded in calculating the difference between the elasticities estimated in 2006-2007 vs. 1999-2000 for the alternative measure of RPD, comparing them with the standard measure. The results are reported in Section 7, in which we compare the messages obtained from all our indicators of competition, including the simple profit elasticity.

7 Measuring the intensity of product market competition

7.1 Screening market functioning from firm-level indicators

In the previous Sections we have presented two different methodologies to evaluate the outcome of competitive pressures throughout firms, and namely a Laspeyres decomposition of firm-level PCM changes and an index of Relative Profit Difference (RPD), itself presented in its standard version (following Boone, 2008) and in two robustness checks, that is the profit elasticity to costs, and the RPD based on stochastic production frontiers (rather than cost measures) as a proxy of efficiency.

As all measures have their pros and cons, and all display a certain degree of heterogeneity across industries, we suggest to combine them, for each industry/country in the study, in order to identify those industries which present non-straightforward or 'problematic' dynamics in terms of market integration. Given the nature of the indicators we have been using (PCMs or indexes measuring to the profit-to-cost relation of firms), the term 'problematic' does not *necessarily* relates to a problem in terms of competition since, as already discussed, PCMs might increase due to an increase in product market competition, while the same relationship between relative profits and relative costs might become non-monotonic, thus preventing (lacking a control for the individual firm-level elasticity of substitution) an interpretation of our indexes in terms of competition dynamics. Rather, these screening tests should be interpreted as an indication that a given industry is behaving differently with respect to a given benchmark in terms of market integration.

In fact, the highly disaggregated nature of our indicators is such that the same benchmark can be defined endogenously by the researcher. Consider for instance the PCM indicator. Theoretically, it would be possible to design at least three different benchmark indicators with respect to an exercise aiming at measuring the extent of product market functioning. First of all, one could wonder whether the level of PCM of a given industry in a given country has actually experienced *divergence* over time with respect to the EU industry average. Second, one could check whether the long-term *changes* of the PCM (from 1999-2000 to 2006-2007) have entailed a persistent increase of the latter. Third, it is possible to measure the *persistence* of particularly high PCMs which do not change over time. All these three tests, which have different relationship with the underlying competition dynamics, can then be combined with our indexes of changes in competition dynamics (RPD) in order to derive interesting messages on the extent of product market functioning.

7.1.1 Divergence of PCM

In order to measure the industry-level convergence of PCM to the EU average, we have calculated the mean square deviation (MSD) of the PCM in a given NACE 3-digit industry in a given country and year, compared it to the industry average across the countries in our sample, and then checked whether the MSD has decreased or increased over time. We have then marked those industries in which the MSD has increased in the years 2006-2007 vs. the initial years (1999-2000), which would therefore diverge from the EU industry average (defined on our sample) in terms of PCM behaviour. Clearly, the latter would not necessarily be associated to competition problems, to the extent that the divergence could take place from the bottom, i.e. the PCM in a given country/industry might *decrease* more than the EU average, and thus diverge. Also, even if the divergence takes place in terms of a country/industry PCM failing to decrease with respect to a decreasing EU average, to the extent that costs retain a country-specific component (e.g. labour costs) a non-decreasing PCM in a given industry might be the results of technological improvements, better functioning of labour markets or a change in local demand conditions (in terms of elasticity of substitution). This is why it is useful to couple the test on the divergence of price-cost margins with a screening of the competition dynamics as emerging from our RPD-based indicators.

To that extent, we will be using two of our three indicators (profit elasticity; RPD cost-based; RPD frontier-based) and namely the profit elasticity and the RPD frontier-based. It turns out in fact that the RPD cost-based and the RPD frontier-based are highly correlated (thus conveying essentially the same information), but the latter is more robust to measurement errors in accounting costs, and thus the ensuing problems of potential non-linearities in the relationship between relative profits and costs are greatly reduced. Our screening test for competition dynamics would therefore highlight those industries in which the relationship between profits and costs signals a potential anti-competitive behaviour, namely a significant increase in the average β of the RPD index or a significant decrease of the average profit elasticity over the period 1999-2007[34].

Combining the test on the divergence of price-cost margins (MSD) with the screening of competition dynamics (PE and RPD indicators, respectively) yields Table 21, where we have marked the result of our screening tests for each industry, highlighting those industries for which

[34] Recall that, in order to avoid spurious measures induced by year-specific shocks, we calculate the average slope for 1999 and 2000 and compare it with the average slope for 2006 and 2007, only for those coefficients turning out to be significant in our estimations. Clearly, all the caveats on the limits of our indicators in measuring actual competitive practices by firms apply here.

all three indicators are relevant.

Table 21: PCM divergence and competition screening

SUMMARY TABLE

Nace 3-digits	BE			DE			ES			FR			IT			PL			RO			SE		
	MSD	PE	RPD	MSD	PE	RPD	MSD	PE	RPD	MSD	PE	RPD	MSD	PE	RPD	MSD	PE	RPD	MSD	PE	RPD	MSD	PE	RPD
151				x				x			x		x	x		x	x		x				x	
152	x	x									x		x	x				x	x	x		x	x	x
153		x		x				x				x	x	x		x	x		x	x	x		x	x
154		x		x	x		x				x	x	x	x				x	x		x			
155	x	x			x			x	x		x				x	x	x		x	x	x	x		x
156	x				x	x		x					x			x	x	x	x	x			x	
157		x	x			x			x	x					x		x			x	x		x	x
158		x			x			x			x	x	x	x		x	x	x	x				x	x
159							x	x	x		x		x	x				x	x	x		x		x
241	x	x		x	x			x		x			x	x		x	x	x	x	x				x
242							x	x		x			x	x	x	x			x				x	x
243	x	x			x	x		x	x					x			x	x	x	x			x	x
244		x		x		x		x		x	x	x	x	x		x	x		x	x	x		x	x
245	x	x					x		x					x		x			x	x				
246		x				x	x	x		x		x		x			x	x	x	x	x		x	x
247			x					x					x	x			x	x	x	x		x	x	
341	x	x		x		x	x	x	x			x	x	x	x		x	x					x	
342		x	x	x	x		x	x		x			x	x		x	x		x			x		x
343		x			x			x					x	x			x		x	x			x	
521	x	x	x				x	x		x	x	x	x	x		x	x	x	x	x		x		
522				x			x	x			x		x	x		x	x	x	x	x	x	x	x	
523	x	x	x	x		x	x	x	x	x	x		x	x					x	x		x		
524	x	x		x	x		x	x			x	x	x	x		x			x	x		x		x
525						x	x	x			x				x				x	x	x		x	x
526	x					x	x	x	x		x	x		x			x	x	x	x	x	x	x	x
527		x			x	x			x		x		x	x		x	x	x	x	x			x	
642		x			x	x					x						x		x	x		x	x	x
701	x						x	x	x	x				x		x			x	x		x	x	
702			x	x	x	x	x	x		x	x	x		x			x		x	x		x		x
703	x	x			x				x	x	x							x	x	x		x		
Total	13	20	6	11	13	12	15	23	11	11	17	10	19	24	5	15	20	15	28	24	9	14	19	0

Not surprising, we can see that most of the industries displaying a diverging behaviour associated to unclear competition dynamics are concentrated in Romania and Poland, the two New Member States of our sample. In the Euro zone, Spain stands out as a country in which industry experiencing a PCM divergence also display a certain sluggishness in the relationship between profits and costs, both in manufacturing (beverage industry, NACE 159 and car production, NACE 341) and in services. Countries in continental Europe (Belgium, Germany and France) display instead a much lower number of 'problematic' industries, although a diverging behaviour *per se* is present in more than one third of the considered industries. In the latter case, most of the divergence is concentrated in the services, rather than manufacturing industries.

Combining this information with the one available in terms of evolution of *consumers'* price dispersion in the Single Market, which has decreased substantially since 1996 (e.g. Ilzkovitz et al., 2008) it is then likely that in Europe the degree of integration of factor markets (which directly drive the cost component of the PCM) seems to be lower than the one of product markets, where consumers' prices are determined. The precise extent to which costs vs. prices drive the overall dispersion of the PCM across EU industries is analysed at the beginning of Section 8.

7.1.2 Changes of PCM

A second benchmark in terms of product market functioning is given by the long-run changes of the PCM over the period considered. In particular, we consider now those industries in which the average PCM in 2006 and 2007 is higher than the average PCM calculated in 1999 and 2000[35].

Once again, an increase in the PCM over the period considered for a given industry does not necessarily imply *per se* the existence of competition problems, as the considerations on dynamic efficiency we have mentioned throughout this study are such that an increase in competition can be associated to the detection of increasing price-cost margins. However, combining this information with a screening of the competition dynamics as emerging from our RPD-based indicators might highlight those industries in which particular industrial dynamics (such as restructuring processes, quality upgrading, increase in import penetration, phenomena not necessarily associated to competition problems) or eventually anti-competitive practices (at least for some sub-industries) might be worth investigating.

Combining the test on the positive change (D>0) of price-cost margins with the screening of competition dynamics (PE and RPD indicators, respectively) yields the results shown in Table 22, where we have marked the result of our screening tests for each industry, highlighting those industries for which all three indicators are relevant.

Once again, most of the problematic industries are concentrated in Romania and Poland, countries in which industries experiencing an overall increase in the PCM over time tend also to have a more sluggish relationship between profits and costs. However, the feature of increasing PCMs is quite common across the considered industries and countries, to the point that unclear industrial dynamics emerge also for a non marginal number of industries in Sweden and France (both concentrated in food and chemicals).

Interestingly, when looking at the Euro area countries, the difference in the behaviour of manufacturing vs. services industries disappear, signalling that while divergence in PCM could

[35] Taking long-run differences allows us to obtain more robust results, as these differences are less sensitive to the choice of particular years.

Table 22: PCM change and competition screening

SUMMARY TABLE																								
Nace 3-digits	BE			DE			ES			FR			IT			PL			RO			SE		
	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD
151	x			x			x	x		x	x		x	x		x	x		x				x	
152	x	x		x						x	x			x		x		x	x	x		x	x	x
153	x	x					x	x		x		x	x	x		x	x		x	x	x	x	x	x
154	x	x		x	x					x	x	x		x				x	x		x			
155	x	x		x	x			x	x		x		x		x		x		x	x	x			x
156	x			x	x	x		x		x						x	x	x	x	x			x	
157	x	x	x			x	x		x	x			x		x		x		x	x	x	x	x	x
158		x			x		x	x		x	x	x		x		x	x	x	x			x	x	x
159	x						x	x	x		x			x		x		x	x	x				x
241		x		x	x			x		x				x			x	x	x	x		x		x
242				x				x		x				x	x				x				x	x
243	x	x			x	x		x	x				x	x		x	x	x	x	x		x	x	x
244		x				x		x		x	x	x		x			x		x	x	x	x	x	x
245	x	x							x					x					x	x		x		
246		x		x		x		x		x		x	x	x			x	x	x	x	x	x	x	x
247	x		x	x				x						x		x	x	x	x	x		x	x	
341		x				x		x	x	x		x		x	x		x	x				x	x	
342		x	x		x			x		x				x			x		x			x		x
343		x		x	x			x						x		x	x		x	x		x	x	
521		x	x				x	x		x	x	x	x	x		x	x	x	x	x		x		
522				x			x	x		x	x			x		x	x	x	x	x	x	x	x	
523	x	x	x	x		x	x	x	x	x	x		x	x					x	x		x		
524		x			x		x	x		x	x	x	x	x		x			x	x		x		x
525						x		x		x	x		x		x	x			x	x	x	x	x	x
526				x		x		x	x		x	x	x	x			x	x	x	x	x		x	x
527		x		x	x	x			x		x			x		x	x	x	x	x		x	x	
642		x			x	x				x	x		x			x	x		x	x		x	x	x
701							x	x	x	x			x	x		x			x	x			x	
702	x		x		x	x	x	x		x	x	x	x	x		x	x		x	x				x
703	x	x			x		x		x		x		x			x		x	x	x		x		
Total	14	20	6	14	13	12	12	23	11	21	17	10	15	24	5	18	20	15	29	24	9	21	19	0

have a sectorial component, being it more important for services (see the previous Table), long-term PCM increases do not prevail in services with respect to manufacturing industries, signalling that dynamic efficiency gains (potentially explaining the long-term PCM changes) operate throughout industries and countries in Europe.

Given the importance of these adjustments for the process of economic integration, in the follow-up of the section we will discuss in some detail the results of this screening test for three selected NACE 3-digit industries.

7.1.3 PCM persistence

As a final benchmark of product market functioning, we have tested whether the PCM in a given industry/country has displayed a persistent behaviour, i.e. it has remained above a certain threshold with respect to the country average over the considered period. In particular, we have selected those industries whose PCMs, in the year 2000, were one standard deviation above the country average PCM, and that have remained such in the year 2007[36]. Interestingly, we have detected very few cases of such persistency, mostly concentrated in Romania, as displayed in Table 23.

Table 23: PCM persistence

Nace 3-digits	BE	DE	ES	FR	IT	PL	RO	SE	Total
151									0
152									0
153									0
154									0
155									0
156				X					1
157				X					1
158									0
159									0
241		X							1
242									0
243									0
244									0
245									0
246									0
247									0
341							X		1
342				X					1
343									0
521									0
522									0
523									0
524									0
525									0
526									0
527									0
642							X		1
701							X		1
702							X		1
703									0
Tot by country	0	1	0	3	0	0	4	0	8

When combining the information reported above with our screening of competition dynamics, however, none of the industries displaying persistence in PCM appear as problematic. The latter clearly depends on the fact that our indicators are able to detect changes in the relationship between profits and costs, and therefore might not react to a situation in which PCM remain persistently higher over time. Clearly, such a persistency might depend on problems in terms of competition, in this case not necessarily captured by our previous analysis.

7.2 A pilot analysis of industries: introduction

In what follows, we deepen our analysis of product market functioning by selecting three Pilot industries, comparing all the relevant information we have gathered in the study, and adding as

[36] Note that now the benchmark is the country average across industries. It was the EU industry average across countries when analysing PCM divergence.

well some more traditional measures of competition such as the Herfindahl index. In particular, we first present the PCM distribution of the industry across the eight countries, for 2000 and 2007. We then report for every year and every country the PCM decompositions, with the interaction term divided into four addenda, in order to emphasize the relative contribution of the addendum in which both the changes in PCM and the changes in market share are positive (those cases potentially more detrimental for competition, or in which dynamic efficiency might be at play). Finally, we run our screening tests based on the overall changes in PCM and the analysis of our two competition indicators (profit elasticity and RPD frontier-based), in order to highlight in which country, and according to which indicator the industry might display unclear industrial dynamics, comparing finally these results with the evolution of the Herfindahl index in the same industry.

We believe such a framework of analysis could be usefully employed as a pilot to carry out a synthetic study on the intensity of competition in a given industry, based on firm-level indicators. Of course, working at this level of disaggregation (NACE 3-digit industry in a given country and year) the number of available observations might be reduced for some countries (see the discussion on the validation in Section 2), and thus plotting the entire PCM distribution in a given year might result problematic. Moreover, as already discussed, since 2007 is the last year of our sample we have by definition a zero exit rate, and thus PCM changes for that year might be slightly upward biased.

Nevertheless, also notice that a given NACE 3-digit industry does not correspond to the competition case of 'relevant market', as even at this relatively disaggregated level of analysis we are still pooling together firms operating in very different businesses[37].

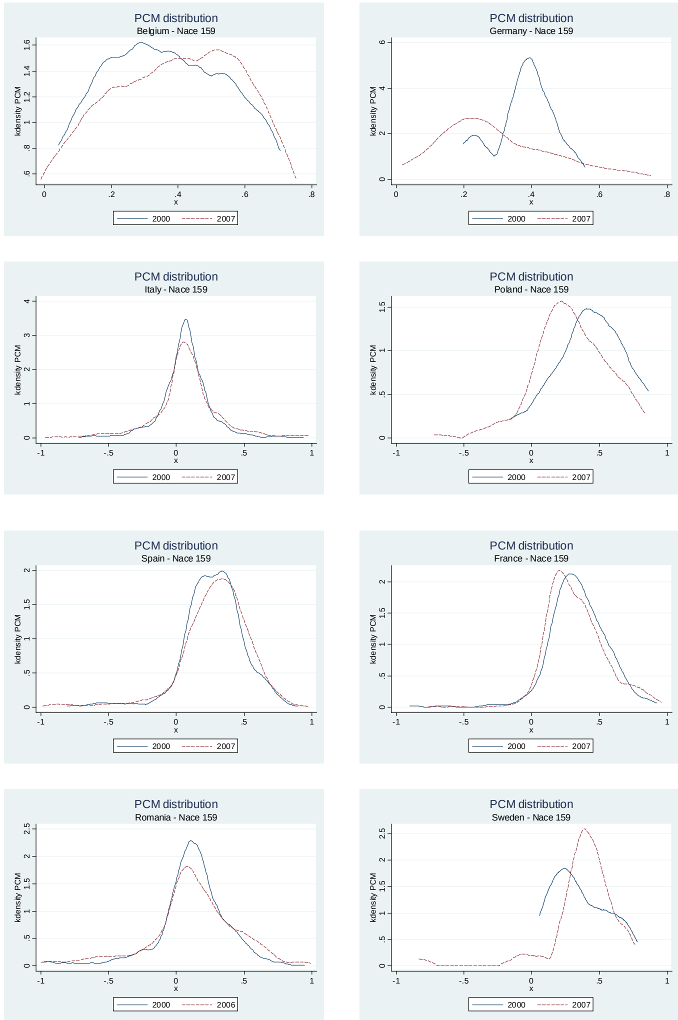
In particular, the industries we have chosen to analyse are the Beverage industry (NACE 159), the Car production industry (NACE 341) and the Distribution of food (NACE 522).

7.3 Pilot study: NACE 159 - Manufacture of beverages

7.3.1 Evolution of PCM distributions across eight countries

At a first glance, the industry does not appear to present many problems of competition: in four countries the density shifts to the left, hinting at pro-competitive dynamics in progress in the industry. In Italy we notice that the distribution is more dispersed while in Belgium, Spain and Sweden the distribution moves towards higher PCM values.

[37] For example, in the beverage industry (NACE 159) we are combining firms operating in the soft drink industry, in the industrial alcohol industry and in the spirits and wine industry.



7.3.2 PCM decomposition

We report the decomposition of the same industry year by year. From column 2 to column 6 we show the addenda of the decomposition already discussed in the previous Sections and reported in the Statistical Annex of the Report.[38] In the last 4 columns we further decompose the interaction term in a term in which both $\Delta PCM < 0$ and $\Delta share < 0$ (column I); a term in which both $\Delta PCM > 0$ and $\Delta share > 0$ (column II); and two cases for the terms $\Delta PCM > / < 0$ and $\Delta share < / > 0$ (column III and IV, respectively). We are particularly interested in Column II, in which both $\Delta PCM > 0$ and $\Delta share > 0$, since if this term is relatively larger with respect to I, III and IV then it would drive the sign of the general interaction term. This would imply that firms with growing mark-ups would become bigger relative to the market, a scenario potentially

[38] Which is available upon request.

indicating competition concerns or, in alternative, an important restructuring of the industry (e.g. changes in the elasticity of substitution of goods). Large values in Column I, instead, could be interpreted as a natural exit process where less efficient firms are losing market shares and thus preparing to exit the market.

Table 24: PCM Decompositions: NACE 159 - Beverages (A)

Belgium										
year	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**	**I**	**II**	**III**	**IV**
2000	0.005136	0.015003	0.000851	0.000749	0.000000	0.021740	0.000215	0.001099	-0.000323	-0.000139
2001	0.036829	-0.046182	-0.013444	0.012390	-0.000497	-0.010903	0.000174	0.000476	-0.000037	-0.014057
2002	0.006100	-0.003469	0.000165	0.001599	0.000000	0.004395	0.000151	0.000482	-0.000273	-0.000196
2003	0.013240	-0.017482	-0.000502	0.017466	0.000000	0.012723	0.000577	0.000567	-0.000053	-0.001592
2004	-0.021106	0.003566	0.000463	-0.000621	0.000000	-0.017698	0.000314	0.001378	-0.000884	-0.000344
2005	0.013283	-0.013382	-0.000644	0.000363	-0.000314	-0.000695	0.000422	0.000339	-0.000189	-0.001217
2006	-0.000920	-0.017228	0.000295	0.009432	0.000022	-0.008400	0.000451	0.000139	-0.000068	-0.000227
2007	-0.004992	-0.003820	0.004440	0.000204	0.000000	-0.004169	0.004222	0.000460	-0.000204	-0.000038
Germany										
year	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**	**I**	**II**	**III**	**IV**
2000	0.020975	-0.117411	-0.001679	0.113206	0.000000	0.015091	0.002340	0.000000	.	-0.004019
2001	0.038945	-0.188276	-0.021069	0.069877	0.000000	-0.100523	0.003018	0.000276	.	-0.024363
2002	-0.011783	-0.091586	0.005040	0.094604	-0.013885	-0.017610	0.006836	0.000165	-0.000019	-0.001943
2003	0.008205	-0.042523	-0.000914	0.105305	-0.002961	0.067113	0.000672	0.000762	-0.000460	-0.001887
2004	-0.028329	-0.084890	0.012533	0.041698	-0.002943	-0.061931	0.013999	0.000026	-0.000071	-0.001421
2005	0.014207	-0.069437	-0.003092	0.082397	-0.001815	0.022261	0.002208	0.000699	-0.000210	-0.005789
2006	-0.011002	0.003675	0.009972	0.028588	-0.046919	-0.015687	0.009723	0.001437	-0.001043	-0.000145
2007	-0.003422	0.049850	-0.002227	0.011318	0.000000	0.055519	.	0.001058	-0.003284	0.000000
Spain										
year	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**	**I**	**II**	**III**	**IV**
2000	0.002222	0.010684	0.001370	0.016428	0.000000	0.030704	.	0.008624	-0.029241	-0.016658
2001	-0.002245	-0.035526	0.004061	0.021523	-0.000001	-0.012189	0.006860	0.001640	-0.000624	-0.003814
2002	-0.002766	0.000338	-0.001301	0.003889	-0.000022	0.000138	0.002866	0.001673	-0.000519	-0.001578
2003	0.009527	-0.000414	0.001448	0.002644	0.000010	0.013213	0.002015	0.001911	-0.001219	-0.001259
2004	0.001911	0.016346	-0.000809	0.008535	0.000019	0.026001	0.001506	0.001349	-0.002754	-0.000910
2005	-0.003057	-0.025036	0.002908	0.002771	0.000020	-0.022394	0.004093	0.001144	-0.000670	-0.001659
2006	0.027596	0.014912	-0.005852	0.001294	-0.004089	0.033860	0.000651	0.004351	-0.002717	-0.008137
2007	-0.004009	0.018704	0.001473	0.006727	0.000000	0.022895	0.001498	0.002093	-0.001383	-0.000735
France										
year	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**	**I**	**II**	**III**	**IV**
2000	-0.014729	-0.026977	0.001171	0.023777	0.000000	-0.016758	0.003709	0.000310	-0.000837	-0.002010
2001	0.006189	-0.027925	0.001654	0.030585	0.000000	0.010503	0.003140	0.001018	-0.001066	-0.001437
2002	0.023027	-0.063897	-0.001338	0.020259	0.000000	-0.021948	0.002017	0.000914	-0.000438	-0.003830
2003	-0.011715	-0.004382	0.003687	0.011051	-0.000051	-0.001409	0.005939	0.001499	-0.002019	-0.001731
2004	0.004516	-0.010993	0.001985	0.002223	-0.000003	-0.002273	0.002242	0.001619	-0.000781	-0.001094
2005	-0.002144	-0.014657	0.002428	0.009110	-0.000266	-0.005529	0.003180	0.001717	-0.000482	-0.001987
2006	0.001350	0.002231	0.001729	0.002892	-0.019465	-0.011263	0.002485	0.001779	-0.001343	-0.001191
2007	-0.005584	0.016336	0.001161	0.003101	0.000000	0.015014	0.000757	0.002612	-0.001710	-0.000499

Looking at our decompositions, as expected we find a certain degree of heterogeneity across the analysed countries. Among the countries that display an increase in the PCM distribution, we see that competition in Belgium should not be an issue, as aggregate PCM is always declining after 2003. In Spain, instead, with the exception of 2001 and 2005, the aggregate PCM is always increasing and the same positive trend is shown by the within, reallocation and interaction components. Moreover, while in the early years of our analysis the positive sign of the interaction term is driven by Column I ($\Delta PCM < 0$ & $\Delta share < 0$), in 2006/2007 we have that Column II ($\Delta PCM > 0$ & $\Delta share > 0$) becomes dominant, thus indicating a potential problem in terms of competition.

Table 25: PCM Decompositions: NACE 159 - Beverages (B)

Italy										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
1999	0.007665	-0.037027	0.010860	0.021917	-0.002192	0.001223	0.007982	0.009108	-0.000059	-0.006171
2000	-0.015034	-0.004700	0.007864	0.001485	0.000204	-0.010181	0.005516	0.004906	-0.001156	-0.001402
2001	0.008873	0.011030	-0.002284	-0.000561	-0.000036	0.017022	0.010519	0.011218	-0.005344	-0.018678
2002	-0.030704	-0.046878	0.039102	0.001157	0.000192	-0.037130	0.026729	0.016403	-0.001202	-0.002828
2003	-3.427767	-0.003973	3.465876	0.000668	-0.000276	0.034529	3.447372	0.024407	-0.001576	-0.004327
2004	0.005176	-0.017506	0.004471	0.006508	-0.004156	-0.005507	0.006292	0.003817	-0.000728	-0.004911
2005	-0.007487	-0.005702	0.014289	-0.000226	-0.028754	-0.027879	0.003548	0.015012	-0.002410	-0.001861
2006	-0.008243	-0.034934	0.051274	0.000987	-0.021177	-0.012094	0.010335	0.044694	-0.002896	-0.000860
2007	-0.017705	-0.284791	0.303477	0.002913	0.000000	0.003894	0.016930	0.291040	-0.002470	-0.002023
Poland										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.003954	0.046984	-0.000759	0.003429	0.000000	0.045700	-0.000759	0.000816	0.001204	-0.002779
2001	0.000065	0.000651	-0.000130	0.001905	0.000000	0.002491	0.002142	0.001454	-0.000398	-0.000130
2002	-0.000035	-0.054328	-0.000983	0.004053	0.000071	-0.051221	0.001185	0.000059	-0.000302	-0.000983
2003	-0.007836	-0.013462	-0.001232	0.013239	0.000000	-0.009291	0.000854	0.001895	0.000396	-0.000204
2004	-0.002463	0.001640	-0.000484	0.000061	0.000000	-0.001246	-0.000163	0.000400	0.000235	-0.000313
2005	0.004600	0.037959	-0.000059	0.002126	-0.003629	0.040998	0.002291	0.001422	0.001294	-0.000365
2006	-0.000089	0.044353	0.000695	0.004183	-0.141403	-0.092261	0.000409	0.001019	-0.000715	-0.000018
2007	-0.004108	0.038820	-0.000181	0.000739	0.000000	0.035271	0.000941	0.000901	0.001031	-0.000810
Romania										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	0.002161	0.010419	0.008402	0.003538	0.000000	0.024520	0.008164	0.009848	-0.003461	-0.006149
2001	0.003660	-0.074440	0.003634	0.114144	-0.000154	0.046844	0.014364	0.002177	-0.000305	-0.012601
2002	0.036104	0.001400	0.004785	0.001298	-0.000098	0.043489	0.005646	0.008655	-0.002698	-0.006818
2003	-0.008922	-0.002330	0.007670	0.001035	0.000037	-0.002510	0.008511	0.005087	-0.002572	-0.003356
2004	0.021204	-0.014651	0.008484	0.000205	-0.000089	0.015154	0.007759	0.006962	-0.001934	-0.004304
2005	0.042599	0.004218	0.002358	0.001264	-0.000708	0.049732	0.004009	0.005185	-0.000704	-0.006132
2006	-0.032761	-0.005933	0.006669	0.000275	-0.011454	-0.043205	0.008749	0.005984	-0.005051	-0.003013
2007	0.172086	0.019586	0.016637	0.000327	0.000000	0.208636	0.002490	0.029995	-0.000598	-0.015250
Sweden										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.012406	0.024754	-0.001507	0.000054	0.000000	0.010895	0.000252	0.000004	-0.001586	-0.000177
2001	0.024300	0.005195	0.000931	0.000005	0.000000	0.030430	0.000197	0.000969	-0.000005	-0.000230
2002	-0.019992	0.051395	-0.004555	0.000276	0.000000	0.027124	0.000060	0.000042	-0.004076	-0.000581
2003	-0.011829	0.004909	-0.000363	0.000000	0.000000	-0.007282	0.000027	0.000222	-0.000417	-0.000194
2004	-0.004813	-0.000304	-0.000195	0.000000	0.000000	-0.005312	0.000019	0.000018	-0.000085	-0.000147
2005	-0.004839	0.011629	-0.000077	0.000000	0.000000	0.006713	0.000067	0.000212	-0.000328	-0.000028
2006	-0.001046	-0.015492	-0.000116	0.000000	0.000000	-0.016654	0.000040	0.000100	-0.000222	-0.000033
2007	0.002821	0.010309	0.000816	0.000031	0.000000	0.013978	0.000186	0.000773	-0.000040	-0.000102

7.3.3 Screening test and market structure

In the first part of this Section we have discussed a methodology to screen the intensity of competition across industries on the basis of criteria based on the PCM evolution (long-run changes) and two indicators of competition dynamics, the profit elasticity to costs, and the relative profit difference (based on the measurement of the efficiency frontier). We report here the results of the screening test across countries, and we compare these results with the evolution of the Herfindahl-Hirschman Index, calculated using the concentration of market shares of the same firms, in order to have a feeling of the evolution of the market structure in the chosen industry.

Table 26: Screening test: NACE 159 - Beverages

Nace 3-digits	BE			DE			ES			FR			IT			PL			RO			SE		
	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD
159	1						1	1	1		1			1		1		1	1	1				1

Our screening test signals Spain as a problematic country as far as the Beverage industry is concerned, a finding consistent with the previous analysis. Also the HHI for the sector is

Table 27: Herfindahl-Hirschman Index NACE 159

NACE 159								
Herfindahl-Hirschman Index								
year	BE	DE	ES	FR	IT	PL	RO	SE
1999	0.10789	0.389396	0.024658	0.03652	0.023381	0.07639	0.056369	0.218732
2000	0.11927	0.273492	0.028534	0.033177	0.024248	0.079479	0.065125	0.228458
2001	0.098729	0.107356	0.027753	0.031718	0.019694	0.087389	0.068446	0.245761
2002	0.102357	0.121975	0.027934	0.022771	0.015404	0.082237	0.065817	0.292719
2003	0.10733	0.071496	0.02821	0.024876	0.02136	0.076419	0.065935	0.293192
2004	0.113586	0.051249	0.027499	0.023843	0.021059	0.080977	0.066191	0.292732
2005	0.107568	0.032334	0.027547	0.024684	0.020475	0.087292	0.069585	0.295961
2006	0.10078	0.036328	0.027215	0.026204	0.01816	0.070406	0.078773	0.281148
2007	0.104624	0.060762	0.02984	0.0279	0.015413	0.085446	0.096167	0.281915

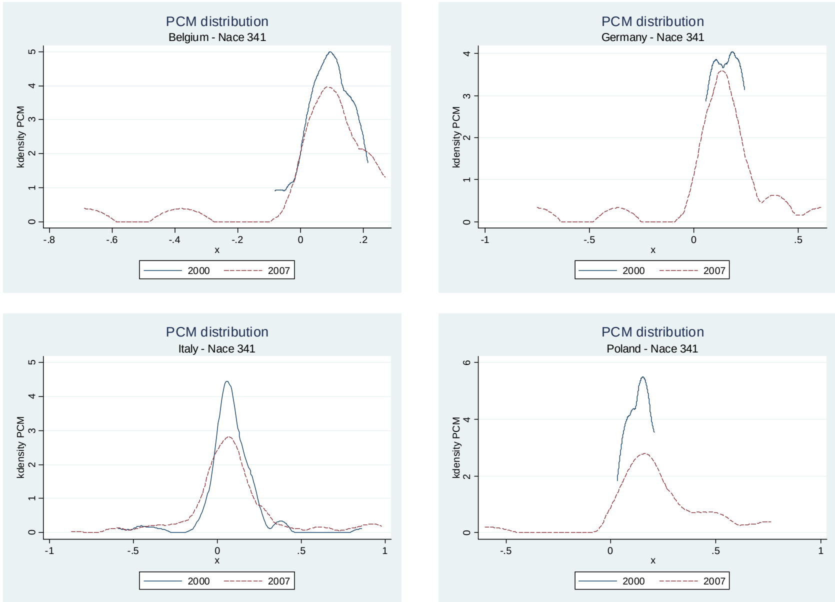
increasing in Spain, hinting a possible rise in the concentration of the industry. However, the increasing trend in the HHI is not peculiar of Spain, but rather it is found in almost all the other countries, a finding which, in a sense, confirms the limitedness of synthetic indicators of competition in retrieving the full spectrum of firm dynamics.

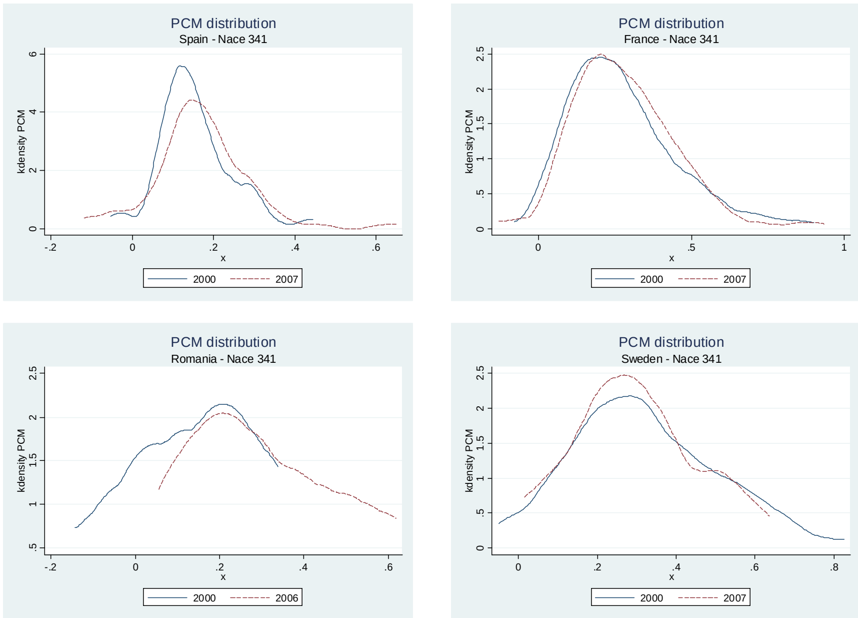
It then follows that profitability in the Spain beverage industry is rising, while the market becomes more concentrated. Clearly, to jump from here to the conclusion that in Spain there are competition problems in the beverage industry is not appropriate, as the same industry is composed of many different 'relevant markets' which we are not exploring in details here (see Section 9 to that extent). However, it would be interesting to analyse the reasons which are leading to these peculiar industrial dynamics (possibly induced by the restructuring of the industry along large distribution chains), which differ from those we observe in the other European countries included in the study.

7.4 Pilot study: NACE 341 - Manufacture of motor vehicles

7.4.1 Evolution in PCM distributions across eight countries

The analysis of the density functions of this specific industry is not very informative, due to the small number of active firms, as reported in the validation previously discussed. We can however notice a general increased dispersion in the PCM distribution, and signal that the Spanish, French and Romanian densities shift to the right.





7.4.2 PCM decomposition

When looking at the decompositions for the Car industry, we find that the PCM is almost always increasing in the latest years. This positive feature is coupled with a positive interaction term, essentially driven by our Column II, in Germany, Italy and Spain, a fact that suggests the presence of relevant industrial dynamics.

Table 28: PCM Decompositions: NACE 341 - Car Production (A)

Belgium										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.001578	-0.005738	0.000868	0.000000	0.000000	-0.006447	0.000728	0.001572	-0.000944	-0.000488
2001	-0.011489	-0.001582	0.000798	0.000133	0.000000	-0.012141	0.001235	0.001113	-0.001144	-0.000406
2002	-0.010634	0.001194	0.000680	0.000000	0.000000	-0.008759	0.002744	0.000292	-0.001353	-0.001003
2003	-0.001236	-0.003326	0.002553	0.001337	0.000000	-0.000672	0.001998	0.001081	-0.000363	-0.000162
2004	0.008009	-0.003115	0.001457	0.000000	0.000000	0.006351	0.000225	0.001849	-0.000003	-0.000614
2005	-0.000145	-0.000370	0.000390	0.000000	0.000000	-0.000125	0.000234	0.000390	-0.000060	-0.000173
2006	-0.005534	0.003161	0.000057	0.000000	0.000000	-0.002315	0.000437	0.000301	-0.000645	-0.000035
2007	-0.076838	0.008281	0.044963	0.000000	0.000000	-0.023595	0.043933	0.001974	-0.000873	-0.000071
Germany										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.006889	-0.003493	0.000184	0.003021	0.000000	-0.007177	0.000445	0.000000	-0.000262	0.000000
2001	0.000403	0.000260	0.000770	0.005328	0.000000	0.006760	0.000408	0.000362	.	0.000000
2002	0.002240	0.002601	0.000382	0.000073	0.000000	0.005296	0.000013	0.000490	-0.000045	-0.000076
2003	-0.012614	0.004113	0.000275	0.000433	0.000000	-0.007793	0.000324	0.000424	-0.000474	0.000000
2004	-0.001129	0.000503	-0.000263	0.000004	0.000000	-0.000884	0.000066	0.000066	-0.000161	-0.000233
2005	0.000790	-0.000707	0.000620	0.000056	-0.000039	0.000720	0.000419	0.000210	-0.000005	-0.000003
2006	0.009209	0.018635	0.002738	0.000154	-0.001431	0.029305	0.000000	0.002879	-0.000140	0.000000
2007	0.000632	0.000598	0.000000	0.000000	0.000000	0.001230	0.000093	0.000022	-0.000019	-0.000096
Spain										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.022646	0.001021	0.000694	0.000004	0.000000	-0.020927	0.002816	0.004371	-0.000547	-0.001893
2001	-0.011185	0.000003	-0.000165	0.000181	0.000000	-0.011166	0.000451	0.000010	-0.000404	-0.000222
2002	0.007303	0.013631	0.001167	0.000001	0.000000	0.022102	0.002182	0.013024	-0.000541	-0.001589
2003	0.011930	-0.027174	-0.002786	0.012379	0.000000	-0.005650	0.000141	0.000043	-0.000003	-0.002967
2004	-0.007796	-0.000188	0.000195	0.000016	0.000000	-0.007773	0.000410	0.000015	-0.000069	-0.000161
2005	0.000348	-0.004741	0.000445	0.006023	0.000001	0.002075	0.000347	0.000295	-0.000012	-0.000186
2006	0.001443	-0.003092	0.002266	0.000001	-0.000008	0.000609	0.000707	0.001716	-0.000007	-0.000151
2007	0.004584	0.026610	0.000241	0.000002	0.000000	0.031437	0.000026	0.001408	-0.000737	-0.000456
France										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	0.001883	0.000109	0.000016	0.000331	0.000000	0.002339	0.000017	0.000023	-0.000004	-0.000020
2001	0.000903	0.002937	-0.000021	0.000494	0.000000	0.004314	0.000025	0.000064	-0.000022	-0.000087
2002	0.000265	-0.012584	0.000174	0.000065	0.000000	-0.012080	0.000192	0.000141	-0.000001	-0.000158
2003	-0.001168	-0.000645	0.000181	0.000060	0.000000	-0.001572	0.000103	0.000126	-0.000005	-0.000043
2004	0.003129	0.004968	-0.000017	0.000093	0.000000	0.008173	0.000019	0.000135	-0.000056	-0.000114
2005	-0.009846	0.003604	-0.000398	0.000004	0.000000	-0.006637	0.000033	0.000028	-0.000456	-0.000004
2006	-0.004739	0.001603	-0.000027	0.000011	-0.000029	-0.003181	0.000049	0.000179	-0.000238	-0.000016
2007	-0.015721	0.002484	-0.000367	0.000000	0.000000	-0.013605	0.000067	0.000012	-0.000446	-0.000001

7.4.3 Screening test and market structure

Reporting the results of our screening test for the intensity of competition for the car industry, we do not detect industries in which all our indicators raise attention, although we see that in those countries where the interaction term of the PCM tends to be positive due to an increase in margins associated with an increase in market shares (Germany, Italy and Spain) also the RPD signals that profits are becoming less responsive to efficiency. Clearly, one should investigate whether this is a result of true competition problems, or rather a phenomenon in which relatively less efficient firms are changing their product mix towards segments of the market characterized by higher value-added (e.g. ‘clean’ cars) and thus higher margins.

When we compare this information with the HHI, we notice that in Spain and Sweden the concentration is mildly increasing, while in Italy we assist to a quite dramatic rise of the concentration in the last years. Finally, in Germany the index is decreasing. Once again, the dynamics of this index seem to be partly not correlated with the detected evolution of industrial dynamics.

Table 29: PCM Decompositions: NACE 341 - Car Production (B)

Italy										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
1999	-0.003243	-0.002260	0.001875	0.001195	-0.000198	-0.002631	0.002442	0.001072	-0.000343	-0.001296
2000	-0.012749	-0.037118	0.006999	-0.008158	-0.000031	-0.051056	0.008919	0.000283	.	-0.002203
2001	-0.022437	-0.007010	-0.004827	-0.000114	-0.000020	-0.034408	0.002302	0.000114	-0.005788	-0.001455
2002	-0.003577	-0.000138	0.001486	0.000045	0.000000	-0.002184	0.000622	0.001216	-0.000170	-0.000182
2003	0.003790	0.004463	-0.000845	0.025887	0.000029	0.033324	0.001425	0.000178	-0.000218	-0.002231
2004	0.017121	-0.001337	0.002331	0.000569	-0.000299	0.018385	0.000595	0.003589	-0.000207	-0.001647
2005	-0.003348	0.000319	0.000425	0.003767	-0.030261	-0.029097	0.000558	0.002498	-0.002606	-0.000025
2006	0.015591	-0.003704	0.007630	-0.000007	-0.000051	0.019459	0.003145	0.005215	-0.000497	-0.000232
2007	0.009205	-0.077576	0.085723	-0.000038	0.000000	0.017313	0.006066	0.080446	-0.000508	-0.000281
Poland										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.002427	0.006878	-0.000002	0.000863	0.000000	0.005313	-0.000728	.	0.000000	-0.000727
2001	-0.011126	-0.014815	-0.000534	0.000373	0.000000	-0.026102	0.003531	0.004001	-0.000251	-0.000534
2002	0.017469	-0.000324	-0.001245	0.000000	0.000000	0.015899	.	0.000418	-0.000140	-0.001245
2003	-0.016887	0.025134	-0.000118	0.000420	0.000000	0.008549	-0.006398	0.000025	0.001721	-0.008025
2004	-0.018849	0.006034	-0.000205	0.000118	0.000000	-0.012902	-0.003820	0.000654	0.000066	-0.004335
2005	0.004165	-0.004548	-0.001085	0.002149	0.000000	0.000681	-0.001293	0.000031	0.000078	-0.000317
2006	-0.009347	0.004361	0.000264	0.000254	-0.000488	-0.004956	0.000407	0.001011	-0.001144	-0.000010
2007	0.001742	0.003295	-0.000194	0.000069	0.000000	0.004912	0.000191	0.000173	0.000254	-0.000041
Romania										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.109745	-0.013348	0.003765	0.000000	0.000000	-0.119327	0.005270	0.000004	-0.001509	0.000000
2001	0.101445	0.005951	0.004281	0.001373	0.000000	0.113050	0.003451	0.001139	-0.000309	.
2002	-0.107869	-0.020780	0.014159	0.000000	0.000000	-0.114489	0.006874	0.007578	-0.000207	-0.000085
2003	-0.059655	0.039868	-0.119827	0.000000	0.000000	-0.139614	.	0.012200	-0.132027	.
2004	0.179400	0.114247	-0.152921	0.000008	0.000000	0.140734	0.042933	0.000000	.	-0.195853
2005	-0.006490	0.039742	-0.037808	0.003058	-0.000008	-0.001505	.	0.020956	-0.058764	.
2006	0.127175	-0.008355	-0.089530	0.000000	-0.000052	0.029238	0.004468	0.000000	.	-0.093998
2007	0.088945	0.003978	-0.018847	0.000577	0.000000	0.074653	0.000222	0.007505	-0.000085	-0.026489
Sweden										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.000008	0.000080	0.000001	0.000026	0.000000	0.000099	0.000002	0.000020	-0.000014	-0.000006
2001	-0.000085	0.000072	0.000026	0.000004	0.000000	0.000016	0.000035	0.000004	-0.000011	-0.000002
2002	0.000139	-0.000057	0.000098	0.000000	-0.000001	0.000178	0.000001	0.000133	-0.000005	-0.000031
2003	-0.000218	-0.000172	0.000168	0.000005	0.000000	-0.000217	0.000175	0.000001	-0.000003	-0.000005
2004	0.000008	-0.000015	0.000075	0.000002	0.000000	0.000069	0.000025	0.000066	-0.000012	-0.000004
2005	-0.000074	0.000191	0.000144	0.000172	0.000000	0.000434	0.000044	0.000108	-0.000005	-0.000002
2006	-0.000074	0.004055	-0.000879	0.000030	0.000000	0.003132	0.000004	0.000008	-0.000891	0.000000
2007	0.000093	0.000394	0.000112	0.000005	0.000000	0.000603	0.000014	0.000113	-0.000003	-0.000013

Table 30: Screening test: NACE 341- Car Production

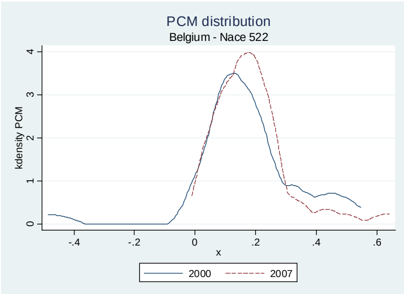
Nace 3-digits	BE			DE			ES			FR			IT			PL			RO			SE		
	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD
341		1				1		1	1	1		1		1	1		1	1				1	1	

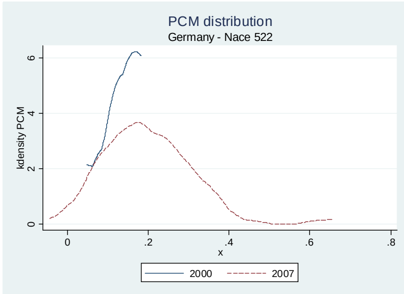
Table 31: Herfindahl-Hirschman Index NACE 341

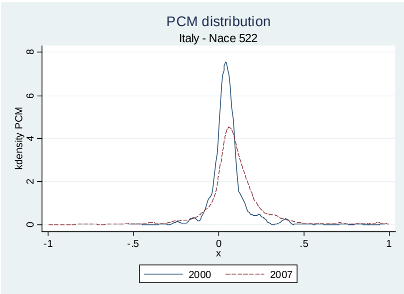
NACE 341								
Herfindahl-Hirschman Index								
year	BE	DE	ES	FR	IT	PL	RO	SE
1999	0.17426	0.391262	0.139236	0.230748	0.147343	0.233299	0.675084	0.259204
2000	0.175693	0.350931	0.134902	0.224932	0.281398	0.217308	0.652253	0.268063
2001	0.173803	0.297457	0.134679	0.218711	0.415075	0.162834	0.653679	0.28914
2002	0.169942	0.290771	0.159219	0.179126	0.401734	0.166653	0.614771	0.266726
2003	0.164019	0.280866	0.123933	0.173941	0.318877	0.161635	0.399494	0.269482
2004	0.186479	0.281255	0.123032	0.186018	0.270017	0.167809	0.795637	0.25941
2005	0.195391	0.280899	0.112622	0.189054	0.311945	0.156529	0.658976	0.255866
2006	0.179039	0.263006	0.128131	0.187151	0.384131	0.1459	0.57738	0.287092
2007	0.185277	0.261196	0.161285	0.196772	0.415427	0.147246	0.728378	0.284861

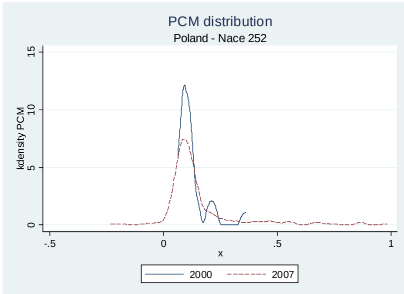
7.5 Pilot study: NACE 522 - Retail sale of food in specialized stores

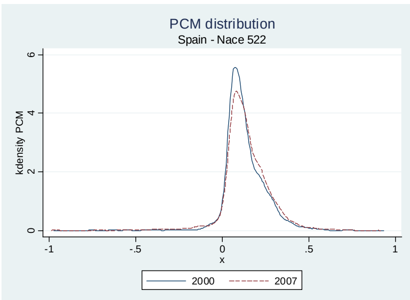
7.5.1 Evolution in PCM distributions across eight countries

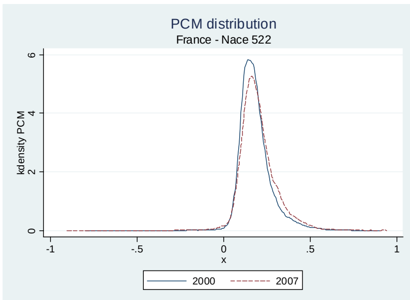


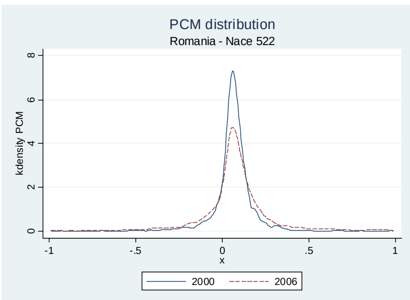


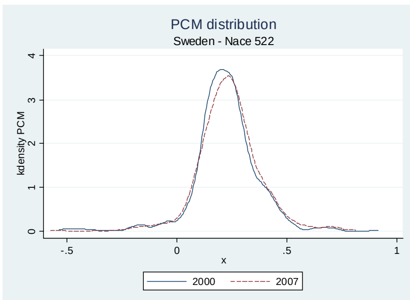












Like in the previous industries considered, the distributions tend to become more dispersed across countries, and, generally, the right tail becomes longer. Countries in which the PCM does not decrease over time in the retail of food and beverage sector are Belgium, Germany, Italy, Poland and Sweden.

7.5.2 PCM decomposition

In the following Table we report the PCM decompositions for the considered countries

Table 32: PCM Decompositions: NACE 522 - Food Distribution (A)

Belgium										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	0.013685	0.001490	0.002504	0.000546	0.000000	0.018225	0.000712	0.001960	-0.000049	-0.000118
2001	-0.003687	0.001951	0.002545	0.001227	0.000000	0.002036	0.002964	0.000577	-0.000518	-0.000479
2002	-0.000430	0.009576	-0.003076	0.000203	-0.003345	0.002929	0.000079	0.001238	-0.003134	-0.001258
2003	0.003794	-0.024010	-0.002315	0.001914	-0.002415	-0.023031	0.001700	0.000000	-0.001371	-0.002644
2004	-0.005259	-0.031272	0.000688	0.006944	0.000000	-0.028899	0.001308	0.000022	-0.000007	-0.000635
2005	0.002730	-0.011728	-0.003800	0.004467	-0.000888	-0.009219	0.000473	0.000633	-0.003908	-0.000998
2006	-0.009694	0.001326	0.010212	0.001704	-0.024887	-0.021339	0.008163	0.002535	-0.000396	-0.000089
2007	0.004830	0.000477	0.001449	0.000346	0.000000	0.007101	0.001372	0.000594	-0.000411	-0.000107
Germany										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	0.015106	-0.003695	-0.002995	0.016816	0.000000	0.025232	0.000455	0.000000	.	-0.003450
2001	0.052756	-0.092998	-0.047391	0.047608	0.000000	-0.040025	0.002635	0.000000	.	-0.050025
2002	0.002068	-0.045067	-0.001666	0.195668	-0.000425	0.150578	0.001503	0.000000	.	-0.003170
2003	-0.008017	-0.061589	0.003251	0.061450	-0.006167	-0.011071	0.003640	0.000187	.	-0.000576
2004	0.004569	-0.066910	-0.001684	0.020269	-0.001964	-0.045720	0.001225	0.000056	-0.000034	-0.002931
2005	-0.006103	-0.026632	0.000959	0.042607	-0.008933	0.001898	0.001970	0.000147	-0.000060	-0.001099
2006	0.001823	-0.003304	0.000349	0.028349	-0.021732	0.005485	0.000289	0.000437	-0.000111	-0.000265
2007	-0.000967	0.041258	0.004687	0.006739	0.000000	0.051717	0.002561	0.003201	-0.001076	0.000000
Spain										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.000368	-0.005581	0.001154	0.008766	0.000000	0.003971	0.002772	0.001182	-0.000916	-0.002002
2001	0.002051	-0.012728	-0.000155	0.015438	-0.000029	0.004577	0.001842	0.001341	-0.001576	-0.001763
2002	0.001196	-0.005901	0.000352	0.006005	-0.000165	0.001487	0.001114	0.001922	-0.001506	-0.002680
2003	0.005842	-0.002394	0.001298	0.005102	-0.000073	0.009775	0.002119	0.002466	-0.001019	-0.002268
2004	-0.012881	-0.009782	0.004878	0.009239	-0.000123	-0.008668	0.005972	0.001690	-0.001021	-0.001763
2005	-0.002149	0.011624	-0.003175	0.002842	0.007009	0.016151	0.001460	0.001913	-0.005383	-0.001164
2006	0.001572	-0.001535	0.001849	0.003105	-0.008252	-0.003260	0.001998	0.002347	-0.001094	-0.001401
2007	0.000785	0.015005	0.001835	0.001451	0.000000	0.019075	0.001380	0.003039	-0.001858	-0.000726
France										
year	Within	Reallocation	Interaction	Entry	Exit	Aggregate	I	II	III	IV
2000	-0.000149	-0.030326	0.000048	0.029510	0.000000	-0.000918	0.002091	0.000436	-0.000373	-0.002107
2001	0.005859	-0.009433	-0.000644	0.009305	-0.000104	0.004984	0.000952	0.000855	-0.000726	-0.001725
2002	0.005579	-0.006195	0.000778	0.007649	-0.000025	0.007787	0.001106	0.001731	-0.000483	-0.001577
2003	-0.002748	-0.014698	0.001003	0.012888	-0.000040	-0.003595	0.001678	0.000906	-0.000507	-0.001074
2004	-0.001532	-0.006954	0.000618	0.009925	-0.000019	0.002037	0.001299	0.000764	-0.000511	-0.000934
2005	-0.001329	-0.009647	0.000379	0.009019	-0.000407	-0.001984	0.001241	0.000904	-0.000626	-0.001139
2006	-0.001625	-0.000879	0.000868	0.010628	-0.010269	-0.001277	0.001771	0.001001	-0.000823	-0.001082
2007	0.001540	0.000354	0.001196	0.010514	0.000000	0.013604	0.001119	0.001924	-0.000806	-0.001041

When looking at the decompositions we find that only the Belgian figures of PCM are steadily decreasing after 2002. In other countries the trend is unclear, although there seems to be a certain persistence for positive values in Germany, Poland, Romania and Sweden. In Romania in particular the Column II component of the interaction terms seem to play a significant role, while in Poland and Sweden, instead, even in the presence of positive aggregate PCM, the overall interaction term is negative.

7.5.3 Screening test and market structure

The screening test confirms that Poland and Romania are actually displaying industrial dynamics which should be checked in light of their potentially anti-competitive evolution over time, while two out of three indicators are relevant also for Sweden.

Once again the HHI behaves differently across countries: it displays decreasing figures for Germany, France, Poland and Sweden, it is very volatile in Belgium, it remains almost constant

Table 33: PCM Decompositions: NACE 522 - Food Distribution (B)

Italy										
year	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**	**I**	**II**	**III**	**IV**
1999	0.028349	0.003865	-0.031038	0.006786	-0.001722	0.006241	0.002031	0.003001	-0.002014	-0.034056
2000	0.005085	-0.015545	-0.000689	0.000968	-0.001185	-0.011366	0.005802	0.003931	-0.000357	-0.010065
2001	-0.014319	-0.001162	0.020250	0.002521	-0.000277	0.007013	0.021546	0.004479	-0.001596	-0.004179
2002	-0.000481	-0.016721	0.001862	0.006852	-0.000108	-0.008596	0.003705	0.004317	-0.002805	-0.003356
2003	-0.013959	-0.000743	0.018380	0.000485	-0.000510	0.003653	0.018987	0.002933	-0.001307	-0.002234
2004	0.010951	-0.009438	0.003285	0.010856	-0.008481	0.007172	0.003308	0.005093	-0.001579	-0.003538
2005	-0.009208	-0.002596	0.008225	0.000017	-0.000980	-0.004541	0.010903	0.002911	-0.001804	-0.003785
2006	-0.000005	0.000877	0.004927	0.003593	-0.029245	-0.019854	0.003735	0.006126	-0.002562	-0.002372
2007	0.003120	-0.008117	0.007825	0.002175	0.000000	0.005003	0.004092	0.008994	-0.002962	-0.002299
Poland										
year	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**	**I**	**II**	**III**	**IV**
2000	0.001313	-0.006314	-0.000486	0.075711	0.000000	0.070223	-0.000486	.	0.000000	.
2001	0.008237	-0.010887	-0.001187	0.007896	-0.000214	0.003845	0.000275	0.000119	-0.000961	-0.002147
2002	0.011449	-0.001728	-0.000906	0.005925	0.000000	0.014739	0.000125	0.000538	-0.000610	-0.000906
2003	0.005809	0.000656	-0.000462	0.002627	0.000000	0.008629	-0.000032	0.000612	0.000112	-0.000293
2004	0.011635	-0.012843	-0.002554	0.004741	0.000000	0.000980	-0.002574	0.000104	0.000006	-0.000130
2005	-0.005901	0.013857	-0.000354	0.004041	0.000000	0.011644	-0.008323	0.000374	0.000193	-0.008536
2006	0.007306	-0.019292	-0.002117	0.012006	-0.001902	-0.003999	0.000263	0.000006	-0.000163	-0.002223
2007	0.002416	0.001530	-0.000776	0.010857	0.000000	0.014027	0.000018	0.000755	0.000164	-0.000125
Romania										
year	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**	**I**	**II**	**III**	**IV**
2000	-0.011652	0.003349	-0.002234	0.002856	0.000000	-0.007681	0.004923	0.002394	-0.003792	-0.005759
2001	-0.024811	-0.007526	0.006403	0.001443	-0.000106	-0.024598	0.007702	0.003625	-0.002444	-0.002480
2002	0.004603	-0.003346	0.002683	0.001024	-0.000137	0.004827	0.004300	0.004400	-0.002040	-0.003977
2003	-0.001295	-0.000198	0.004434	0.001647	-0.000176	0.004413	0.005218	0.005471	-0.002540	-0.003715
2004	0.000806	0.003482	0.000300	0.001659	-0.000219	0.006028	0.004418	0.004282	-0.003722	-0.004677
2005	-0.001066	-0.015932	0.006286	-0.000984	-0.000271	-0.011968	0.007142	0.005054	-0.002017	-0.003892
2006	0.014047	-0.016403	0.015913	0.002262	-0.001306	0.014513	0.005336	0.018545	-0.001922	-0.006046
2007	0.741222	-0.008683	0.004663	0.001920	0.000000	0.739122	0.000465	0.173006	-0.000621	-0.168186
Sweden										
year	**Within**	**Reallocation**	**Interaction**	**Entry**	**Exit**	**Aggregate**	**I**	**II**	**III**	**IV**
2000	-0.001443	0.001702	-0.000203	0.001876	0.000000	0.001932	0.000280	0.000218	-0.000534	-0.000166
2001	0.000754	0.000247	0.000096	0.000969	0.000000	0.002066	0.000314	0.000374	-0.000177	-0.000415
2002	-0.000588	-0.000147	0.000207	0.001554	0.000000	0.001026	0.000417	0.000207	-0.000181	-0.000237
2003	-0.000810	-0.000294	0.000423	0.001659	-0.000026	0.000952	0.000471	0.000348	-0.000218	-0.000179
2004	0.000868	0.003343	-0.000235	0.001980	0.000005	0.005961	0.000200	0.000405	-0.000678	-0.000162
2005	0.000267	0.000620	-0.000662	0.001374	-0.000089	0.001510	0.000350	0.000364	-0.000677	-0.000699
2006	0.000441	-0.000191	-0.000582	0.002825	-0.000493	0.002000	0.000920	0.000234	-0.001286	-0.000451
2007	-0.001255	0.004415	-0.000593	0.002778	0.000000	0.005345	0.000585	0.000466	-0.001055	-0.000589

Table 34: Screening test: NACE 522 - Food distribution

Nace 3-digits	**BE**			**DE**			**ES**			**FR**			**IT**			**PL**			**RO**			**SE**		
	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD	D>0	PE	RPD
522				1			1	1		1	1			1		1	1	1	1	1	1	1	1	

in Italy, while it increases sharply in Romania. Given the different trend of concentration across countries it is difficult to link such a measure of market structure to the evolution of profitability in the industry.

Table 35: Herfindahl-Hirschman Index NACE 522

NACE 522								
Herfindahl-Hirschman Index								
year	**BE**	**DE**	**ES**	**FR**	**IT**	**PL**	**RO**	**SE**
1999	0.079655	0.553156	0.007838	0.004462	0.015305	0.568429	0.019515	0.767529
2000	0.078142	0.440729	0.007573	0.003706	0.036722	0.499299	0.022867	0.733113
2001	0.083495	0.286243	0.006717	0.003486	0.03623	0.385046	0.018436	0.717258
2002	0.089668	0.184766	0.006213	0.003076	0.032279	0.342596	0.009688	0.700941
2003	0.194753	0.114666	0.005993	0.002802	0.035482	0.322734	0.01238	0.66569
2004	0.150522	0.075339	0.008091	0.002416	0.01915	0.255976	0.018583	0.588343
2005	0.118142	0.055656	0.00584	0.00222	0.023271	0.274554	0.034348	0.548843
2006	0.138801	0.051926	0.006065	0.001926	0.011534	0.201389	0.034438	0.500937
2007	0.149341	0.119756	0.006906	0.001927	0.010605	0.247341	0.052887	0.4506

8 Aggregating the results at the EU level

8.1 PCM mean and dispersion at the EU level

The previous analyses have mainly dealt with the countries of interest separately. Each country has been considered *per se*, and then results for each country have been compared across countries. This approach is methodologically sound, as it allows to investigate country level dynamics excluding external factors. Nonetheless, it implicitly assumes that the relevant market for a firm is defined by its country borders. As EU countries share a common market, this assumption may be too strong. Indeed, especially after the introduction of the Euro, for many European firms the geographical scope of their relevant market is now the whole EU (or at least the Euro area)[39].

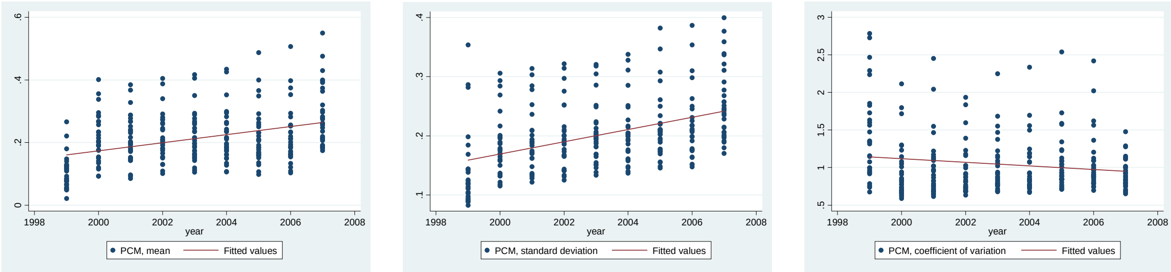
In this section, we thus try to explore what messages can be derived assuming that all our firms can be treated as operating within a unified market, that is one in which only differences across industries, not countries, matter. We will then discuss to what extent this assumption can be validated by our data.

The next graph therefore reports, for every one of our 30 NACE 3-digit industries, the mean, standard deviation and coefficient of variation (standard deviation over mean) of the PCM calculated over the firm-specific observations pooled together across countries, for every year. In order to avoid distortions induced by the different market sizes (and the relative numerosity of firms by country) and, most importantly, by the different evolutions of our country samples 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 1999 and we have explored their PCM evolution until 2007. By pooling together these firms, the implicit assumption is that their PCMs derive from a unique 'European' distribution, and are endogenously determined as a reaction to common shocks these firms face.

What is clear from Figure 21 is that, on average, the PCMs across EU industries have displayed an increasing trend over time (at an average annual rate of 1.3 per cent, significant at the 1% level), but their dispersion, as measured by the coefficient of variation, has indeed being reducing (at an average annual rate of -2.4 per cent, significant at the 5% level). The latter signals that a process of quality upgrading induced by dynamic efficiency considerations is certainly in place across European industries, while at the same time the overall dispersion of

[39] On the other side, in any country there are a number of firms whose relevant market is local, not even national: for these firms a country-level analysis seems more appropriate than cross-country analysis.

Figure 21: Aggregate evolution across countries of industry PCMs, 1999-2007

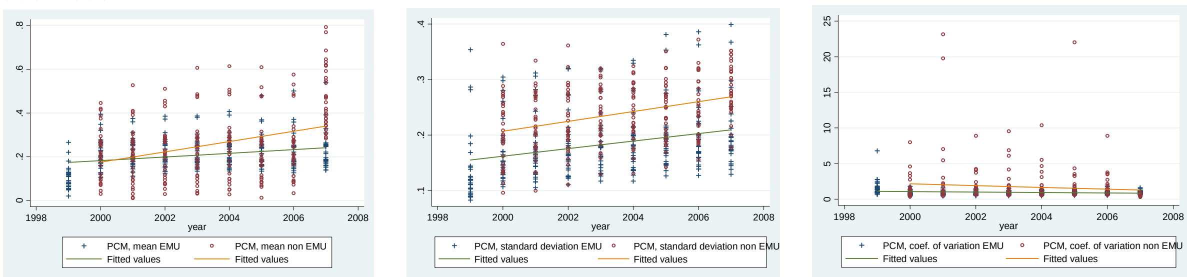


the PCMs of these industries is being reduced, in line with the theoretical priors of a functioning product and factor market integration[40].

If we now split the overall evolution of the PCM dispersion using the introduction of the euro as a threshold, we would however see that most of the reduction in the dispersion has actually taken place before 2002, while a non-significant trend persists after that year.

In the following graph we split further the sample distinguishing in eurozone vs. other countries.

Figure 22: Aggregate evolution across countries of industry PCMs, Euro vs. non-Euro countries, 1999-2007



A number of findings emerge from Figure 22: first of all, while starting with similar average levels of PCMs in the early 2000s, industries operating in eurozone countries have seen a much smaller increase of their PCM over time (an average increase of 0.8% vs. 2.3% for industries within non-euro area countries), thus ending up with an average PCM over the considered period of 20.8%, that is five points smaller than the PCM of industries operating within non-eurozone countries (25.8%). In terms of dispersion, the coefficient of variation of PCM across industries in the euro area is also significantly smaller (.97 vs. 1.72), and, most interestingly, it displays a clear and significant downward trend (-3.4%) which essentially drives the downward trend detected

[40] The result is robust to the exclusion of 2007, to the exclusion of one country, Romania, whose PCM dynamics in 2007 were particularly asymmetric with respect to the EU average, and to the same tests run on the unbalanced sample of firms (with the only difference of a slightly less significant trend in the reduction of the coefficient of variation).

for our full sample (the trend in the PCM dispersion of industries belonging to non-euro area countries is not significant)[41].

However, if we now split again the sample around the year 2002, we would see that the dispersion of PCM has seen a strong and significant reduction before 2002 essentially due to the behaviour of industries related to euro-adopting countries, while no trend is clear for non-euro countries. On the contrary, after 2002, the dispersion of PCM in industries belonging to the euro area tends to increase, while industries in non-euro countries tend to experience a slight decrease.

In other words, it seems that the competitive shock entailed by the adoption of the euro has had the effect of greatly reducing the dispersion of PCM for those countries which were about to enter the single currency, while it has had no effect on non-euro countries. Once the euro has been introduced, however, industries in the euro area have started to diverge in terms of PCM, possibly due to phenomena of dynamic efficiency stimulated by the higher competitive pressures operating in the single market, combined with the greater weight now attached to 'real' divergences in costs (factor markets), as convergence in nominal exchange rates is likely to have played a role in the reduction of PCM dispersion in the period 1999-2002. At the same time, however, the dispersion of PCM of non-euro countries is being slightly reduced.

8.2 The aggregation problem of PCM levels

The results derived insofar assume implicitly that PCM levels are directly comparable across countries, in the sense that they derive from similar country-specific distributions of prices *and* costs. While the former might be true to a certain extent, as a number of studies report that consumers' price dispersion in Europe has experienced a downward trend since 1996, it could be the case that within the single market systematic differences in costs' distribution exist across countries, e.g. due to different employment subsidies, payroll taxes, social security payments, infrastructures, and other country-specific conditions (e.g. the extent to which home firms in a given country take part in global supply chains providing them cheaper access to inputs worldwide).

Since we are not able to distinguish firms by their relevant market, we can just provide some hints on how the choice of the geographical dimension might affect our results. To that extent, we consider two sectors: beverages (NACE 159) and motor vehicles (NACE 341) in two different countries: Italy and France. We choose these two countries as the analysis reported in Section 3

[41] Once again, these results are robust to the exclusion of a number of potential outliers.

has shown that they differ in their level PCMs. In particular, recalling in Figure 23 the evolution of the average PCM over time in the two countries, we can observe how the average price cost margins are substantially different between France and Italy, with France showing higher PCMs.

Figure 23: Unweighted PCM over time, beverages

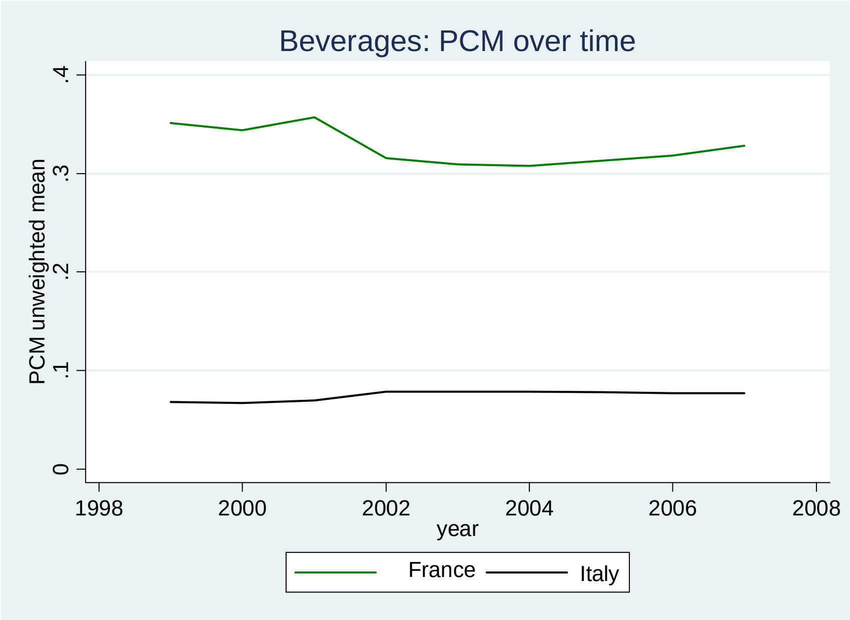


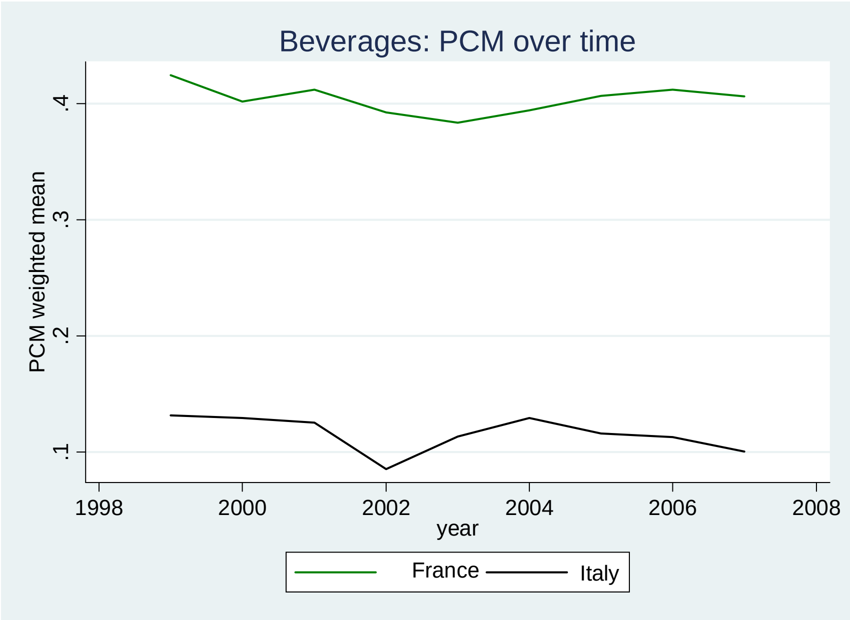
Figure 24 reports the same plot using weighted average PCMs, where the weights are firm's share in total sales. The gap between the two markets seems even wider.

We repeat the same exercise for Motor vehicles, as shown in Figure 25. Still, we observe large differences as regards the average PCM in France and Italy. The picture is slightly different when considering weighted PCM, as in Figure 26. 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 the differences in competition reported in the car industry for the two countries, and previously discussed.

Overall, we can thus observe that these two countries show substantially different levels of PCM in the two industries considered. Now, the question is: assuming that these two countries make up the Euro area, can we simply pool the two series together in order to retrieve a synthetic, Euro-based indicator of PCM?

If we assume that the two countries belong to the same common market, we should indeed compute the average PCM weighting each firm by the relative share of the *combined* sales in the two markets. This would yield the red middle line in Figures 27 and 28. Obviously, the average PCM is a mean of the two PCMs previously found, with the average closer to the series of the

Figure 24: Weighted PCM over time, beverages



country whose market is larger.

However, since our average PCMs are retrieved from firm-level observations, we can precisely evaluate the extent of the bias we might be introducing when considering averages across countries by plotting the entire distributions of PCMs in the two countries[42]. By doing so, we indeed find that these are poorly overlapping In particular, Figure 29 shows the kernel densities for PCMs in beverages industry for France and Italy. The Kolmogorov-Smirnov test for equality of distribution functions rejects at 1% significance level the equality between the two distributions, both on the whole time period as in the two intervals (1999-2000 and 2006-2007) plotted. Table 36 shows the results.

In Figure 30 we repeat the exercise for PCMs in motor vehicles manufacture. Again, the Kolmogorov-Smirnov test for equality of distribution functions rejects at 1% significance level the equality between the two distributions, both on the whole time period as in the two intervals plotted. Thus, we reject the null hypothesis of equality of the distribution in all the two-sided tests.

This suggest that, in levels, the distributions of PCM in France and Italy are different, and can not simply be pooled together.

In order to get an idea of the bias we might be introducing, in Figures 31 and 32 we have

[42] Note that in this case we are not constraining the PCM to the (0,1) interval, as we are interested in the entire density of the distribution. However, the cumulated density residing in the left tail of the distribution is fairly small.

Figure 25: Unweighted PCM over time, motor vehicles

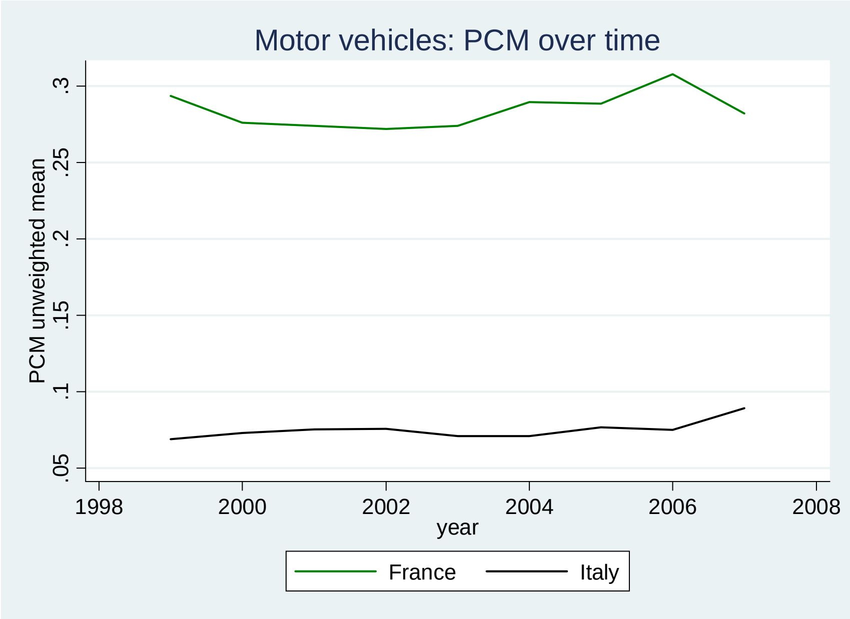


Table 36: Kolmogorov-Smirnov test for equality of distribution of PCM

Beverages

	D	p-value	corrected
France	0.0018	0.975	
Italy	-0.5169	0.000	
Combined K-S:	0.5169	0.000	0.000

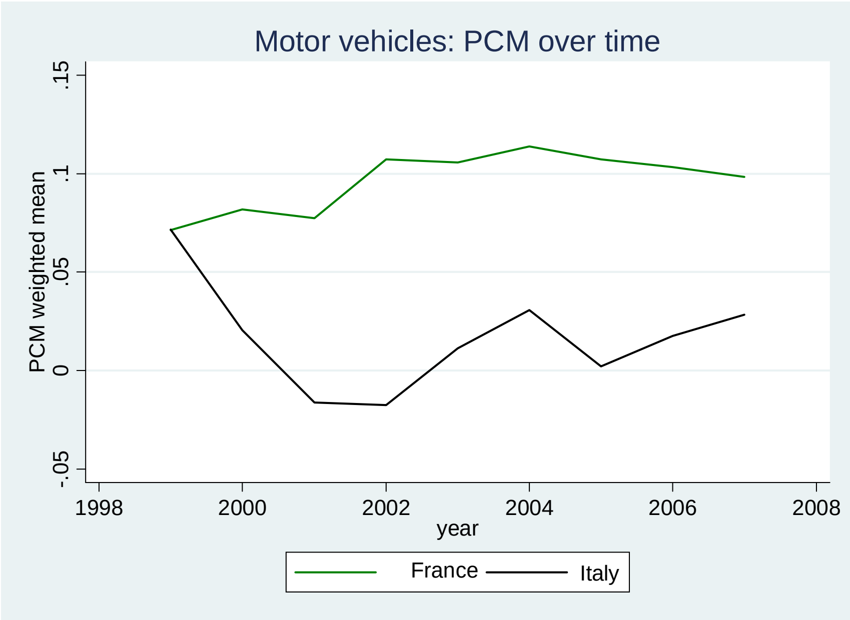
Motor vehicles

	D	p-value	corrected
France	0.0098	0.910	
Italy	-0.5492	0.000	
Combined K-S:	0.5492	0.000	0.000

reported the distributions of firm-level PCMs for France, Italy, and the 'artificial' PCM obtained by pooling together the two country-specific ones. Again, we observe that the pooled distribution is clearly different from the single countries' distributions not only in terms of mean but also of variance, thus relaying very different, and potentially biased, messages in terms of the type of reallocation ongoing in the market.

To solve this important aggregation problem, nonetheless, we can exploit the finding, reported in the previous graphs, of a quite symmetric pattern of adjustment of the distribution over time for both Italy and France, and in general across the Euro area. And in fact, if we plot the PCMs in first differences for the whole time interval, we observe that the two distributions almost overlap. Results are shown in Figure 33 for beverages and Figure 34 for motor vehicles.

Figure 26: Weighted PCM over time, motor vehicles



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.

Overall, we can thus conclude that pooling together PCMs from different countries does not seem to be fully appropriate, since each country's PCM distribution is determined by a data generating process which is clearly country-specific. Nonetheless, country dynamics are driven by common factors, as a consequence of EU driven market integration, and therefore the distributions of first differences of price cost margins tend to share the same distribution, and can thus be aggregated easily, and more importantly, without biases in order to provide synthetic indicators valid for the aggregate common market.

Figure 27: Comparison of different weights, beverages

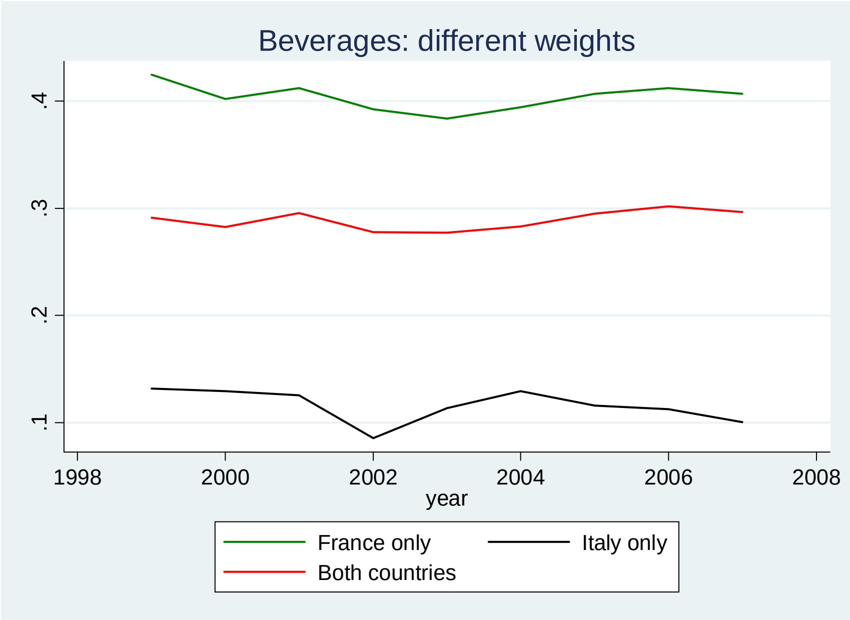


Figure 28: Comparison of different weights, motor vehicles

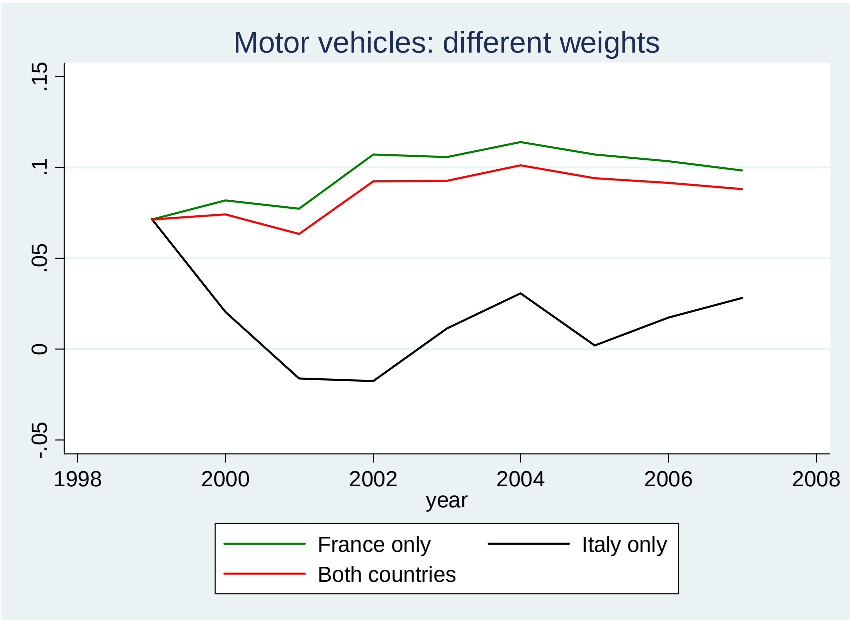


Figure 29: PCM distribution, beverages

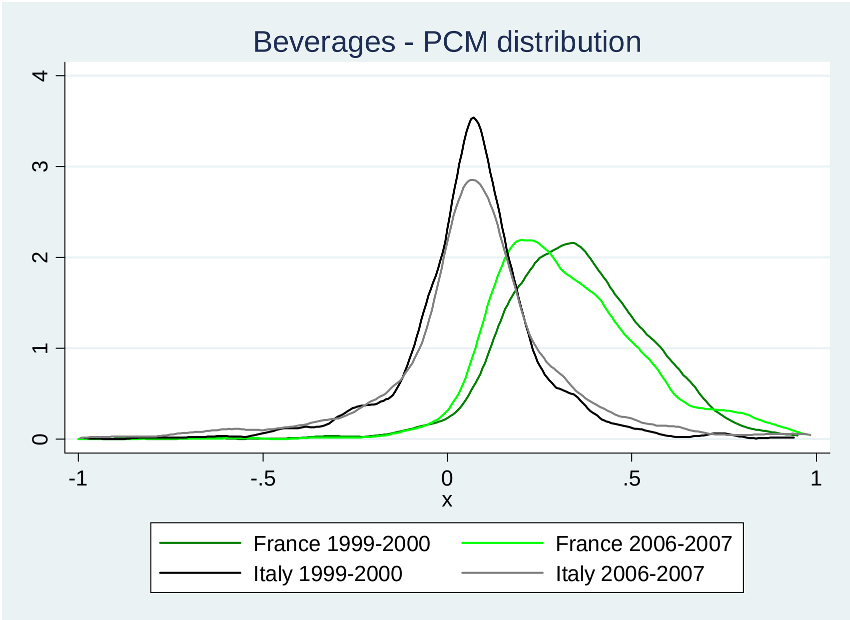


Figure 30: PCM distribution, motor vehicles

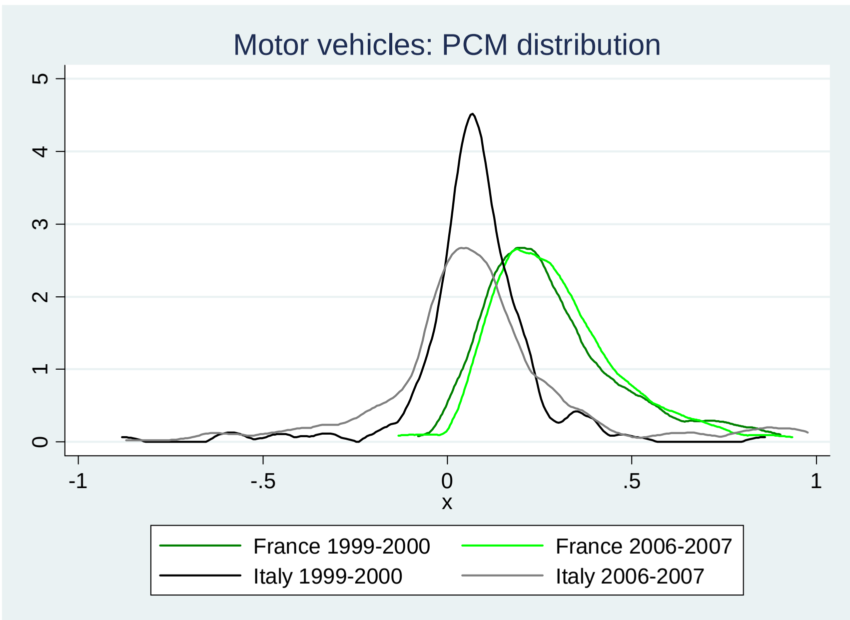


Figure 31: PCM distribution, beverages

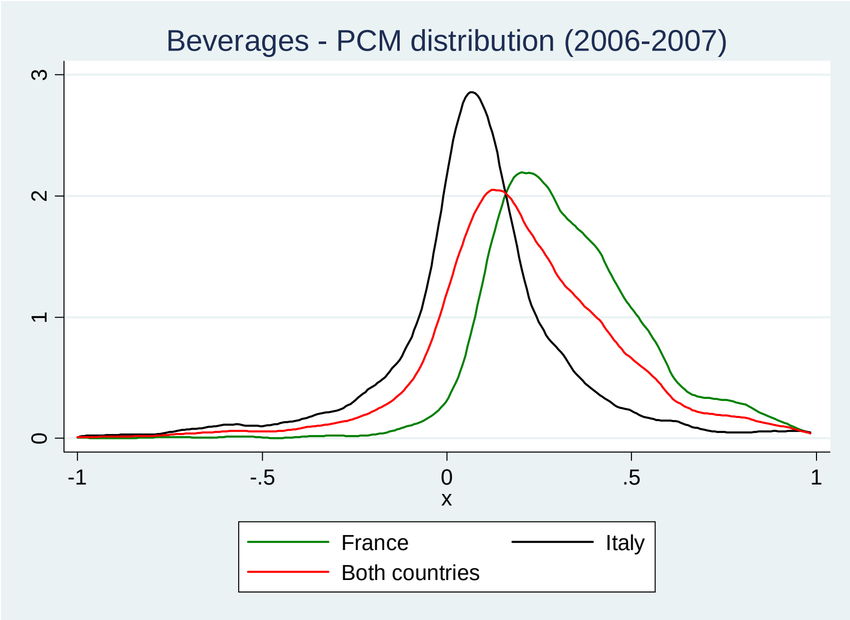


Figure 32: PCM distribution, motor vehicles

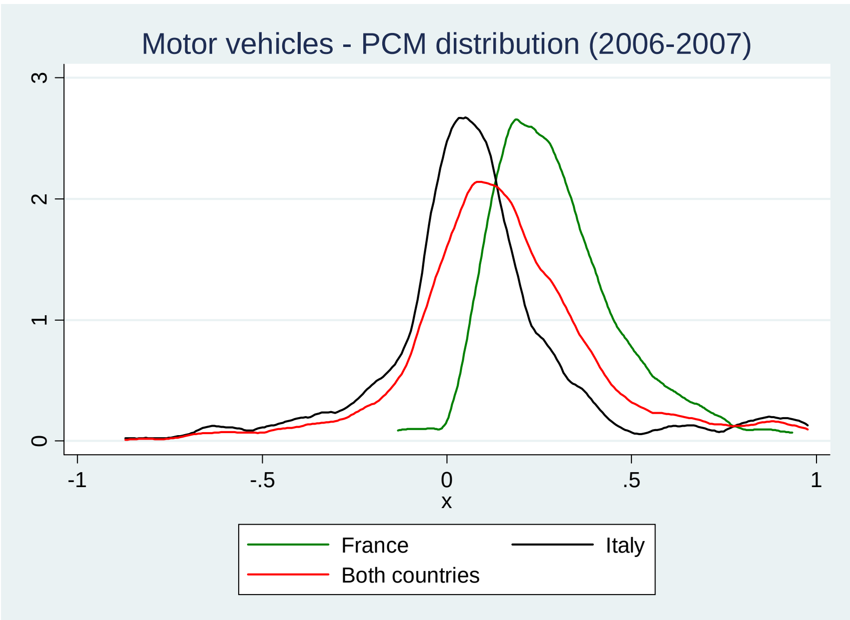


Figure 33: PCM first differences distribution, beverages

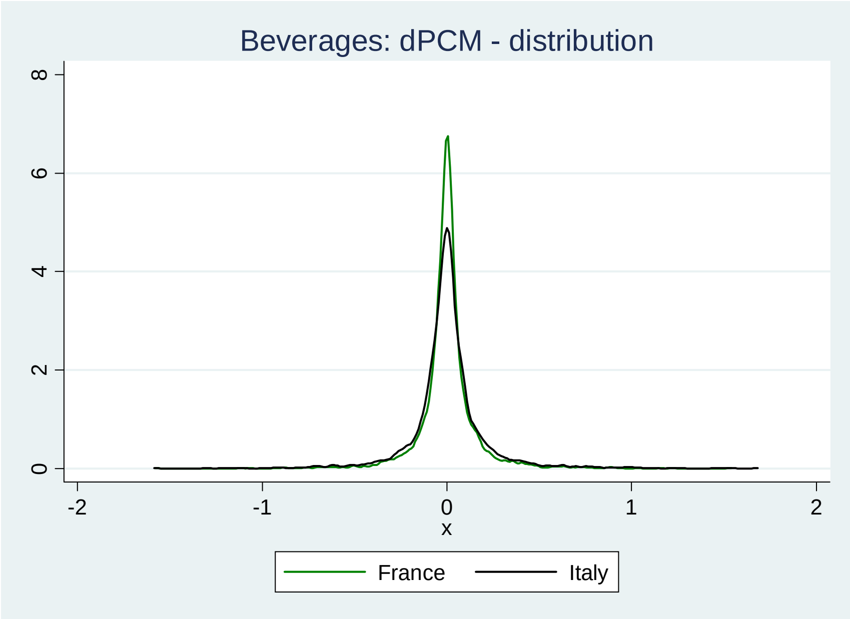
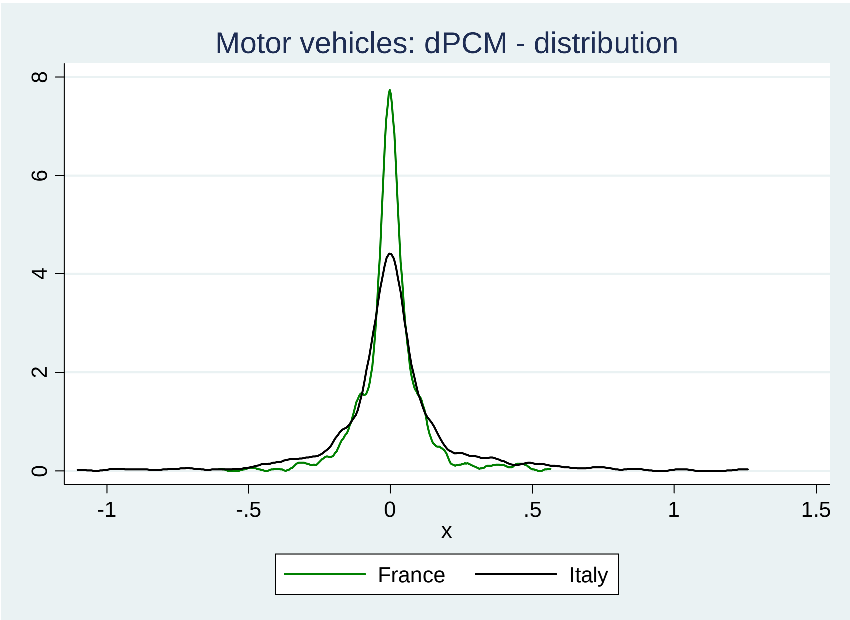


Figure 34: PCM first differences distribution, motor vehicles



8.3 Evolution of aggregate PCM differences

The aggregation of different countries has been proven to be a risky task. As shown in the previous section, it is not entirely appropriate to aggregate PCM levels across countries. Nonetheless, a comparison in the annual changes in price-cost margins can be implemented. Table 37 shows average PCMs for each NACE 3-digits industry over the eight countries included in the report.

Table 37: average change in PCM

Nace 3-digits	dPCM
151	0.0072
152	0.0043
153	0.0077
154	0.0059
155	0.0139
156	0.0131
157	0.0029
158	0.0091
159	0.0082
241	0.0021
242	0.0020
243	0.0040
244	0.0057
245	0.0026
246	0.0011
247	-0.0024
341	0.0045
342	0.0012
343	0.0005
521	0.0505
522	0.0150
523	0.0352
524	0.0117
525	0.0096
526	0.0253
527	0.0053
642	0.0238
701	0.0217
702	0.0102
703	-0.0034
Total	0.0206

Consistently with the overall trend detected in the previous paragraphs, we always observe an average positive change in PCMs, apart from industries 247 (manufacture of man-made fibres) and 703 (real estate activities on a fee or contract basis). Notice however that these results are obtained pooling together countries which are profoundly different in terms of GDP per capita and market structure[43].

[43] Note that the reported average change here is the simple average of industry-specific changes in PCM, while

The full set of annual changes by country and NACE 3-digit industry over the period 1999-2007 is reported in Table 38.

Table 38: average change in PCM across countries

Nace 3-digits	Belgium	France	Germany	Italy	Poland	Romania	Spain	Sweden
151	0.0057	0.0005	0.0013	0.0055	-0.0001	0.0608	-0.0005	-0.0029
152	0.0002	0.0054	0.0102	0.0041	0.0028	0.0476	0.0023	-0.0071
153	0.0046	-0.0002	0.0033	0.0085	-0.0049	0.0636	0.0002	-0.0045
154	0.0074	-0.0073	0.0017	0.0029	0.0090	0.0326	0.0003	-0.0085
155	0.0004	0.0041	0.0018	0.0130	0.0039	0.0455	0.0018	0.0052
156	0.0031	-0.0021	0.0036	-0.0012	-0.0017	0.0329	-0.0034	-0.0048
157	0.0005	-0.0005	-0.0025	0.0014	0.0011	0.0343	0.0016	0.0074
158	0.0020	-0.0020	-0.0017	0.0046	-0.0011	0.0485	0.0013	-0.0007
159	0.0023	0.0032	-0.0019	0.0058	-0.0015	0.0417	0.0013	-0.0218
241	-0.0048	-0.0009	0.0061	0.0013	0.0022	0.0296	-0.0016	-0.0027
242	0.0122	0.0003	0.0192	0.0013	-0.0148	0.0690	-0.0129	-0.0059
243	-0.0070	-0.0011	-0.0009	0.0027	0.0006	0.0327	0.0005	0.0006
244	0.0048	0.0029	-0.0014	0.0050	0.0038	0.0421	0.0002	-0.0044
245	0.0015	0.0002	-0.0002	0.0046	-0.0027	0.0294	-0.0016	-0.0055
246	-0.0042	-0.0004	0.0027	0.0021	0.0072	0.0103	-0.0014	0.0025
247	-0.0024	0.0045	-0.0173	-0.0081	-0.0045	0.0452	-0.0048	0.0030
341	0.0004	-0.0001	0.0048	0.0079	0.0063	0.0321	0.0020	0.0003
342	0.0063	-0.0006	0.0039	0.0043	0.0009	0.0051	0.0024	-0.0039
343	0.0075	-0.0010	0.0033	0.0004	0.0023	0.0168	-0.0046	-0.0024
521	0.0012	0.0007	0.0007	0.0182	0.0000	0.0893	0.0013	-0.0008
522	-0.0052	-0.0005	-0.0002	0.0087	0.0044	0.0892	0.0011	-0.0029
523	-0.0033	-0.0024	0.0040	0.0198	0.0040	0.1086	0.0002	-0.0070
524	-0.0007	-0.0032	0.0041	0.0247	0.0031	0.0936	-0.0001	-0.0021
525	-0.0035	-0.0021	0.0056	0.0232	0.0476	0.0634	0.0004	0.0008
526	0.0013	-0.0013	-0.0004	0.0132	0.0101	0.0736	0.0024	-0.0022
527	-0.0062	-0.0034	-0.0083	0.0108	0.0054	0.0292	-0.0012	-0.0024
642	0.0320	0.0052	0.0127	0.0086	0.0192	0.0490	0.0084	-0.0020
701	0.0093	0.0004	0.0067	0.0455	-0.0042	0.0325	0.0025	-0.0191
702	-0.0065	0.0050	0.0057	0.0214	0.0134	0.0307	-0.0009	-0.0030
703	0.0004	-0.0038	0.0059	-0.0090	0.0060	0.0121	-0.0168	-0.0056
Total	0.0013	-0.0017	0.0037	0.0222	0.0037	0.0809	0.0004	-0.0023

Given the diverging trends we have detected for euro vs. non-euro area countries, and the changes in the evolution of PCM over time, it is more informative to partition our results in sub-groups.

First of all, we compare average changes in PCM in manufacturing industries versus services industries. Table 39 reports the results. We observe that PCM dynamics are not always statistically different between manufacturing and services. Indeed, two countries display a similar increase in PCM (Belgium and Spain), four countries present an average increase which is higher

in Section 8.1 we had derived the trend as a regression over the entire pooled (balanced) sample of firms.

in services (Germany, Italy, Poland and Romania), while two countries only present an average decrease in PCM: France (where the decrease is more pronounced in services) and Sweden.

Table 39: average change in PCM across countries: manufacturing vs services

	Belgium	France	Germany	Italy	Poland	Romania	Spain	Sweden
Manufacturing	0.0013	-0.0006	0.0011	0.0049	0.0007	0.0444	0.0003	-0.0022
Services	0.0012	-0.0019	0.0047	0.0272	0.0054	0.0854	0.0004	-0.0023
Test on the equality of means		***	**	***	***	***		
Total	0.0013	-0.0017	0.0037	0.0222	0.0037	0.0809	0.0004	-0.0023

As regards the average change in PCM over time, we may compare again averages before and after the Euro. Table 40 reports the results obtained on the full sample, and on a balanced sample, which excludes those firms who entered or exited from our sample during the time period considered. As already discussed, this robustness check allows us to investigate whether our results are affected by asymmetric changes in the composition of the sample across countries.

Similar to what has been observed for the evolution of the PCM dispersion, we notice that changes in PCMs were negative before the introduction of the euro, and then became positive after 2002. Moreover, the difference tends to be statistically significant when considering services, while it is generally poorly significant in manufacturing industries. Notice that our results are confirmed in the balanced panel.

As before, we split the sample distinguishing the countries belonging to the euro area (Belgium, France, Germany, Italy and Spain) from the non-euro ones (Poland, Romania, Sweden). Table 41 shows the results. First, we observe that in a number of industries in the euro area the average PCM change has been negative, while this result does not hold in the non-euro countries. Moreover, the average change in PCM, even when positive, is always lower in euro countries compared to non-euro ones, and this difference is almost always statistically significant[44]. This evidence is in line with the results obtained when discussing PCM levels, in which the upward trend was much flatter for euro-area countries. Therefore, splitting countries according to the adoption of the euro allows us to highlight different dynamics among the two groups.

Finally, we consider the evolution of PCM changes in the five countries that belong to the EMU distinguishing, again, in before and after the introduction of the euro. Results are reported

[44] The only exception is industry 342 (manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailer), however the difference between the two averages is not significant.

in Table 42. Once again, similarly to what we have noticed when discussing PCM dispersion, we observe that the competitive shock entailed by the adoption of the euro has limited the increase in PCM for those countries which were about to enter the single currency, with many industries experiencing a reduction in PCMs. Once the euro has been introduced, however, industries in the euro area have started to experience slightly upward changes in PCM, again possibly due to phenomena of dynamic efficiency stimulated by the higher competitive pressures operating in the single market.

Table 40: average change in PCM before and after the euro

All Countries

Nace 3-digits	1999-2001	2002-2007	Test on the equality of means
151	-0.0060	0.0106	***
152	-0.0006	0.0056	
153	0.0081	0.0076	
154	0.0054	0.0060	
155	-0.0090	0.0199	***
156	-0.0187	0.0223	
157	-0.0002	0.0037	
158	-0.0066	0.0125	***
159	-0.0036	0.0109	***
241	0.0010	0.0024	
242	-0.0047	0.0039	
243	-0.0069	0.0070	***
244	0.0048	0.0060	
245	0.0011	0.0030	
246	-0.0047	0.0026	***
247	-0.0072	-0.0011	
341	0.0008	0.0055	
342	0.0005	0.0014	
343	-0.0023	0.0012	
521	-0.0104	0.0647	***
522	-0.0027	0.0186	***
523	-0.0052	0.0433	***
524	-0.0013	0.0144	***
525	-0.0040	0.0127	***
526	-0.0082	0.0323	***
527	-0.0075	0.0079	***
642	0.0056	0.0260	***
701	0.0104	0.0231	***
702	0.0065	0.0110	***
703	-0.0069	-0.0030	
Total	-0.0035	0.0256	***

* significant at 10% level, ** significant at 5% level, *** significant at 1% level

All Countries - balanced sample

Nace 3-digits	1999-2001	2002-2007	Test on the equality of means
151	-0.0038	0.0094	***
152	0.0005	0.0051	
153	0.0128	0.0061	
154	0.0177	0.0045	
155	-0.0140	0.0186	***
156	-0.0294	0.0226	***
157	0.0020	0.0031	
158	-0.0102	0.0116	***
159	-0.0051	0.0090	***
241	0.0002	0.0002	
242	-0.0083	0.0044	
243	-0.0067	0.0050	***
244	0.0030	0.0035	
245	-0.0022	0.0016	
246	-0.0065	-0.0001	**
247	-0.0118	-0.0027	
341	0.0056	0.0018	
342	0.0023	-0.0003	
343	-0.0050	-0.0010	
521	-0.0131	0.0660	***
522	-0.0035	0.0183	***
523	-0.0096	0.0435	***
524	-0.0021	0.0119	***
525	-0.0039	0.0115	***
526	-0.0103	0.0316	***
527	-0.0102	0.0082	***
642	0.0024	0.0177	**
701	0.0082	0.0121	
702	0.0054	0.0081	
703	-0.0113	-0.0042	
Total	-0.0053	0.0240	***

* significant at 10% level, ** significant at 5% level, *** significant at 1% level

Table 41: average change in PCM: euro vs non-euro countries

Nace 3-digits	Euro	Non Euro	Test on the equality of means
151	0.0012	0.0391	***
152	0.0034	0.0091	
153	0.0036	0.0297	***
154	0.0009	0.0285	***
155	0.0081	0.0369	***
156	-0.0019	0.0299	***
157	0.0008	0.0176	***
158	-0.0001	0.0393	***
159	0.0030	0.0350	***
241	-0.0002	0.0172	***
242	-0.0029	0.0405	**
243	0.0008	0.0216	***
244	0.0027	0.0252	***
245	0.0008	0.0148	***
246	0.0002	0.0077	
247	-0.0055	0.0262	
341	0.0041	0.0065	
342	0.0015	-0.0019	
343	-0.0012	0.0067	**
521	0.0035	0.0865	***
522	0.0007	0.0688	***
523	0.0016	0.1015	***
524	0.0026	0.0498	***
525	-0.0012	0.0502	***
526	0.0019	0.0654	***
527	-0.0020	0.0218	***
642	0.0085	0.0441	***
701	0.0217	0.0179	
702	0.0094	0.0126	*
703	-0.0091	0.0082	***
Total	0.0042	0.0636	***

* significant at 10% level, ** significant at 5% level, *** significant at 1% level,

Table 42: average change in PCM before and after the euro: EMU countries

Only EMU Countries

Nace 3-digits	1999-2001	2002-2007	Test on the equality of means
151	-0.0036	0.0025	***
152	0.0021	0.0038	
153	0.0092	0.0021	**
154	0.0153	-0.0023	***
155	-0.0040	0.0113	***
156	-0.0043	-0.0012	
157	-0.0003	0.0012	
158	0.0006	-0.0003	
159	0.0005	0.0036	
241	0.0006	-0.0004	
242	-0.0054	-0.0021	
243	-0.0049	0.0024	***
244	0.0053	0.0019	
245	0.0036	0.0001	
246	-0.0038	0.0012	**
247	-0.0033	-0.0062	
341	0.0015	0.0048	
342	0.0013	0.0016	
343	-0.0026	-0.0008	
521	0.0023	0.0038	***
522	0.0013	0.0006	
523	0.0005	0.0018	
524	0.0010	0.0029	***
525	-0.0004	-0.0014	
526	-0.0010	0.0025	**
527	-0.0007	-0.0023	
642	0.0049	0.0089	
701	0.0105	0.0232	***
702	0.0080	0.0097	
703	-0.0015	-0.0101	**
Total	0.0019	0.0046	***

* significant at 10% level, ** significant at 5% level, *** significant at 1% level

Only EMU Countries - balanced sample

Nace 3-digits	1999-2001	2002-2007	Test on the equality of means
151	-0.0013	0.0009	
152	0.0003	0.0029	
153	0.0145	0.0008	***
154	0.0259	-0.0048	***
155	-0.0122	0.0095	***
156	-0.0075	-0.0026	
157	0.0017	0.0005	
158	-0.0019	-0.0021	
159	0.0021	0.0017	
241	-0.0004	-0.0030	
242	-0.0038	-0.0016	
243	-0.0048	0.0005	*
244	0.0043	-0.0018	*
245	-0.0013	-0.0019	
246	-0.0056	-0.0013	
247	-0.0085	-0.0061	
341	0.0095	0.0010	
342	0.0024	-0.0003	
343	-0.0065	-0.0026	
521	0.0017	0.0002	**
522	0.0017	-0.0007	***
523	-0.0035	-0.0009	**
524	-0.0005	-0.0005	
525	-0.0018	-0.0020	
526	-0.0027	-0.0008	
527	-0.0030	-0.0022	
642	-0.0055	0.0029	
701	0.0080	0.0121	
702	0.0065	0.0062	
703	-0.0047	-0.0115	
Total	0.0004	0.0007	

* significant at 10% level, ** significant at 5% level, *** significant at 1% level

9 Extending the Pilot study: issues and possible solutions

9.1 Extending the number of countries

Table 43 reports the situation in terms of total number of firms in the AMADEUS database for the remaining European countries not included in the study.

Table 43: Number of firms in the AMADEUS database for the other EU countries, 2007

Country	*N. of firms*
Austria	176,099
Bulgaria	200,677
Cyprus	676
Czech Rep.	100,829
Denmark	199,399
Ireland	156,516
Estonia	73,856
Finland	82,950
Greece	29,335
Hungary	294,815
Latvia	7,982
Lithuania	10,550
Luxembourg	6,101
Malta	2,907
Netherlands	387,825
Portugal	305,160
Slovakia	11,516
Slovenia	37,980
United Kingdom	2,434,201

Based on the experience in the validation of data for the considered countries, the extension of the analysis to countries such as Austria, Bulgaria, Denmark, Ireland, Netherlands and Portugal should be relatively straightforward. The inclusion of Hungary should be possible as far as the PCM is concerned, but with the exclusion of those indicators requiring direct information on employment data (e.g. frontier-based RPD, based on production function), as these data are only sparsely available in balance sheet information of Hungarian firms. As shown, the inclusion of Poland is technically possible, but one has to take into account the selection bias induced on the PCM by the restriction of the analysis only to relatively large firms (>30 employees), discussed in Section 4. As for the United Kingdom, the vast majority of firms do not report employment and do not report sales, but only value added, thus making comparisons on the use of a PCM indicator hardly possible.

The situation of the Czech Republic has to be assessed, as of with Estonia and Finland. For the remaining countries (Cyprus, Greece, Latvia, Lithuania, Luxembourg, Malta, Slovakia, Slovenia) the existing data do not seem sufficient to allow an in depth analysis, although the situation might change as long as the national statistical office release their existing, and generally much more detailed databases.

9.2 How to deal with firm censored data

The quality of the firm-level databases varies across countries in the AMADEUS database, as not every sample is constructed from census data. In particular, for some countries the distribution of firms in terms of size might be censored to a given number of employees, or the representativeness of the smaller firms might be not adequate. To provide an assessment of the extent to which such a feature of the data might create a limitation for possible extensions of the analysis, we compare here two countries included in our sample, Poland and Romania.

As already discussed in Section 2, the nature of firm-level data available for Poland is skewed to the left with respect to other distributions, in the sense that micro firms tend to be severely under-represented in the Polish sample. On the other hand, instead, Romanian data come from the census of industrial firms, and thus ensure a fairly adequate representation of firms' distribution. Moreover, the two countries are comparable as they share a similar experience of transition. Table 41 compares in particular the distribution of firms by size classes.

Table 44: Distribution of firms by size classes, Romania vs. Poland

Poland, Manufacturing				**Poland, services**			
Size class	Freq.	Percent	Cum.	Size class	Freq.	Percent	Cum.
1-10	860	5.99	5.99	1-10	4,300	21.69	21.69
11-20	1,087	7.57	13.55	11-20	3,091	15.59	37.29
21-50	2,579	17.95	31.5	21-50	4,284	21.61	58.9
50-250	6,969	48.51	80.02	50-250	6,667	33.64	92.54
>250	2,871	19.98	100	>250	1,479	7.46	100
Total	14,366	100		Total	19,821	100	
Romania, Manufacturing				**Romania, services**			
Size class	Freq.	Percent	Cum.	Size class	Freq.	Percent	Cum.
1-10	32,964	66.84	66.84	1-10	464,250	93.01	93.01
11-20	6,815	13.82	80.66	11-20	22,526	4.51	97.52
21-50	5,407	10.96	91.63	21-50	8,892	1.78	99.3
50-250	3,163	6.41	98.04	50-250	3,026	0.61	99.91
>250	966	1.96	100	>250	461	0.09	100
Total	49,315	100		Total	499,155	100	

As it can be seen, firms up to 20 employees constitute only 14 and 37 per cent of all firms in Polish manufacturing and services industry, respectively, compared with 81 and 97 per cent for Romania. For firms larger than 20 employees, instead, the coverage for both countries seem comparable, with 12,419 firms larger than 20 employees recorded for Poland in manufacturing, vs. 9,536 in Romania, and 12,430 firms in services, vs. 12,379 for Romania.

In order to assess how this censoring of Polish data might affect our result, we have re-run the decomposition on Romania (for the period 1998-2002) censoring it to the threshold of 20 employees. In Table 45 we report the differences obtained between the new decomposition and the original ones.[45]

As it can be seen, with very few exceptions, limited (not surprisingly) essentially to the services sector, the overall difference between the two decompositions as induced by censoring is below 0.1 points for all our measures across sectors. This is because the decomposition, being based on a weighted PCM measure, is by nature relatively less affected by micro firms. It then follows that, with some caveats, the methodology here presented can be applied also to the case of databases characterised by an overrepresentation of medium to large firms without major biases in the analysis.

[45] Original Tables may be retrieved from the Statistical Annex of the Report, which is available upon request.

Table 45: Censored (>20 employees) vs. standard decomposition, Romania

ROMANIA - Difference in the decompositions

	1999-2002					
Nace 3-digits	**within**	**reallocation**	**interaction**	**entry**	**exit**	**aggreagate**
MSNUFACTURING						
151	0.000	0.000	0.000	0.001	0.000	0.001
152	-0.001	0.000	0.000	-0.001	0.000	-0.001
153	-0.005	0.000	0.006	-0.001	0.000	0.000
154	-0.004	-0.001	0.003	0.001	0.000	0.000
155	0.002	0.000	0.001	-0.001	0.000	0.000
156	-0.002	-0.001	0.001	0.000	0.000	0.000
157	-0.002	0.000	0.001	0.000	0.000	0.000
158	-0.001	0.000	0.001	-0.002	0.000	-0.002
159	-0.002	-0.013	0.015	0.000	0.000	0.000
241	0.001	0.000	0.000	-0.001	0.000	-0.001
242	-0.003	0.000	0.000	-0.018	0.000	-0.018
243	0.001	0.000	0.001	-0.005	0.000	-0.005
244	0.000	-0.001	0.001	-0.005	0.000	-0.006
245	-0.002	-0.003	0.000	-0.004	0.000	-0.004
246	-0.002	-0.011	0.010	-0.004	0.000	-0.005
247	0.004	0.000	0.000	0.000	0.000	0.003
341	0.004	0.000	0.000	-0.002	0.000	0.001
342	-0.003	-0.012	0.013	-0.003	0.000	-0.004
343	0.000	0.001	0.000	-0.004	0.000	-0.003
SERVICES						
521	-0.001	-0.010	0.011	0.000	0.000	0.000
522	-0.001	0.000	0.001	0.000	0.000	0.000
523	-0.001	-0.001	0.001	-0.002	0.000	-0.002
524	-0.004	-0.001	0.004	-0.001	0.000	-0.001
525	-0.008	-0.001	0.009	-0.001	0.000	-0.001
526	-0.001	0.001	0.000	0.001	0.000	0.001
527	-0.001	0.000	0.001	-0.001	0.000	-0.001
642	0.000	0.003	0.000	-0.006	0.000	-0.007
643	-0.004	-0.002	0.005	-0.007	0.000	-0.008
644	-0.006	-0.007	0.009	-0.013	-0.001	-0.015
701	-0.002	-0.001	0.003	-0.002	0.000	-0.002
702	-0.001	-0.006	0.009	-0.002	0.000	-0.002
703	-0.001	0.000	0.002	-0.004	0.000	-0.003

9.3 Changing aggregation level: NACE 3-digit vs. NACE 4-digit industries

The entire Report has been drafted starting from firm-level observations, but then constructing synthetic indicators at the industry level measured at the NACE 3-digit level of aggregation. The latter is a finer disaggregation with respect to the current existing level of analysis (traditionally undertaken at the NACE 2-digits level), while at the same time it still ensures comparability of the retrieved indicators across countries in synthetic tables as the one presented throughout this Report.

On the other hand, a finer disaggregation level (e.g. NACE 4-digit) would allow the analysis to become closer to the definition of 'relevant market' traditionally employed in competition studies, but would suffer from a lack of numerosity of firm-level observations once industry, country and year-specific indicators are constructed. A researcher would therefore face a clear trade-off in terms of economic relevance of the retrieved indicator vs. its correct measurement. Moreover, to the extent that multi-product firms operating in a given industry encompass different relevant markets (e.g. a car producer, producing cars in different segments of the market), the benefits of a finer disaggregation level would be non-existing (as balance sheet data do not allow to distinguish the pricing behaviour for a given product), while the limitations of the NACE 4-digit analysis would remain the same.

As we believe it is more important to have an unbiased understanding of a rough evolution of competition (measured at the NACE 3-digit level), rather than a biased understanding of a relatively more precise industrial dynamics (measured at the NACE 4-digit level), in this Report we have chosen to work at the NACE 3-digit level of aggregation.

Nevertheless, to provide an idea of the extent to which a different level of aggregation might convey a different message in terms of our selected indicators, in what follows we have calculated, for a NACE 3-digit industry in which enough observations are available for each NACE 4-digit sub-industry, the same PCM indicator. The industry in question is NACE 159 (beverages), which itself is disentangled in 8 sub-industries (15.91 Manufacture of distilled potable alcoholic beverages; 15.92 Production of ethyl alcohol from fermented materials; 15.93 Manufacture of wines; 15.94 Manufacture of cider and other fruit wines; 15.95 Manufacture of other non-distilled fermented beverages; 15.96 Manufacture of beer; 15.97 Manufacture of malt; 15.98 Production of mineral waters and soft drinks).

In Figure 35 we compare the PCM distribution for three sub industries in France vs. Italy, taking 2006 as the reference year.

As it can be seen, there is an important degree of heterogeneity of PCMs not only across

Figure 35: PCM distribution of selected NACE 4-digit industries, 2006

countries, as we have already discussed, but also across NACE 4-digit industries within the same country, especially in France, while for Italy the three sub-industries display more or less similar dynamics. Once again, therefore, average PCM indexes retrieved at the NACE 3-digit level can provide useful indications on the overall general direction of the competitive behaviour of firms in the single market, but can hardly be used to derive information on the underlying competition dynamics, as the evolution of the underlying 'relevant markets' is very heterogeneous.

As a matter of general comparison, Table 43 reports for all the considered countries the average changes in PCM in the considered period, for each NACE 4-digit industry.

Table 46: Censored (>20 employees) vs. standard decomposition, Romania

Nace 4-digits	ALL	BE	ES	DE	FR	IT	PL	RO	SE
1591	0.01010	0.00579	-0.00334	0.00196	-0.00288	0.00070	-0.00095	0.06433	-0.01540
1593	0.00567	-0.00370	0.00285	-0.00084	0.00519	0.00831	0.00067	0.03423	-0.18994
1594	-0.00238		-0.00054	0.03034	-0.00185		-0.00108	0.08034	-0.05681
1595	0.01155		0.01309	-0.03541	-0.02280	0.01229	0.02815	0.04555	-0.00685
1596	0.00510	-0.00121	0.00768	0.00053	0.01557	0.00633	-0.02719	0.01163	-0.01749
1597	-0.01619	-0.00087	-0.05210	-0.02226	0.01442	-0.06966	-0.00691	-0.03849	0.01292
1598	0.01612	0.01018	-0.00295	-0.00874	0.00404	0.00318	0.00648	0.05109	-0.00934

9.4 Stimulus indicators: PCM and trade penetration

9.4.1 Introduction

The same data insofar retrieved and discussed can be conveniently exploited in order to introduce in the analysis some stimulus indicators able to better identify the sources and the directions of the adjustments made by the single firm in terms of competition dynamics. In particular, it is possible to assess through an econometric estimation how much of the variations of competition as measured by the firm-level RPD index, as well as the PCM are accounted for by internal (to the firm) features, such as firm size, and how much by external factors, such as the external competitive pressures accruing from a process of international economic integration.

In particular, while an increased trade exposure should lower the prices of domestic firms (the pro-competitive effect of trade), firms might react to these increased competitive pressures by endogenously compressing their product mix towards products characterized by a lower elasticity of demand. At the same time, multi-product exporting firms might also restrict their availability of traded products, with the result that an increased trade pressure has a non-obvious impact on firms' mark-ups. Along the same lines, an increase in price-cost margins might not necessarily signal a problem in competition in the short run, as long as the effect is driven by an adjustment of costs to the now available cheaper inputs.

In order to gather some evidence on all these possible effects, in this section we test the effects of different measures of import penetration (horizontal and vertical, for both services and manufacturing) on our firm-specific competition indicators, that is to say the PCM and the RPD. Once again, as it is convenient for a Pilot study, we take a comparative perspective, by testing these effects for firms operating in Italy and Germany. Since we use both horizontal and vertical trade penetration measures, we also broaden the analysis to all the industries comprised in manufacturing and services, so as to gather a more comprehensive evidence of the effects of trade on price-cost margins.

9.4.2 Trade penetration measures

Information on trade flows has been provided by the COMEXT database of Eurostat as regards manufacturing, and the UN Service Trade Database for service industries. Values of imports and exports of the manufacturing sector were collected at a detailed product level according to the CN 8-digit classification used for custom purposes, for the period 1999-2007, considering the trade flows of Italy and Germany with the rest of the World. The data were then reclassified at the 2-

digit NACE rev. 1.1 level, using the relative correspondence tables provided by EUROSTAT. UN Service Trade Database provides data on trade in services classified according to the Extended Balance of Payments Services Classification (EBOPS): we build a concordance between this classification and 2-digit NACE. Overall, we are able to obtain trade statistics for 18 service industries expressed in 2-digit NACE classification.

Data on production in manufacturing were collected using EUROSTAT with its PRODCOM database at a 8-digit product classification, whose codes were once again converted at NACE industry detailed levels as done for trade flows. As regards services, data in production are retrieved from EUROSTAT National Account statistics.

Import penetration indexes have then been constructed for both manufacturing and services industries taking into account both a measure of horizontal import penetration and one of vertical import penetration, H_imp_{zjt} and V_imp_{zjt} respectively, from country z in industry j at time t. The horizontal penetration index (i.e. import penetration ratios considering the industry of affiliation) is calculated as:

$$H\_imp_{zjt} = \frac{IMP_{zjt}}{IMP_{zjt} + PROD_{zjt}} \quad (10)$$

where IMP_{zjt} are the total imports of Germany or Italy (z) in industry j in year t, while $PROD_{zjt}$ is the national output of industry j in year t retrieved from the PRODCOM database. The index is therefore bounded between 0 and 1[46].

The measure of the vertical import penetration, V_imp_{zjt}, is somewhat more complicated, since it reflects the linkages present in the upstream industries. Following Smarzynska Javorcik (2004), who has used a similar indicator in order to measure "vertical" FDI presence, the index is computed as the weighted average of the upstream industries' horizontal import penetration ratios using as weights the time-varying input-output coefficients retrieved from the Italian and German Input-Output matrixes, which distinguish between general figures for intermediates and specific amounts of imports used by economic activities for production purposes[47]. The indicator

[46] Results are robust when using an import penetration index calculated excluding exports from the denominator.

[47] In order to check whether the latter display a clear time-trend, we have checked the correlation between the 1996 and the 2003 input-output coefficients, which turned out to be very high and significant. However, a process of technological change is in some cases quite relevant, with differences in coefficients ranging from -15% (the weight of sector 23 - petroleum products - as input of itself) to +12% (the weight of sector 34 - motor vehicles - as input of itself).

has thus been constructed as

$$V\_imp_{zjt} = \sum_{k\ if\ k \neq j} a_{kjt} \cdot H\_imp_{zkt} \quad (11)$$

where a_{kjt} is the weight of industry k as input of industry j at time t.

9.4.3 Trade penetration and competition

Once endowed with our import penetration indexes, calculated both horizontal and vertical and for both manufacturing and services trade, we relate these measures to competition by estimating for each country z the following general model:

$$Comp_{ijt} = \alpha_0 + \alpha_1 H\_imp_{jt} + V\_imp_{jt} + X_{it} + \delta_t + \epsilon_{ijt} \quad (12)$$

where $Comp_{ijt}$ is our firm-level proxy measuring competition through PCM or the RPD index, while H_imp_{jt} and V_imp_{jt} are the industry-specific import penetration measures discussed above, X_{it} are controls at the firm-level, while δ_t are time-fixed effects.

When using firm-level PCM as a proxy for competition, in order to wipe out firm-level fixed effects potentially inducing a serial correlation in the error term, we have first-differenced our dependent variable. Firm-level characteristics are however accounted for including a control for firm size, proxied by the logarithm of employees at time t-1. We have also clustered the standard errors at the industry level in order to take into account that we are regressing firm-specific observations against industry-level covariates, a fact that might induce a spurious downward bias in our standard errors.

We estimate an OLS specification with time dummies in order to control for the presence of a time trend. Alternatively, we estimate a between effects estimator, which produces regressions on firm means. Notice that by considering firm means over time, we are already taking into account time variability, and time dummies are therefore redundant.

Table 47 presents the results of the above specification, again for both Italy and Germany in the manufacturing sector.

Results show that import penetration may affect a firm's price-cost margins in different and contrasting ways, consistently with the idea that working with heterogeneous firm-level data, the presence of multi-product firms might generate outcomes different from traditional representative firms' models. Indeed, we find horizontal import penetration to be *positively* related with the change in price-cost margins, although this effect is statistically significant only in the Italian

Table 47: Average PCM and Trade Penetration, Manufacturing

Dep Var: PCM_t-PCM_{t-1}	Italy	Italy	Germany	Germany
import penetration	0.0401***	0.0729*	0.391	1.308
	(0.0130)	(0.0404)	(0.452)	(1.122)
osm	-0.0890***	-0.133*	-0.137	-0.444
	(0.0217)	(0.0726)	(0.322)	(1.595)
oss	-0.585	-3.454*	9.135	28.81*
	(0.806)	(1.876)	(8.882)	(15.32)
$size_{t-1}$	-0.00974**	-0.0114***	0.0556	0.161*
	(0.00405)	(0.00410)	(0.0556)	(0.0895)
Constant	0.0619***	0.0768***	0.485	-1.129*
	(0.0103)	(0.0230)	(1.191)	(0.592)
Specification	OLS	BE	OLS	BE
Time dummies	Yes	No	Yes	No
Observations	322412	322412	11571	11571
Groups		90061		5694

sample[48]. On the other hand, vertical import penetration from other manufacturing industries is associated with a fall in firm's PCMs. Interestingly, we find that vertical import penetration in services has different effects across the two countries considered: while it leads to a reduction in PCMs in Italy, it is related to a rise in PCMs in Germany.

For firms operating in the services sectors, we do not obtain any significant impact of import penetration on PCMs, in any way measured. Table 48 tells us that changes in price-cost margins in service industries are not influenced by neither horizontal nor vertical import penetration. The results concerning horizontal import penetration and vertical import penetration are coherent with previous findings. The index of import penetration in service industries is much more limited in size, being on average equal to 0.08 and 0.13 in Italy and Germany respectively, against 0.32 and 0.40 in manufacturing, respectively. Thus, it is not surprising that import penetration in services fails to affect PCMs.

As an alternative specification, we have then re-estimated our Equation (12) using as dependent variables the estimated β for every sector j and year t, that is the $\hat{\beta}_{jt}$ as retrieved from our RPD Equation 9. Table 49 presents the results of this exercise for Italy and Germany, where the RPD measure has been retrieved for each NACE 3-digit industry of the manufacturing sector, regressed against the horizontal penetration index of the same NACE 3-digit industry[49].

[48] Estimates are impecise in the German sample, but we suspect that this may be due to the lower number of observations.

[49] We cannot retrieve vertical penetration measures at the NACE 3-digit level, as our available I/O tables are at NACE 2-digit, nor for the time being we have been able to retrieve trade data for services at the NACE 3-digit level of disaggregation.

Table 48: Average PCM and Trade Penetration, Services

Dep Var: PCM_t-PCM_{t-1}	Italy	Italy	Germany	Germany
import penetration	0.159	0.347	3.292	0.730
	(0.17)	(0.53)	(3.78)	(0.83)
osm	-0.0125	-0.0594	0.205	1.409
	(0.069)	(0.20)	(1.11)	(1.14)
oss	0.297	0.286	2.737	-0.332
	(0.17)	(0.70)	(4.41)	(1.18)
$size_{t-1}$	-0.0105	-0.00484	0.00690	0.0190
	(0.0097)	(0.015)	(0.012)	(0.031)
Constant	0.00779	0.0189	-0.810	-0.245
	(0.026)	(0.067)	(0.87)	(0.26)
Specification	OLS	BE	OLS	BE
Time dummies	Yes	No	Yes	No
Observations	150774	150774	4226	4226
Groups		57683		2340

Interestingly, we find that import penetration affects RPDs differently in the two countries considered. While we observe an anti-competitive effect in Italy, both in the OLS and the BE specification, import penetration has a pro-competitive effect in Germany. This result confirms previous findings on changes in PCM reported in Table 47: horizontal import penetration leads to an increase in price-cost margins in Italy, not induced by a reduction of costs, but rather by a higher elasticity of profits to costs. The result is thus consistent with the idea that firms might react to these increased competitive pressures by endogenously compressing their product mix towards products characterized by a lower elasticity of demand, with a resulting positive change in mark-ups.

Table 49: RPD and Horizontal Trade Penetration, Manufacturing - NACE 3-digit

Dep var: RPD indicator	Italy	Germany	Italy	Germany
Import penetration	0.101***	-0.172	0.101**	-0.449**
	(0.000)	(0.278)	(0.041)	(0.045)
Year2001	0.007	-0.647**		
	(0.024)	(0.001)		
Year2002	-0.055**	-0.307*		
	(0.020)	(0.095)		
Year2003	-0.072**	-0.496**		
	(0.002)	(0.001)		
Year2004	-0.103***	-0.604**		
	(0.000)	(0.001)		
Year2005	-0.097***	-0.620**		
	(0.000)	(0.001)		
Year2006	-0.115***	-0.610**		
	(0.000)	(0.001)		
Year2007	-0.136***	-0.629**		
	(0.000)	(0.001)		
Constant	0.164***	0.97***	0.093***	0.565***
	(0.000)	(0.000)	(0.000)	(0.000)
Specification	OLS	OLS	BE	BE
Time dummies	yes	yes	no	no
Observations	776	712	776	712

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