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Exploring the evolution and the state of competition in the EU

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This report provides new evidence that competition weakened in European countries between 2000 and 2019. Concentration and markups have increased, while business dynamism among market leaders was low and decreased further. These measures are examined in a unified framework, incorporating several methodological innovations: industries are defined at the 3-digit level; a taxonomy of industries is developed to define the geographic dimension of competition and to account for international trade; novel product-level data are used to corroborate the informativeness of analyses conducted at industry-level. Markups and concentration are positively correlated with the intensity of intangible investments and negatively correlated with international openness. At the same time, industries more exposed to international competition display a stronger positive relationship between intangible investments and concentration and markups. The combination of these results suggests that international openness increases competition while also amplifying the scale effects of intangible investments, which disproportionately benefit larger firms. Factors directly affected by competition policy also play a role: industries with more M&A activity by leading firms and more stringent regulatory barriers in the input market are relatively more concentrated. The analysis calls for a harmonised policy framework to promote global and domestic level playing fields.

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Executive summary

In recent years, a lively debate has emerged on whether firms' market power has increased in OECD countries. Several empirical studies have found evidence of an increase in concentration, markups, and other proxies for market power since the early 2000s.

This report contributes to this debate by providing evidence on the state of competition in several European countries (18 to 23 countries, depending on data availability for the measure considered). It examines the joint evolution of several proxies for competition – such as concentration, entrenchment, and markups - over the last twenty years.

Since each of these proxies captures different aspects of competition, assessing them in a unified framework is essential for a complete overview of the competition landscape. A better understanding of the relationship between these indicators and of the economic forces that shape them can help inform policies and provide a clearer picture of the state of competition.

Several methodological innovations have been developed to improve the measurement and informativeness of the proxies of competition. First, to reach a more disaggregated level of detail than previous representative cross-country analyses, industries are defined at the 3-digit level whenever possible. Second, a taxonomy of industries is developed to determine the geographic dimension at which competition takes place (domestically, at the European level, or globally). This taxonomy defines the geographical boundaries of a market when computing proxies of competition. Importantly, it accounts, to a large extent, for the role of international trade and cross-border activities of multinationals in industries that compete internationally, even in the absence of firm-level trade data. Third, linkages between firms in the same business group are accounted for. Fourth, these methods are used to measure, in a unified framework, industry concentration and measures of business dynamism at the top alongside firms' markups – estimated using state-of-the-art techniques – to provide a comprehensive analysis of the state of competition. Fifth, novel product-level data are used to show the strong relationships between concentration measured at the product and the industry levels – providing support to the findings of industry-level analyses. Sixth, the report provides evidence on the channels related to the evolution of concentration and markups in a harmonised setting. Concentration, markups, and prices are regressed against several economic and policy measures, including intangible intensity, openness to trade, proxies of product market regulation, indicators of merger and acquisition activities, and measures of pro-competitive interventions by the European Commission. Finally, the relationship with macroeconomic indicators such as productivity and labour share is also explored.

Key findings

By analysing several indicators of competition and incorporating several significant methodological advancements, this report identifies the following key findings:

- Over the 2000-2019 period and across 18 countries and 127 industries considered, industry concentration – measured as the share of gross output accounted for by the four largest business groups in an industry – has increased by 5 percentage points on average.

- The increase in average concentration was more pronounced in industries competing at the domestic level (6 percentage points) than in industries competing at the European and global levels (about 4 percentage points).
- The evolution of concentration across industries over time shows an increase in the number of industries with a share of gross output accounted for by the four largest business groups higher than 35%, and at the same time a reduction in the number of those with very high concentration.
- Entrenchment, rank persistence, and market share instability suggest that the level of business dynamism at the top is low, and it has further decreased during the period considered, especially in industries competing at the domestic and European levels.
- Estimated firm-level markups, a widely used proxy for market power defined as the ratio between price and marginal cost, have increased by about 7% on average.
- The average markup increase is mainly driven by firms in the top decile of the markup distribution, while the markups of firms closer to the bottom decile remain constant. This dynamic implies an increase in markup dispersion.
- Firms competing in global markets experienced, on average, the highest increase in markups (12%), followed by firms competing in European industries (7%), with the smallest increase in average markups occurring in domestic markets (3%).
- Measured average concentration in product markets is higher than at the industry level.
- Product market concentration is strongly correlated with concentration in relevant industries, suggesting that industry concentration is a good proxy for capturing the evolution of market concentration.
- Both industry and product concentration are positively correlated with EU Commission antitrust interventions.
- Concentration and markup measures at the industry level are broadly uncorrelated. This result aligns with existing literature and is consistent with economic theory. It supports the view that these indicators capture different aspects of competition.
- Despite this, concentration is positively correlated with average unit prices, especially in industries competing domestically.
- Concentration and markups are positively correlated with the intensity of intangible investments. Intangible investments seem to benefit larger and high-markup firms disproportionately.
- Globalisation, proxied by openness to trade, is negatively correlated with concentration, markups, and prices, suggesting evidence of the pro-competitive effects of trade.
- At the same time, industries more exposed to international competition display a stronger positive relationship between intangible investments and the measures of concentration and markups. The combination of these results suggests that there might be two forces at play in international markets: international openness increases competition; at the same time, it increases market size, amplifying the scale effects of intangible investments, which disproportionately benefit larger firms.
- Industries with a higher dependence on inputs from industries with more burdensome regulations display on average higher concentration, lower markups, and higher prices at the product market level.
- Industries with more merger and acquisition activity by leading firms display higher markups and concentration.
- Concentration is positively correlated with total factor productivity of firms at the frontier of the productivity distribution, while negatively correlated with the productivity of other (laggard) firms. Moreover, concentration is negatively correlated with labour share, and the correlation is driven by the most productive firms. Therefore, in more concentrated industries frontier firms are more productive, but workers get a lower share of output.

Overall, the analysis finds that, between 2000 and 2019, concentration and markups rose on average across the 23 European countries analysed, suggesting that competition has decreased. This finding aligns with a wealth of existing literature but, importantly, holds when accounting for firms' international activities, narrower definitions of market scope, and the connected activities of business groups.

The analysis also suggests that the state of competition has been partly influenced by two important structural shifts – increasing importance of intangible assets and globalisation. While there is evidence of the pro-competitive effects of openness to trade, concentration and markups are higher in more intangible intensive sectors. Furthermore, the rise in concentration and markups is most significant when the increasing importance of intangibles and globalisation combine; the increased market size from openness to trade seems to amplify the returns – in terms of market shares and margins – from intangible investments, which are already greater for larger, high markup firms. To the extent that the rise in concentration and markups reflect a reallocation process towards firms better equipped to benefit from the recent structural changes, one might infer that these trends are productivity and innovation enhancing. However, even if in the short-run some firms attain their currently dominant positions by out-competing rivals, on the basis of their performance, in the long-run they may use their position to raise prices and entrench their position by buying off possible competitors. Moreover, their incentives to be efficient and innovate might be reduced once their position in the market is not threatened. With these risks in mind, the underlying reasons for which the top firms reach their dominant position in the market does not change the implications for policy, which require the adoption of a holistic and whole-of-government approach to ensure a competitive and dynamic business environment. Appropriate innovation, trade and industrial policies, as well as actions directed to promote knowledge and technology diffusion, are just some of the policy areas that should be combined with the efforts of competition authorities to encourage global and domestic level playing fields.

1 Introduction

1. In recent years, a lively debate has emerged on whether market power has increased in OECD countries. Several empirical studies have documented an increase in industry concentration (Bajgar et al. (2023[1])) and markups (Calligaris et al. (2024[2]) and De Loecker et al. (2020[3])), at least since 2000. These trends may reflect a decline in competition.

2. Industry concentration captures the share of an industry accounted for by the largest firms. High concentration may reflect excessive barriers to entry or collusion. However, concentration may also exist when heterogeneous firms producing differentiated goods vary in productivity, and there are sunk costs to enter the market. Similarly, markups may also provide a measure of market power, measuring the ability of firms to set prices above marginal costs. However, a wedge between price and cost may also exist in the short term in markets characterised by high fixed costs. Therefore, high levels of concentration or markups alone do not necessarily imply that a market is lacking competition (see Syverson (2019[4])). Multiple variables must be examined side-by-side to assess the state of competition.

3. This report presents new evidence on trends in concentration, entrenchment, market share instability, rank persistence and markups for many European countries (between 18 and 23, depending on data availability for the measure considered) between 2000 and 2019. A key contribution is to examine multiple indicators of market conditions in a harmonised cross-country setting (OECD, 2021[5]). Concentration reflects the market shares of leading firms; entrenchment captures churn of firms among market leaders; market share instability measures the variation in market shares among leading firms; rank persistence identifies the differences in the ranking of leading firms from one year to the next; markups provide an indication of pricing power. Each measure is computed for (mainly) 3-digit industries across countries over a long period and incorporates important methodological innovations. Together, these measures are informative on the state and evolution of competition in European countries.

4. Alongside the debate around interpreting these recent trends, ongoing discussions exist on appropriately defining and computing these measures. Regarding concentration, for example, the critical measurement decision is how to accurately define the relevant market. The geographic level of competition may be local, national, or international, and there is no clear definition of which industries or products should be considered within a single market. Defining a relevant market is also crucial to measuring market dynamism's proxies among market leaders (entrenchment, rank persistency, and market share instability). Markups are seldom directly observed in the data, as they require information on both prices and marginal costs. Instead, they must be econometrically estimated using balance sheet data and rely on several assumptions.

5. The report incorporates several methodological innovations in measuring concentration and market dynamism among market leaders. The first of these critical methodological innovations is to define industries at the most disaggregated level possible. Increasing the level of industry detail takes the measures closer to the true definition of a market while still using high-quality, representative data covering most sections of the economy. In contrast to previous representative cross-country studies that have only been able to measure concentration at the 2-digit level, industries are defined mostly at the 3-digit NACE rev.2 level (with some higher aggregations due to data constraints). A supplementary analysis is also conducted at the 4-digit level for a subset of industries.

6. Second, a novel methodology to account for cross-border activities and international trade of firms is introduced, even in the absence of cross-country firm-level trade data. Specifically, a taxonomy of industries is developed, defining the geographic level at which competition takes place. It classifies each industry as either competing nationally, at the European level, or globally.[1] The market is defined as the combination of the industry and the geographical scope implied by the taxonomy, and the measures are computed at the corresponding level.[2] Importantly, using the taxonomy, the activities of firms are aggregated to the relevant geography, implying that firms' sales to other countries within the geographic level of competition are accounted for. Put differently, the taxonomy accounts, to a large extent, for international trade within the relevant geography, even without firm-level trade data, which is unavailable in a cross-country setting. Recent research by Amiti and Heise (2021[6]) shows that concentration in the United States, which is generally defined as the ratio between the gross output of the largest firms in an industry and the gross output of the industry itself, remained flat when accounting for the growth of import penetration because most foreign firms tend to be small (so they enter the denominator but not the numerator of concentration ratio measures). The present analysis accounts for such trade within the relevant geographic level of competition. In addition, robustness checks are conducted by considering the role of imports and exports.

7. Third, leveraging the procedure introduced by Bajgar et al. (2019[7]), the linkages between firms belonging to the same business group are accounted for. Such a methodology captures the activities of multinational firms in the market and accounts for the role of mergers and acquisitions in driving trends in concentration. This approach is crucial for computing concentration and measures of business dynamism among market leaders: all subsidiaries belonging to the same business group and active in the same market are treated as a unique entity. Neglecting these ownership linkages may lead to underestimating concentration and measures of business dynamism among market leaders.

8. Applying these methodological innovations, the report shows that average concentration increased across all geographical buckets from 2000 to 2019. The increase was largest in industries competing domestically (6 percentage points, p.p. from here onward), followed by those competing at the European and global level (4 p.p.). The increase is similar across broadly defined sectors (1-digit) and across industries with different digital intensities (according to the OECD taxonomy constructed by Calvino et al. (2018[8])).

9. The report also uses novel firm-level data on sales by *product* markets from "Euromonitor International Passport Consumer Industries and Services" to show that concentration measured at the product level is strongly correlated with concentration measured at the industry level. Recent studies have noted that even within narrowly defined industries, concentration measured at the industry level may not reflect concentration at the product market level (Berry et al. (2019[9]); Benkard et al. (2021[10]); Shapiro (2018[11]); Werden and Froeb (2018[12])). Benkard et al. (2021[10]) use product market data for the United States to show that product market concentration has been flat, even though industry concentration has grown. The present report finds the same trend for the United States, but in Europe both product market and industry concentration have increased between 2012 and 2019 by 1.0 p.p. and 1.6 p.p., respectively. These novel findings show the positive relationship between product and industry concentration and add weight to the wealth of studies documenting industry concentration patterns, for which data are more readily available.

[1] In this cross-country setting, data on firm's sub-national activities are unavailable. Rossi-Hansberg et al. (2021[36]) show that concentration measured at the local level in the United States may have declined on average. However, Autor et al. (2023[39]) show that only local employment concentration fell while local sales concentration increased.

[2] For example, industry "052" (Mining of lignite) is classified as domestic, and, therefore, industry "052" in France and industry "052" in Germany represent two distinct markets. Industry "132" (Weaving of textiles), which is European, is considered a unique market across countries.

10. The evolution of business dynamism among market leaders is analysed through different indicators: entrenchment, rank persistence, and market share instability measures. Entrenchment, a dynamic indicator capturing churn among market leaders, suggests a high degree of persistence in the composition of the four biggest (in terms of sales) business groups in a market: on average, more than three firms out of four remain among the leaders from one year to the next. In addition, the trend is increasing for industries competing at the domestic and European levels. Moreover, average entrenchment is higher in strongly concentrated industries and has been increasing in both weakly and strongly concentrated industries. Rank persistence, which captures eventual differences in the ranking among the four market leaders from one year to the next, not only suggests that the composition of the market leader group has remained relatively stable over the years, but also shows a decreasing trend in the changes of the relative position in the group of the four leaders. These results are also consistent with the market share instability measure, which captures the variability in the market shares of market leaders and suggests a decrease in market dynamism among the group of the four leaders. All in all, the combination of these indicators suggests that the level of business dynamism at the top is low and has decreased slightly during the period considered, especially in industries competing at the domestic and European levels.

11. A third proxy used to capture the state of competition is markups, defined as the price-to-marginal cost ratio. Markups are indicative of market competition because they reflect the ability of firms to raise prices above marginal costs (see Syverson (2019[4])). Since information on firm-level prices and marginal cost are generally unavailable in datasets covering broad sections of the economy, state-of-the-art estimation techniques that rely on the estimation of the firm's production function from data on revenues and expenditures are used to estimate markups at the firm level ((De Loecker and Warzynski (2012[13])). By showing the evolution of markups over 20 years for a large sample of European countries and 3-digit industries, this report adds to the recent literature that has shown evidence of rising market power in the United States and other countries (Calligaris et al. (2024[2]); De Loecker et al. (2020[3]); Autor et al. (2020[14]), De Loecker and Eeckhout (2018[15])). The heterogeneity in the evolution of markups is also explored by looking separately at groups of firms with a different position in the markup distribution, a different geographic level of competition, firms belonging to different 1-digit sectors, or industries with different digital intensities.

12. Markups have been increasing over the period considered: on average, they increased by slightly more than 7%. The result is mainly driven by the increase in firm's markups in the top half of the markup distribution, with the bottom half remaining rather flat, implying an increase in markup dispersion. When looking at the heterogeneity across geographical buckets, the ranking of changes in markup is opposite to that observed for concentration: the average markup increased relatively more in industries competing at the global level (+12%), followed by industries competing at the European (+7%) and at the domestic level (+3%). In addition, in line with the existing literature (see Calligaris et al. (2024[2])), markups increased relatively more in non-financial market services than in manufacturing, and more in highly digitally intensive sectors than in low ones.

13. The above-mentioned patterns are further explored through econometric analysis. First, the degree of correlation between the different competition proxies is assessed. The measures, all aggregated to the industry-geography-year level, are regressed against each other. In line with the industrial organisation literature (see Berry et al. (2019[9]) and Syverson (2019[4]) for a discussion), markups and concentration are broadly uncorrelated, with estimated coefficients close to zero. Such a finding is unsurprising, as theory suggests that there can be economic environments where markups and concentration are positively correlated (classical Cournot competition) or negatively correlated (models of monopolistic competition with product substitutability). Both markups and concentration are market outcomes that result from the fundamental characteristics of a market, including the nature of competition. Therefore, cross-industries regressions will likely capture an average over these different environments.

14. Relatedly, data on average unit prices in consumer product markets are used to relate prices and concentration. Using an equivalent specification to the previous one, the results suggest that average unit prices are instead positively correlated with concentration, especially in non-tradeable sectors. However, given the weak correlation between concentration and markups, it is difficult to draw conclusions from these correlations alone about the implications for market power.

15. The second objective of the regression analysis is to analyse the role of economic and institutional fundamentals in explaining trends in competition. This report provides novel evidence on the channels related to the evolution of concentration and markups in a harmonised setting. Concentration, markups, and prices are regressed against several economic and policy measures, including intangible intensity, openness to trade, proxies of product market regulation, indicators of merger and acquisition (M&A) activities, and measures of anti-trust interventions by the European Commission. Although the setting does not allow for the identification of causal effects, the correlations provide useful information on possible underlying mechanisms.

16. Concentration is positively correlated with the intensity of intangible asset investments, whereas is negatively correlated with globalisation, proxied by openness to trade. At the same time, more open industries, and thus more exposed to international competition, display a stronger positive relationship between intangible asset investments and concentration level. The combination of these results suggests that there might be two forces at play in international markets: international openness increases competition and puts downward pressure on concentration, as in Amiti and Heise (2021[6]); at the same time, international openness increases market size, amplifying the scale effects of intangible assets. Put differently, when industries are more open to trade, large firms reap higher returns from intangible investments.

17. Concentration is also positively correlated with a higher dependence on inputs coming from industries with more burdensome regulations.[3] If inputs are relatively more expensive, bigger firms may be advantaged by running operations at a larger scale and having more market power vis-à-vis suppliers, leading to higher concentration levels. M&A activities conducted by the top four business groups are also positively correlated with concentration. This result aligns with previous literature (Bajgar et al. (2021[16])) showing that large incumbents might use mergers and acquisitions to strengthen a dominant position and increase their market shares. Moreover, the relationship between concentration and antitrust interventions is positive when looking at lagged concentration levels, suggesting that the authority's activity focuses more on concentrated sectors. Finally, the relationship of concentration with macroeconomic indicators such as productivity and labour share is also explored in a firm-level context. Although descriptive, the evidence is in line with the findings by Autor et al. (2020[14]), suggesting that superstar firms explain several macroeconomic trends: total factor productivity is positively correlated with concentration for the most productive firms, while the relationship is negative when looking at the bottom 90% of the Total Factor Productivity (TFP) distribution. This result suggests a positive relationship between concentration and TFP dispersion. On the other hand, labour share is negatively correlated with concentration, and the relationship is driven by firms in the top decile of the TFP distribution. This suggests that more productive firms have, on average, a lower labour share and that this negative relationship is even stronger in more concentrated industries. Put differently, in more concentrated industries, frontier firms have higher productivity but their workers get a lower share of income relative to in less concentrated industries.

[3] The OECD compiles a number of indicators capturing anti-competitive regulation in the economy. The primary indicators are the Product Market Regulation (PMR) and the Energy, Transport and Communication Regulation (ETCR) indicator. The ETCR indicator covers seven network industries (electricity, gas, telecom, post and air, rail and road transports). The REGIMPACT indicator – which is the variable used in this report – builds on the ETCR indicator (and low-frequency indicators such as regulation in retail and professional services) to assess the indirect effect of regulation in other sectors of the economy (see Égert and Wanner (2016[71]) for the details).

18. Unlike concentration, markups can be analysed at the firm level. Markups are positively correlated with the intensity of intangible investments in the industry, and this relationship is stronger for the most productive firms (in line with Autor et al. (2020[14])). As for concentration, average markups are lower in industries that are more exposed to international competition, but openness to trade amplifies the positive relationship between markups and intangible investment. These findings align with the theoretical insight that global firms, having access to larger markets, are in a better position to exploit the gains induced by intangibles, which, at the cost of higher fixed costs, can lower marginal costs and, therefore, raise markups (De Ridder (2024[17])). The analysis of product market regulation suggests that the more an industry depends on inputs provided by sectors with a higher regulatory burden (which, in principle, are more expensive), the higher the marginal costs, so the lower the average markups. Finally, higher M&A activities conducted by firms in the top decile of the markup distribution are associated with higher average markups across the entire industry, suggesting that firms may use M&A to increase market power.

19. Together, the analysis of trends and correlations presents new evidence on the state of competition and on the economic and policy factors linked to it. There has been a rise in average concentration and markups in Europe over the last two decades. This tendency seems partly driven by two important structural shifts – the increasing importance of intangible investments and globalisation. While there is evidence of the pro-competitive effects of openness to trade, concentration and markups are higher in more intangible intensive sectors. Furthermore, the rise in concentration and markups is most significant in globalised intangible intensive sectors: the increased market size from openness to trade seems to amplify the role of intangible investments, which disproportionately benefit highly productive, high markup firms. Such a narrative is in line with the "superstar firms" explanation of Autor et al. (2020[14]), according to which the observed increase in concentration and markups is the result of reallocation activity towards more efficient, large and high markups firms. Based on this narrative, one might be tempted to conclude that the rise of "superstar firms" would benefit the economy by increasing aggregate innovation and productivity, at least in the short run. But the increase in market power associated with these changes has important implications (Bessen, 2022[18]). Even if in the short-run some firms attain their dominant positions by out-competing rivals on the basis of their performance, in the long-run they may use their position to raise prices and entrench their position by buying off possible competitors. Indeed, there is evidence that higher M&A activity among leading firms is associated with higher markups and increased concentration. Moreover, their incentives to be efficient and innovate might be reduced once their position in the market is not threatened.

20. Therefore, independently of the underlying reasons for which the top firms reach their dominant position in the market, a holistic and whole-of-government approach to ensure a competitive and dynamic business environment should be adopted. Appropriate innovation, trade and industrial policies, as well as actions directed to promote knowledge and technology diffusion, are just some of the policy areas that should be combined with the efforts of competition authorities to encourage global and domestic level playing fields.

21. Finally, while this report provides a detailed description of aggregate trends and possible explanations for their evolution, it does not detail individual industry dynamics. The report has highlighted the importance of examining multiple measures that may proxy for competition simultaneously. Therefore, in a companion report – Abele et al. (2024[19]) – the measures used in the present report (and some additional ones) are combined to produce a composite index that ranks industries according to their degree of competition.

22. This report begins by summarising the literature in Section 2. In Section 3, the numerous datasets used in the analysis, as well as the cleaning procedures implemented, are described. The methodology to define concentration, entrenchment, and markups is outlined in Section 4. Section 5 presents trends. The relationship between concentration at the product market level and industry level is shown in Section 6. The correlations between the various competition measures and other economic and policy variables are

explored in Section 7. Finally, Section 8 draws together all the analysis and discusses possible explanations for the trends and correlations analysed.

2 Literature Review

23. There is a growing literature documenting recent trends in market concentration, markups, entrenchment, and other measures that can be used to proxy trends in competition in OECD countries. Studies on concentration differ in their definition of a market – both in terms of the product or industry scope and the geographical coverage – and in their specification of firm boundaries across products/industries and countries, such as through the role of business groups. The literature looking at the dynamism among market leaders is still very scant. Studies estimating trends in average markups differ in the granularity of data used (based on firm-level data or estimated at the sectoral level), as well as the estimation technique. In this section, the different strands of the literature are reviewed, focusing on studies that document trends in possible proxies of competition, as well as explanations for these trends.

Concentration

24. Although defining concentration might seem straightforward, several methodological decisions must be taken to measure concentration (OECD, 2018[20]). As a result, the literature is characterised by differences between alternative approaches – regarding both the perspective and methodologies –, resulting in different concentration measures. Most studies are based on a concentration measure defined at the industry level, as industry-level data are more readily available, while some studies measure product market concentration, which is more directly in line with practices used by competition authorities in antitrust cases. Analyses also vary in the geographic dimension at which concentration is computed, varying from local (sub-national) to national and international levels.

25. Each approach has its advantages, and analysing different concentration measures reveals a more comprehensive indication of the state of competition. This sub-section begins with studies that document concentration trends at the national level, most of which exhibit an increase in the average (industry-level) concentration over recent decades. Then, it discusses recent innovations in concentration measurement and how they affect the corresponding trends.

26. Several analyses that measure concentration ratios at the national industry level, mainly focused on the United States, have documented an increase in national average concentration over the past few decades (Autor et al. (2020[14]); Barkai (2020[21]); Covarrubias et al. (2019[22]); Furman and Orszag (2015[23])). Grullon et al. (2019[24]) show that more than 75% of US industries have experienced an increase in industry concentration since the late 1990s. Looking over the past 100 years, Kwon et al. (2023[25]) document a long-term rise in concentration. Industry concentration also increased in Canada, with the largest rise coming from in industries that were already more concentrated (Canada Competition Bureau (2023[26])). Ganapati (2021[27]) shows that changes in industry concentration in the US are positively correlated with productivity and real output growth, uncorrelated with price changes and overall payroll, and negatively correlated with labour's share of revenue.

27. In European countries, studies have also found increasing industry concentration, albeit usually at a slower pace than in the United States. For example, Lashkari et al. (2019[28]) and De Ridder (2024[17]) both find rising industry concentration using administrative data for France, and De Loecker et al. (2022[29]) show similar patterns for the United Kingdom. Koltay et al. (2023[30]) look at the five biggest European countries (France, Italy, Germany, Spain and the United Kingdom) using commercial data (from

Euromonitor) and document a rise in industry concentration and in the share of industries defined as highly concentrated. In addition, they also show that high concentration levels are associated with antitrust interventions by the EU Commission. Using a similar methodology on commercial data (from Orbis), the IMF (2019[31]) documents rising average concentration across 27 economies, both advanced and developing. Affeldt et al. (2021[32]) use a different approach and construct market shares from information available from EU Commission merger cases. They also find that concentration has increased over time. The comparison between the results obtained with this unique dataset and other results that rely on more standard measures suggests that the level of concentration may be magnitudes higher than that implied by measures of industry concentration.[4] Given that EU Commission merger cases are focused on product market concentration, the finding of a higher level of concentration is in line with that of Benkard et al. (2021[10]) who show that product market concentration is higher than industry concentration.[5]

28. Previous studies on Europe – even those that look jointly at several countries – compute concentration measures at the national level and then study cross-country dynamics. The work by Bajgar et al. (2023[1]) is an exception as, in addition to national level analysis, it considers the EU as a single market and computes concentration measures not only at the national, but also at the European level. Accounting for the cross-country subsidiaries of business groups, they document a slight increase in concentration across 12 European countries included in their sample, both at the national and European levels.

29. In contrast with previous evidence, Gutierrez and Phillippon (2023[33]) and Kalemli-Özcan et al. (2023[34]) have found national industry concentration trends in Europe to be flat or decreasing. These differences are likely to be explained by contrasting methodologies. Importantly, Gutierrez and Phillippon (2023[33]) construct the total market size (the denominator of concentration measure) using data from Orbis, which has increasing coverage of small firms over time and can consequently lead to flat industry concentration trends. Kalemli-Özcan et al. (2023[34]) do not account for connections between firms within a unified business group, which leads to contrasting trends in concentration (see Bajgar et al. (2019[7]) for a detailed discussion about these two points).[6] As discussed in Section 4, accounting for such connections between firms is crucial given the potential implications for the link between concentration and market power.

30. Recent papers on industry concentration have sought to address issues surrounding the appropriate definition of a market and show that, once the role of international trade is accounted for, concentration in manufacturing remains flat or decreases. Amiti and Heise (2021[6]) note that existing studies had measured industry concentration using only sales of firms located in the relevant country rather than sales on the relevant market. That is, existing studies did not account for international trade, in particular import competition. For this purpose, they merge confidential information from three different sources: the United States Census of Manufacturing, time-consistent establishment level information at the 6-digit North American Industrial Classification (NAICS) 2007 industry code and transaction-level import data from the Longitudinal Firm Trade Transactions Database (LFTTD). These data allow them to cover the universe of US imports since 1992, construct the market shares of the foreign sellers in the

[4] One potential concern is about the nature of the data: given that the definition of a market is based on EU antitrust cases, the focus is on problematic sectors and, therefore, exactly on those with higher concentration. Furthermore, in 43% of their observations, the Commission only reports the joint market shares of the firms involved in a prospective merger.

[5] This report also confirms that product market concentration is higher than industry concentration in European countries and the United States (see Section 6).

[6] They find increasing concentration trends only when restricting the sample to firms reporting consolidated accounts. Note that, as explained in detail in Section 4 and in Bajgar et al. (2019[7]), the methodology followed in this report does not use consolidated accounts but relies instead on unconsolidated accounts.

United States and correct for double counting of imports from US plants abroad.[7] Accounting for this import competition, they show that US industry concentration has been flat between 1992 and 2012 because foreign firms have increased their exports to the United States, even if their individual market shares tend to be small. Put differently, on average, foreign exporters increase the overall size of the market more than they impact the relative size of the top firms. Concentration mostly fell in industries with high initial import penetration, which also experienced the fastest growth in import competition. In the United Kingdom, the Competition and Markets Authority (2022[35]) (henceforth, CMA) show that correcting concentration ratios for international trade causes a fall in the level of concentration, although this still shows a slight increase over the period 1997-2018.[8]

31. While these studies have highlighted the importance of accounting for the international integration of markets, other studies have argued that, for non-tradeable products, the relevant geographic dimension is likely local. The evidence on concentration trends at the local level is mixed. Rossi-Hansberg et al. (2021[36]) observe that the national trend of increasing industry concentration is not reflected in average local market concentration, which is declining in the United States. They explain the differing trends at the national and local levels by observing that large firms are expanding by opening establishments in new local markets. Relatedly, Hsieh and Rossi-Hansberg (2023[37]) document how the "industrial revolution in services" – the increasing returns to fixed-cost-intensive technologies and changing management practices in services sectors – has led to the expansion into new markets and a reduction in local concentration. Rinz (2022[38]) finds similarly decreasing trends in local industry concentration between 1976 and 2015.

32. However, Autor et al. (2023[39]), still looking at the United States, find that only local employment concentration has decreased, while local sales concentration has increased. They explain the divergence in local and national employment concentration trends with the structural shift of the economy, with a reallocation of economic activity from relatively concentrated manufacturing sectors, where employment concentration is high, to fairly unconcentrated services sectors, where employment concentration is relatively lower. When looking within industry-by-county cells, concentration has increased, even for employment. They suggest that the differences between their findings and those of Hsieh and Rossi-Hansberg (2023[37]) and Rinz (2022[38]) are explained by the use of alternative datasets. Benmelech et al. (2022[40]) and Smith and Ocampo (2022[41]) find increasing average local concentration, in line with Autor et al. (2023[39]), with the latter focusing on the retail sector.

33. Some studies have argued that the relevant market is supra-national. As discussed above, Bajgar et al. (2023[1]) compute industry concentration at the EU level to account for the integrated market. Lyons et al. (2001[42]) estimate a model of industry concentration which endogenously allows for markets to be defined at either the national or EU level, showing that the four countries studied – France, Germany, Italy, and the United Kingdom – varied in their integration in the EU. Affeldt et al. (2021[32]) use market definitions from EU horizontal merger cases to define the geographic scope, showing that concentration increased most in worldwide markets. Note, though, that their sample is an unbalanced panel, and the relevant geography is not fixed over time, so the results could be driven by changing sample composition if more concentrated sectors become global over time.

34. Most of the literature on concentration has used industries to proxy for markets, mainly because most data sources collect information on the industry to which firms belong instead of the product markets to which they sell their products. Industry classifications are constructed to reflect production processes and may not reflect consumer product markets. Industries are also often much broader than product markets. Therefore, some authors have argued that industry concentration may not capture an

[7] Matched firm-level data of this nature are confidential and only available for one country at a time, not on a cross-country basis.

[8] Freund and Sidhu (2017[46]) find that an increase in the number of emerging market firms in an industry is associated with a decline in concentration, looking at both manufacturing and services industries.

economically relevant measure of market concentration, where the consumer demand side is the relevant concept (Berry et al. (2019[9]); Werden and Froeb (2018[12]); Shapiro (2018[11]). Benkard et al. (2021[10]) re-examine trends in the United States concentration using data that more accurately reflect consumer product markets, although the set of markets covered is relatively limited. They find that the concentration level is typically higher in product markets, with 45% of industries in their sample defined as highly concentrated according to the US "Horizontal Merger Guidelines". However, they show that the median product market concentration decreased between 1994 and 2019. In line with previous studies, concentration increases when they aggregate to the industry level. They explain these divergent trends with a model in which the cost of firms supplying in adjacent product markets has fallen over time, so firms expand by adding products in new markets within the same industry. The model of Aghion et al. (2023[43]) follows similar lines and may also be able to explain these trends. Pellegrino (2023[44]) takes an alternative approach to defining relevant product markets based on observed similarities and substitutability across products, with the results suggesting a broad increase in market power over time.

Entrenchment

35. Market concentration captures the market shares of leading firms but does not identify whether there is churn among the market leaders. Schumpeterian "creative destruction" and industry dynamism among market leaders can also reflect competition (for the market), even in markets characterised by high concentration levels. Therefore, an important measure that may reflect a lack of competition is the extent of entrenchment among market leaders.

36. Bessen (2020[45]) proposes two alternative measures of entrenchment: first, the annual displacement hazard rate of firms ranked in the top four in an industry dropping out of the top four (i.e., the likelihood that a leading firm loses its place among the top firms in a market but remains in operation); second, the annual hazard rate of a firm ranked fifth to eighth in the industry progressing into the top four (i.e., the probability that a competing firm leapfrogs a top four firm to become a market leader). Using US data, he finds that displacement rates of the top firms rose from the 1970s to the 2000s but have declined sharply since then.

37. Freund and Sidhu (2017[46]) use Orbis data to show that between one-third and one-half of firms in the top four in an industry in 2014 differ from the top four in the same industry in 2006. CMA (2022[35]) finds that, in the United Kingdom, the likelihood that the ten largest firms in an industry were among the largest ten firms even three years before has increased over the last two decades, implying that competition among market leaders may have fallen. Davies (2022[47]) shows an increasing persistence of the largest firms in the top 10 until 2018 in the United Kingdom. Furthermore, the study finds that the persistence of the largest firms at the top is more pronounced in more concentrated industries. In Canada as well there seems to be increasing stability among firms' industry rank and less entry (Canada Competition Bureau (2023[26])). On the contrary, using data from Japan, Honjo et al. (2018[48]) show that market leaders are more likely to be replaced by competitors in industries with negative growth and high concentration.

38. Finally, Bajgar et al. (2021[16]) focused on three variables to explore the churning of the top firms: the share of firms that are in the top 8 but were not in the top 8 in the previous year, the rank correlation between the market shares of top 8 firms over two years, and the market share instability. Using data from a sample of OECD countries, they show that increased concentration is associated with reduced churning among the top firms, namely with less entry of new firms at the top and more rank persistence of the leading firms.

Markups

39. Markups, defined as the ratio between price and marginal cost, are often used as a proxy for market power as they measure the ability of firms to set individual prices above the (perfectly) competitive level. Given that prices and marginal costs are rarely directly measured, a rich literature has developed techniques to estimate markups. The methodologies are usually divided into a demand and a production approach, and both rely on first-order conditions from optimal firm behaviour. The former approach relies on the estimation of a demand system, derived from a fully specified model of consumer's choice. Such a modelling strategy requires assumptions on consumers preferences and the nature of competition in the market (see, for example, Berry, Levinsohn and Pakes (1995[49])). This approach, however, is not feasible unless detailed data on prices and quantities are available, which is often not the case when relying on data for a large and cross-country sample.[9] In this case, therefore, the production approach proposed by De Loecker and Warzynski (2012[13]), who build on Hall (1988[50]), can be used. This approach does not require assumptions on the mode of competition or demand as it derives the relevant parameters from the firm's cost minimisation problem (see Section 4 for a deeper discussion and further references on the estimation of markups). Using such techniques, several studies have described the evolution of markup trends across countries and the distribution of markups across firms.

40. Numerous studies have focused on the United States and Canada and have found rising markups in recent decades. De Loecker, Eeckhout, and Unger (2020[3]) show that markups have risen since 1955 and that this trend was driven by firms at the top of the distribution. Furthermore, there was a reallocation from low-markup firms to high-markup firms, in line with Autor et al. (2020[14]). Hall (2018[51]) uses industry-level data and an alternative estimation technique to show that markups grew modestly between 1998 and 2015. Narrowing in on the retail sector with highly detailed data, Anderson, Rebelo and Wong (2020[52]) show that markups were relatively stable over time, but there is a large dispersion across regions related to local incomes. In Canada, average markups rose, with the rise most significant among firms with initially high markups (Canada Competition Bureau (2023[26])).

41. In European countries, the findings have been more varied. The trend of rising markups is also present both in France (De Ridder (2024[17])) and in the United Kingdom (De Loecker et al. (2022[29]), CMA (2022[35])). However, in the Netherlands, the trend has been flat. According to the authors, this trend is attributable to a methodological innovation of the study whereby temporary contract hours are used as the flexible input required for markups estimation (van Heuvelen et al. (2021[53])). In Spain, average markups rose between 2004 and 2009 but decreased between 2009 and 2017. Unlike in other studies, they find that this trend was driven by small and unproductive firms following an increase in the share of fixed costs in production (García-Perea et al. (2021[54])). Finally, average markups rose in Austria, especially in non-tradeable services (2024[55]).

42. In a cross-country setting, Calligaris et al. (2024[2]) show that average markups have increased between 2001 and 2014 across 26 countries. By estimating markups at the firm-level, they show that this rise was driven by firms at the top of the markup distribution, while markups have been stable for firms in the bottom half of the distribution. These trends are also captured in the cross-country work of Díez et al. (2021[56]), who further show that the increase in markups was driven by advanced economies, while they have been flat in emerging markets. De Loecker and Eeckhout (2018[15]) collected data on 70,000 firms from 134 countries to show that average markups have increased considerably, mostly in North America and Europe and least in Latin America.

[9] In addition, it requires strong assumptions on the modes of competition and demand structure, which are likely to vary across industries and countries, making the estimation of markups in a cross country and industry setting particularly challenging.

43. Besley et al. (2021[57]) look at profit margins rather than markups and argue that firms in tradeable sectors are more likely to be subject to competition that limits their market power, while firms in non-tradeable sectors are more dependent on domestic policies and institutions. Using cross-country Orbis data, they find that, in non-tradeable sectors, firm's profit margins are significantly lower in countries with stricter antitrust policies than in tradeable sectors.

Explanations of recent trends in competition proxies

44. Numerous theoretical and empirical explanations have been proposed to explain the observed increasing trends in industry concentration, markups, and the entrenchment of industry leaders. Many claim that these trends are, at least partially, driven by technological change, including the rise of intangible capital and lower diffusion of technology between firms, while others argue for institutional factors such as antitrust policies or declining worker power. Many, or all, of these explanations likely play a role (see Section 8 for a summary of the findings of this report and likely explanations of the trends). Some authors have also discussed the extent to which these macro trends do indeed reflect increasing market power; Syverson (2019[4]) suggests that market power is a leading candidate explanation of these trends, while Berry et al. (2019[9]) highlight the importance of establishing causal relationships to understand the drivers of these trends.

45. The fall in IT costs could disproportionately affect market-leading firms. Aghion et al. (2023[43]) propose a model in which the cost for firms to supply multiple markets has fallen due to IT advances, causing the most efficient firms to expand into new markets. Even though markups fall within firms, the reallocation of activity to high-markup firms causes an aggregate increase in markups. Using data on French firms, Lashkari et al. (2019[28]) document a positive within-industry relationship between firm size and IT demand, and this disproportionately affects larger firms through mitigating issues of organisational efficiency associated with firm growth.

46. More generally, intangible capital, which incorporates IT technologies, can explain trends in market power. De Ridder (2024[17]) models intangibles as an investment that can be made that raises fixed costs to reduce marginal costs. Intangible-intensive firms can operate at low marginal cost and, therefore, deter entry into their market. These firms also have greater incentives to innovate, causing an increase in overall R&D, although its benefits are lower because it is concentrated in a few leading firms. Crouzet and Eberly (2019[58]) also focus on intangibles, noting that the combination of their scalability and legal protections (i.e., patents) can lead to a rise in concentration. Studies show that intangibles are correlated with concentration, markups, business dynamism and entrenchment (Bajgar et al. (2021[16]); Calvino et al. (2020[59]), Calligaris et al. (2024[2]), Berlingieri et al (2020[60]), Bessen (2020[61]), Covarrubias et al. (2019[22])). De Loecker et al. (2020[3]) discuss the possibility of the reverse relationship, whereby an increase in concentration can cause a decrease in investment in intangibles because a lack of competition can reduce the incentives to innovate and invest.

47. A slowdown in technology diffusion from leading innovative firms to followers can also explain the macro trends on concentration and business dynamism. Akcigit and Ates (2021[62]) propose a model in which diffusion has declined because firms increasingly use intellectual property rights to deter technology transmission outside the firm. Olmstead-Rumsey (2020[63]) shows that the decline in innovation of small firms can explain the rise in concentration, providing evidence that small firms' patents have made less significant innovations in the 2000s relative to the 1990s. Andrews et al. (2019[64]) provide evidence of increasing productivity divergence between firms at the global frontier of productivity and laggard (non-frontier) firms. This divergence could be triggered by structural changes in the global economy, such as digitalisation, globalisation, and the rising importance of tacit knowledge, that fuel rapid productivity gains at the global frontier.

48. Autor et al. (2020[14]) propose that technological change, combined with globalisation, can disproportionately benefit the most efficient firms, leading to a rise in concentration and higher markups (the latter because most efficient firms have higher markups on average). Kwon et al. (2023[25]) suggest a positive relationship between rising industry concentration and technological intensity and higher fixed costs, as well as suggesting that globalisation has played a role in rising concentration in recent decades. Antoniades (2015[65]) develops a model in which an increase in market toughness, such as due to globalisation, causes an increase in competition but also an increase in the scope for quality differentiation, which generates an incentive to invest in fixed costs of innovation, leading to increased quality, markups, and prices.

49. In contrast, more relaxed antitrust policies and merger enforcement could provide an alternative explanation for increasing competition, markups, and entrenchment. In the United States, Grullon et al. (2019[24]) show that industries that experienced the largest increases in product market concentration had more profitable M&A deals but no increase in operational efficiency. Gutierrez and Philippon (2023[33]) and Döttling et al. (2017[66]) argue that there has been a divergence in the strength of antitrust enforcement between the United States and the EU. In Europe, antitrust enforcement has been stricter and product market regulations have decreased, in contrast to the United States, and these differences explain higher investment and declining real prices in the EU.[10]

Contribution of this report to the literature

50. This project makes numerous contributions to the literature on competition in European countries. It covers multiple measures that may proxy for different facets of competition (or lack thereof) in an integrated setting: concentration, entrenchment, rank persistence, market share instability, and markups. Examining different characteristics of markets in the same setting provides richer inferences about the trends in market power, as well as possible explanations for these trends. The analysis is conducted for manufacturing and services (as well as mining and utilities) across many European countries and over a long time horizon. Constructing a database that allows such analysis is itself a significant contribution.

51. The project innovates on the existing literature in its measurement of concentration, aimed at reflecting markets more accurately. First, it measures concentration within more narrowly defined industries than previous representative cross-country studies - mainly at the 3-digit level.[11] Second, international trade is accounted for by constructing a taxonomy which defines whether markets compete domestically or internationally, at both the European or the global level, and computes concentration at the corresponding geographic level. Using this taxonomy means that the concentration measures account for firms' international activities, even when firm-level trade data is absent. On top of this, in the robustness checks, imports and exports are incorporated in the concentration measure using industry-level data. Third, following the methodology by Bajgar et al. (2019[7]), the business group structure is accounted for to incorporate the role of mergers and acquisitions in driving concentration trends and to capture the complete activities of multinational firms in a market. Fourth, a comparison between concentration computed at the

[10] Various alternative explanations for changing indicators of competition have also been put forward. A reduction of worker power can lead to a redistribution of rents from workers to firms, causing a rise in corporate profitability and a fall in the labour share (Stansbury and Summers, 2020[115]). A decline in long-term interest rates can disproportionately increase investment by market leaders relative to followers (Liu, Mian and Sufi, 2022[116]). A decline in population growth (Peters and Walsh, 2020[117]), growth of industries (Kwon, Ma and Zimmermann, 2023[25]), economic growth (Ekerdt et al., 2023[118]), or network effects (Berry, Gaynor and Morton, 2019[9]) have all been proposed as alternative explanations.

[11] Some cross-country studies have measured concentration at the 4-digit level, such as IMF (2019[31]), but use only Orbis data to construct the denominator, therefore leading to a biased measure of concentration since Orbis does not capture the entire size of the industry (Bajgar et al. (2020[81]); Bajgar et al. (2019[7])).

industry and product market levels is conducted to understand the extent to which industry measures of concentration are indicative of product market concentration.

52. Alongside concentration, which is a static measure of market shares at any point in time, the project also considers other measures of market dynamism among market leaders. For example, entrenchment is a dynamic measure of the persistence of firms as market leaders and provides richer insights into the extent of competition, even when concentration is high. The measurement of entrenchment innovates on previous literature by defining markets according to whether they compete at the domestic, European or global level (according to the taxonomy) and by accounting for the connectedness of firms within a business group.

53. The study estimates markups in a cross-country setting for detailed industries and over a long period, also looking at changes along the markup distribution. It also estimates changes in average markups across different industry types (digital versus non-digital, manufacturing versus services) and different geographical buckets.

54. Trends in all these measures are examined, as well as differences in these trends along different industry characteristics, such as tradeability and digital intensity. The measures are then regressed against each other, as well as against key economic and policy variables. By providing a rich analysis of trends and correlations for all these measures together, while incorporating the methodological innovations mentioned above, the report provides evidence on the overall state of competition and the potential causes of these trends. It therefore contributes to the literature that aims to explain the causes of observed macroeconomic trends; indeed, the findings are supportive of many of the proposed explanations discussed in this literature review. The harmonised framework and extensive analysis provide a richer and more robust picture of competition than previous cross-country studies. They inform the policy debate on competition and provide methodological innovations that could be used in future work.

3 Data

Overview

55. The analysis requires merging detailed data collected from numerous sources. The data needed include product level and firm-level data, as well as data at the industry-country-year level, with industries generally defined at the 3-digit NACE revision 2 level of granularity.[12] Using cross-country data at this level of granularity combined with international trade data is an important innovation of this study.

56. The total value of production for each industry-country-year is a key variable used in constructing both the concentration measures and the geographic taxonomy of industries. Production data is collected from National Accounts (NA, henceforth), the STAN database and Eurostat's Structural Business Statistics (SBS).

57. Production data are matched with data on international trade flows from OECD Inter-Country Input-Output (ICIO) tables, the "Base pour l'Analyse du Commerce International" (BACI) dataset, and the Trade in Services by Partner (TISP) data. To measure the contribution of the largest firms to total production and to compute markups, firm-level production data collected from Moody's Orbis database are required. In addition, to conduct a comparison between product and industry-level concentration, the Euromonitor International Passport Consumer Industries and Services (2022 edition) dataset is used. Finally, the analysis relates proxies of competition to various of economic variables, such as foreign ownership, intangibles, and policies, which are collected from numerous sources described below.

58. For concentration and the measures of business dynamism among market leaders, the final sample covers 15 European countries plus three non-EU countries (Japan, Korea and the United States). In contrast, for markups, the sample covers 23 countries.[13] Regarding sectoral coverage, the analysis focuses on mining, manufacturing, non-financial market services (excluding real estate), and utilities sectors following the NACE Rev. 2 classification at the 3-digit industry level. Due to data limitations and different data requirements to construct each alternative proxy of competition analysed in the study, the sector level of aggregation and coverage slightly changes across different sections of the analysis. Specifically, the markups analysis is carried out at the 3-digit level and includes each of the 204 3-digit industries belonging to the sectors of interest. Instead, for concentration and the measures of business

[12] NACE is the "statistical classification of economic activities in the European Community". It is subject of legislation at the EU level, which imposes the use of the classification uniformly within all the Member States. The present NACE Rev. 2 is the new revised version of the NACE Rev. 1 and of its minor update NACE Rev. 1.1.

[13] The countries with suitable data quality are Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Spain, Sweden and the United Kingdom. Due to different cleaning procedures implemented to create the different measures used in the analysis and the combination of multiple data sources with different coverage for some of them, samples slightly change between the different measures. Due to data availability, Austria, Bulgaria, Czechia, Estonia, Ireland, Latvia, Luxembourg, the Netherlands, Romania and Slovakia are included in the markup measure but not in concentration measures and entrenchment, whereas Greece, Japan, Korea, Norway, and the United States are included in the latter measures but not in markups.

dynamism among market leaders, some industries have been aggregated at a higher level with respect to the full list of 204 3-digit industries, and some industries have been excluded from the analysis due to data limitations, leaving a baseline sample of 127 industries.[14] Out of these, 112 (88%) are 3-digit, 10 (8%) are 2-digit, and 5 (4%) are aggregation of two or more 2-digit industries.[15] The period covered is 2000-2019.

59. This section discusses the datasets used in the analysis, including the processes conducted to clean and prepare the data.

Production data

60. The total value of production, defined as gross output in millions of euros in each industry-country-year, is a key variable used in the construction of the concentration measures and the geographic taxonomy of industries. To measure concentration at the most disaggregated level possible, this study has made a substantial effort to calculate the value of production at the 3-digit NACE Rev. 2 level. This data must be representative of the entire 3-digit industry and internationally comparable.

61. The main data source for gross output is the Eurostat National Accounts (NA, henceforth), which is the primary dataset used by countries to measure Gross Domestic Product (GDP) and other key economic variables.[16] However, Eurostat publishes NA, including the value of production, at the A*64 level of the industry classification NACE Rev.2, comprising of aggregations of 2-digit level activities.[17] It is therefore supplemented with data from Eurostat's SBS, which contain information on economic activity of all economic sectors excluding agriculture and personal services, and provide data on the value of production at the 3-digit level of aggregation.[18]

62. To get production data at the 3-digit level, the 3-digit SBS data are used to construct the share that each 3-digit industry represents within its own 2-digit industry. These shares are then used as weights to apportion each 2-digit production value from the NA to the corresponding 3-digit industries. The 3-digit production data obtained are therefore consistent with NA – which are often based on the population of firms – and at the same time available at the desired level of granularity.

63. The main reason for using the SBS 3-digit production data to apportion the 2-digit data coming from NA instead of relying directly on SBS is the following: SBS captures the structure of the economy at a higher level of disaggregation than NA, and data are representative of the economy within countries but not across countries (due to different methodologies adopted by National Statistical agencies to collect them). Therefore, SBS is an excellent source for obtaining long time series of 3-digit weights, but less than

[14] The data limitations and cleaning steps are fully outlined in Annex A. Among these steps, it has been decided to exclude industries for which there are less than four firms in the Orbis sample – which are required to compute the concentration measure properly. This conservative approach may lead to concentration and entrenchment being underestimated if the observed small number of firms accurately reflects the market rather than being a data issue. For example, the tobacco industry is excluded due to very limited data availability but is known to be a highly concentrated sector.

[15] For further details on the different levels of aggregation in the concentration sample, please refer to Annex A.

[16] For the extended documentation, see National Accounts metadata; for further definitions, see European System of Accounts - ESA 2010

[17] Note that in this section, 2-digit will also be used to indicate generic A*64 industries that are sometimes slightly more aggregated. For further details on the A*64 classification, see the OECD industry classification

[18] For further details, please refer to the Methodological Manual on European Structural Business Statistics – 2021 edition and the SBS website Structural Business Statistics

ideal to directly measure production of the population of firms in a cross-country context. Thus, to maximise cross-country comparability, NA are preferable when looking at totals.

64. There are two main obstacles to overcome to obtain consistent 3-digit level data on production over the long period considered. First, the SBS dataset contains missing values (about 26% and 9% in the pre-2008 and post-2008 samples, respectively), so an imputation procedure is needed. Second, the classification of economic activity changed in 2008 (from NACE Rev. 1.1 to NACE Rev. 2), and SBS provides two different time series: one for the years pre-2008, reported in NACE Rev. 1.1, and one for the years post-2008, reported in NACE Rev. 2 (available from 2006). Therefore, a conversion from the old to the new NACE classification system is required to have a time series at the industry NACE Rev. 2 level from 2000 to 2019.

65. To fill in missing values in the SBS data, a multi-step imputation procedure has been implemented. The various steps are imposed sequentially, according to the strength of assumptions required, with priority given to the most robust methods. The next paragraph provides a brief description of each method (and parentheses report the weighted average percentage –across the two SBS samples –of observations recovered through each of them).[19] For further details, both on the methodology and the imputation process results, see Annex A.

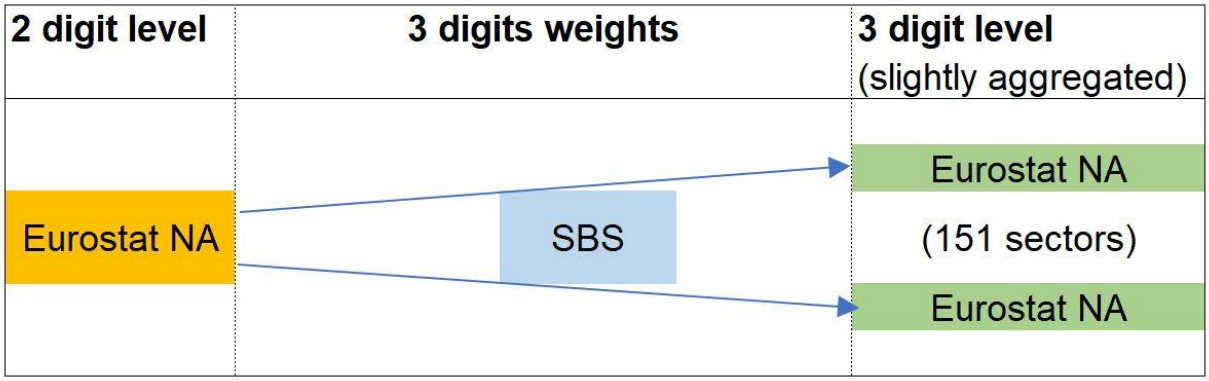
66. First, accounting identities are used, whereby if only one 3-digit industry value is missing within a 2-digit industry, the missing value is filled with the difference between the 2-digit and the sum of the non-missing 3-digit (applied to 2.2% of observations). Second, interpolation is used if the previous year's and following year's values are available (applied to 1.4% of observations). Third, a method similar to propensity score matching is implemented, whereby growth rates of similar countries are used to impute missing values (applied to 3.2% of observations). In this context, for a given industry, two countries are considered similar if they grew approximately at the same pace the previous year. Then, the average growth of the five closest countries (using the abovementioned criterion) is used to impute the missing value. Finally, regressions using additional non-missing economic variables, such as turnover, employment, and the number of firms, are used to predict missing values (applied to 3.9% of observations). If, following these steps, a value is still missing, it is left as missing.

67. The NACE classification was updated from NACE Rev. 1.1 to NACE Rev. 2 in 2008. Eurostat provided correspondence tables to facilitate the conversion between the two coding systems. However, the changes were substantial, and the correspondence between the two classification systems is many-to-many (i.e., there are multiple correspondences between industries). Given that the present analysis requires a consistent and unique industry classification –chosen to be NACE Rev. 2 –, data pre-2008 is converted to the newer system. Even in the most obvious cases, such as industries with one-to-one mapping from Rev. 1.1 to Rev. 2, the values in the overlapping year in the two datasets, 2008, are not always consistent. Therefore, to obtain the complete time series, the pre-2008 data are used to compute country-industry growth rates across consecutive years, which are then applied backwards using the 2008 values obtained from NACE Rev. 2 as a starting point. Further details of the conversion from NACE Rev. 1.1 to NACE Rev. 2 are reported in Annex A.

68. As mentioned above, SBS data are used as weights to apportion the values provided by NA at the 2-digit industry level into 3-digit industries while ensuring that that the values of all the 3-digit within a 2-digit industry still aggregate to the NA figures. The apportioning procedure is diagrammatically represented in Figure 3.1.

[19] The weights are given by the relative size of the two samples (pre-2008 41%, and post-2008 59%) in the total SBS sample.

Figure 3.1. Apportioning for Production Data



Note: The chart illustrates the process of apportioning aggregated production data to more disaggregated industries.

69. Mathematically, $GO_{Sct}^{2d\,NA}$ is the value of gross output for the 2-digit industry S in country c and year t obtained from the NA data. Then, $GO_{sct}^{3d\,SBS}$ is the value of gross output for the 3-digit industry s in country c and year t obtained from SBS. The apportioned values of gross output at the 3-digit level $GO_{sct}^{3d\,NA}$ are calculated as:

$$GO_{sct}^{3d\,NA} = \frac{GO_{sct}^{3d\,SBS}}{GO_{Sct}^{2d\,SBS}} GO_{Sct}^{2d\,NA}, \qquad \text{Equation 1}$$

70. Where the first term of the right-hand side are the weights calculated from SBS data, with $s \in S$ representing each 3-digit industry contained in the associated 2-digit industry S, such that $\sum_{s \in S} GO_{sct}^{3d\,SBS} = GO_{Sct}^{2d\,SBS}$. The computed value $GO_{sct}^{3d\,NA}$ is the measure of gross output used throughout the analysis.

71. The data for extra-EU countries included in the analysis (Japan, Korea, and the United States) are required for industries that compete at the global level, as defined by the taxonomy. In most cases, these data are available at the desired level of disaggregation in the original data sources used and, as such, no additional cleaning or data preparation was needed.[20] However, for two industries in the services sector, data was only available at the 2-digit level, with no 3-digit level production data attainable from alternative sources. In these cases, exports were used as a proxy of the shares of economic activity attributed to each 3-digit industry within its associated 2-digit industry (equivalent to the procedure described above, except the more detailed data used was exports). The assumption that production shares are proportional to export shares is stronger, as some industries may be more tradeable than others. However, the strong correlation between exports and production makes this assumption a reasonable approximation.

72. Annex A provides detailed information on the NA and SBS datasets, the imputation procedure, the mapping of pre- and post-2008 data, as well as the apportioning procedure. Finally, Table A B.1 lists the 151 sectors included in the final production sample.

[20] Data for the extra-EU countries come from the OECD STAN database complemented with data from the Korean Statistical Information Service (Korea), the Ministry of Economy, Trade and Industry (Japan), and the Bureau of Economic Analysis (the United States). Period covered: 2000-2019.

Trade data

73. Trade data at the 3-digit level (or slightly more aggregated, due to data limitations) are needed to define the taxonomy which identifies the geographic level on which an industry competes. Furthermore, as a robustness check, the denominator in the concentration measures is adjusted to consider import penetration and exports. These data are also used to measure openness to trade, which is related to concentration and markups in the regression analysis.

74. International trade data is collected from three main sources to obtain data on import and export flows at the 3-digit industry-level. The primary data source is the OECD ICIO tables, which provide import and export flows for each country, industry, and year and can distinguish trade with EU and non-EU countries. The ICIO data have two main advantages over other standard trade data. First, they account for re-export, meaning that trade is not disproportionately allocated to countries with large ports for redirecting shipments, such as Rotterdam in the Netherlands (hence, this phenomenon has been termed the "Rotterdam effect"). Second, they are in basic prices, in line with the data on production used in the analysis, meaning that comparisons can be made more accurately. However, ICIO data are only available at a higher level of aggregation (more aggregated than the 2-digit level) than the desired one.

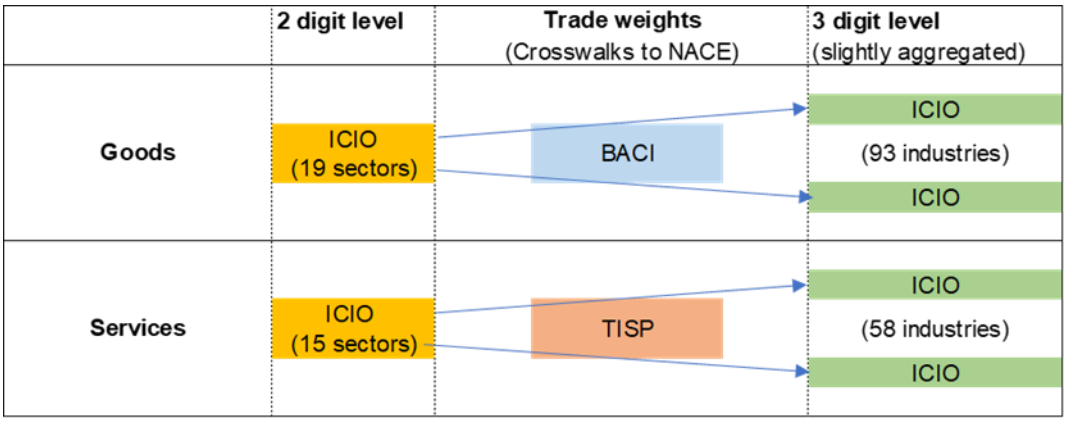
75. These data are thus supplemented with highly disaggregated information on trade flows from the Centre d'études prospectives et d'informations internationals (CEPII) "Base pour l'Analyse du Commerce International" (BACI) database for physical goods, and the OECD "Trade in services by partner economy" (TISP) database for non-financial market services. These data are reported at the product level; therefore, crosswalks have been used to convert the product-level data to disaggregated industry-level. Following this matching exercise, it is possible to recover goods trade data for all manufacturing and mining industries at the 3-digit level, while industries belonging to utilities and non-financial market services have, in some cases, been aggregated at a high level.[21] BACI and TISP do not have the advantages of being in basic prices and accounting for re-export, so they are not used directly.

76. The detailed trade data are used to construct weights at the country-partner-industry-year level, where the partner is usually either EU or non-EU countries, and an apportioning procedure in the same fashion as the one used for the production data is carried out for the trade data. The weights are used to distribute the more aggregated trade values from ICIO to more detailed industries. This method maintains the desirable characteristics of the ICIO trade flows data while providing a more disaggregated industry classification. The process is represented diagrammatically in Figure 3.2.[22]

[21] Out of the 99 3-digit industries belonging to utilities and non-financial market services, it has been possible to recover trade data at 3-digit level for 37 industries, while the remaining 62 have been aggregated into 14 2-digit industries (or slightly more aggregated levels). For the full list of industries used see Table A B.1.

[22] Note that with this method it is possible to have exports larger than production for some observations even if at the 2-digit level it is imposed by the production and ICIO data that exports values are lower than total production. This can happen when the 3-digit trade share is high relative to the 3-digit production share, and the value of production and trade at the 2-digit level are relatively close. This is the result of noise in the data. For example, for multi-product firms, production is typically allocated to their main (single) industry by statistical offices, while their trade flows would be split across products in customs declarations or in services trade surveys. The more disaggregated the industry definition, the more likely discrepancies can arise.

Figure 3.2. Trade data apportioning



Note: The chart illustrates the process of apportioning aggregated trade data to disaggregated industries.

77. The apportioning procedure can be described more formally as follows. $Trade_{Sct}^{2d\ ICIO}$ is observed in the ICIO data, where S denotes the 2-digit (or more aggregated) industry, c denotes the country, and t is the year. $Trade_{sct}$ can be imports or exports, and with either the EU or non-EU as a partner, for a 3-digit industry s.

78. Let $s \in S$ be any 3-digit industry s included in the 2-digit industry S. From BACI and TISP, $Trade_{sct}^{3d}$ is observed, where s are more disaggregated industries that can be aggregated to the 2-digit level S. Then trade at the 3-digit industry s level is defined as:

$$Trade_{sct}^{3d\ ICIO} = \frac{Trade_{sct}^{3d}}{Trade_{Sct}^{2d}} \times Trade_{Sct}^{2d\ ICIO} \qquad \text{Equation 2}$$

79. Annex A provides further details about the international trade datasets and the cleaning procedures applied in each case.[23]

Firm-level financial data

80. Financial data at the firm level are required to compute concentration, the measures of business dynamism among market leaders, and for estimating markups. The main firm-level dataset used is the Moody's Orbis database. It collects data on 450 million listed and unlisted firms worldwide, providing information on their economic activities, such as employment and output. The data used in the analysis are obtained from the 2021 Orbis vintage. Numerous steps are undertaken to clean the data, closely following Gal (2013[67]) and Kalemli-Özcan et al. (2023[34]).

81. Financial information within Orbis is available at the business group level (consolidated financial data aggregated across all firm subsidiaries) and at the individual firm level (unconsolidated information

[23] Note that the trade data capture trade in the final industrial activity of each industry at the point at which the good or service crosses the border. As an example, considering the car industry, the trade variables capture the value of cars crossing the border from the source to the destination country. The trade variables do not capture trade in all products of firms classified in a particular industry. For example, a firm in the car industry may import tires, windscreens, and other parts – these would be classified under the other relevant 3-digit level industries. Furthermore, only products that cross borders are captured in the data: no sales of a car manufacturer located in the United Kingdom that only sells to the United Kingdom market would be registered as trade in cars in the data.

referring to individual firms' activities). In this report, as detailed in Section 4, unconsolidated accounts are used.[24]

82. For the analysis on concentration and entrenchment, further data are collected from WorldScope, provided by Thomson Reuters, a cross-country firm-level commercial database of listed firms. This dataset covers 95% of the global stock market capitalization, substantially increasing the coverage of listed firms included in the sample. These additional data provide relevant information, especially for non-EU countries, usually less represented in Orbis.[25]

83. While for concentration and entrenchment the only financial information retrieved from Orbis is the sales of each firm, the computation of markups requires rich firm-level data covering additional variables. Specifically, information on revenues and input costs – including the cost of employees, materials, and capital – is required to estimate the firm production function from which firm markups are derived (see Section 4).

84. Following the literature on markup estimation (De Loecker and Warzynski (2012[13]), De Loecker et al. (2020[3]), Calligaris et al. (2024[2])), additional cleaning of the Orbis data is performed. This procedure includes ensuring comparability of nominal values across years and countries, by deflating with industry-level price indices at purchasing power parity and netting out the influence of measurement error and extreme values in the analysis. In addition, following Bajgar et al. (2019[7]), to limit concerns over the representativeness of the dataset, the analysis includes only firms employing, on average, at least 20 workers over the period. As markup computation requires estimating production functions, in order to meet minimum requirements for a robust production function estimation, the final sample is restricted to countries with at least 500 observations.[26]

85. Finally, as in preceding literature (De Loecker et al. (2020[3])): i) before estimating the production function, the 1% tails in the share of materials in sales each year are trimmed; ii) the baseline markup measure is further trimmed at the top and bottom 3% after estimation.[27]

86. The Data Appendix provides a detailed summary of the steps taken to clean and prepare the Orbis data for the analysis, as well as summary statistics on markups and key balance sheet variables used for the markup estimation.

[24] As explained in Section 4, the measures of concentration and entrenchment built in this report use business group activities. The approach adopted fundamentally relies on unconsolidated data of the individual subsidiaries within a business group, as the objective is to identify the precise industry and location of all the subsidiaries belonging to a group and to correctly apportion the group sales to the markets in which the business group is active. In Annex A, additional details on the data cleaning and preparation are provided, especially on when and how consolidated accounts are used.

[25] As explained in Bajgar et al. (2019[7]), Orbis data are generally well suited to analysing industry concentration in Europe – the main geographic market of interest in this study – since it has good coverage of medium and large enterprises in these countries. In contrast, Orbis generally has poorer coverage of subsidiary-level information for non-EU countries, especially for US firms. Note that this concern does not apply to business group-level information (consolidated accounts) since Orbis and WorldScope together cover the universe of listed firms closely.

[26] All 3-digit industries belonging to the sectors analysed in the report are included in the markup estimation since they all provided the minimum data requirement for the markup estimation.

[27] As shown by De Ridder et al. (2021[82]), the trimming thresholds adopted do not qualitatively affect the analysis's results.

Firm ownership information

87. For the analysis on concentration and entrenchment, the key variable of interest is the gross output of business groups – rather than firms – following the methodology developed by Bajgar et al. (2023[1]) (see Section 4 for a detailed discussion on the choice of looking at business groups). Therefore, it is necessary to reconstruct the worldwide structure of business groups, identifying ownership linkages between headquarters and all their subsidiaries.

88. Orbis data contain detailed ownership information, with each firm being linked to its global ultimate owner. The global ultimate owner is defined as the firm owning at least 50.01% of the total shares of a subsidiary. However, Orbis ownership information only covers the period 2007-2020. To get this information before 2007 and to further complement and quality-check the existing information, Orbis is supplemented with data from the Zephyr database, also provided by Moody. This database reports information on worldwide firms' Merger and Acquisition (M&A) activities. It captures domestic and cross-border M&As and covers deals involving target and acquiring firms across all industries. Observing M&A activity between firms enables tracking changes in ownership over the years, allowing the identification of the business group structure even before 2007.

89. A detailed discussion of the methodology is provided in Annex A, with further details on the cleaning and harmonising procedure of multiple data sources. For a very detailed explanation of the methodology used to build the business group structure, refer to Bajgar et al. (2023[1])

Euromonitor International Passport Consumer Industries and Services (2022 edition)

90. To assess the evolution of concentration at the product market level, it is necessary to have data on the sales of firms in each product and country, as well as the total size of each market. Euromonitor collects such data using a variety of methods and presents it in the International Passport Consumer Industries and Services (CI&S, henceforth Euromonitor) database, covering 2012-2021 (but only data up to 2019 is used, in line with the main analysis). The key distinction of Euromonitor is that it collects firm-level data at the product market level, enabling a novel comparison of competition among product and industry markets in European countries.

91. Data are collected at the level of national brands, each of which is matched to a global ultimate owner (for example, Fanta and Coca-Cola Zero could be attributed to the global entity Coca-Cola Company). Additionally, the total size of each market is measured so that national and international market shares can be computed. For 82% of product markets, the size of each firm and the overall market are recorded as a monetary value. For the remaining 18%, the value is reported in non-monetary units, such as the number of establishments or the quantity of sales. These cases are included in the baseline analysis but must be excluded when weighting by market value (used as robustness checks). The data used are restricted to the same countries as those used in the baseline concentration analysis.

92. Product markets are presented at different aggregation levels. This report uses the most detailed level of aggregation available, along with a concordance included in the dataset that maps each product to a unique industry classification. Thus, product markets are matched to the same NACE rev. 2 industry classification used throughout the baseline concentration analysis. Five product markets cannot be easily mapped to a unique industry because the products use a range of production methods spanning several industry categories. These products are excluded from the analysis.[28] This illustrates a broader point, that

[28] These are "Floor Covering", "Kitchen Sinks", "Other Gardening", "Cookware", and "Kitchenware".

product markets are defined differently than industries. Product markets are defined to capture the goods and services that consumers would consider in a specific choice set when making a purchase. Industries are defined based on production technologies. While there is often a clear mapping between the two, there are also differences. When constructing industry statistics by aggregating product-level data, parts of an industry are likely to be omitted, particularly intermediate inputs. Finally, the industry "Manufacture of computers and peripheral equipment" is excluded from the analysis as it is a significant outlier in concentration from the baseline sample and contains concentration ratios greater than one, which is not possible in the Euromonitor data. The results presented in Section 6 are robust to including it and to restricting baseline concentration to be at most one.

93. Annex A includes a full list of the products used in the analysis, their corresponding industry, the associated taxonomy classification, the value of the product market, and its share in the industry.

Merger control interventions

94. The EU Commission (EC, henceforth) provides publicly available data, through its website, on the decisions of merger control cases and on antitrust and cartel intervention it makes. Two datasets on these EC decisions are used in this analysis, both compiled by the EC.

EU Commission merger control interventions database

95. EC collects data on every decision made on merger controls in the EU. For each decision, the outcome – intervention or not – is recorded. The data cover the past thirty years, and each decision is attributed to the relevant industries to which the case applies. If a decision applies to multiple industries, it is considered to be applied separately to each relevant industry. Note that the database also contains decisions made at the national level within the EU, as well as those made by EC for the EU as a whole.

96. Cases are brought to the EC for a decision if the firms involved in the proposed merger are above a certain size threshold or if they are referred by a national government. These cases are used to construct the average intervention rates and counts for each industry-year.

EU Commission antitrust and cartel intervention decisions database

97. The dataset provided by DG Competition seeks to report all antitrust and cartel intervention decisions based on Articles 7 or 9 of Regulation 1/2003 adopted by the Commission between 1/1/2004 and 2019. To avoid double counting of interventions, it reports only the main intervention decision in each case and therefore excludes readoption decisions or partial cartel settlement decisions. For each decision, it reports (1) the case number, (2) the date of adoption of the decision, (3) whether the decision is a cartel case under Article 101 of Regulation 1/2003, a non-cartel case under Article 101 of Regulation 1/2003 or an abuse of dominance case under Article 102 of Regulation 1/2003 (4) the NACE Code of the industries affected by the decision and (5) the firms which were the addressees of the decision. The dataset has been prepared by DG Competition staff based on internal research.

Additional variables

98. To study the possible drivers behind the evolution of the proxies of competition, several variables from different data sources are exploited. In the next paragraphs a brief description of these variables and their sources is provided. Descriptive statistics are provided in Table A A.12.

Intangible Data

99. The data on intangible investment come from the EUKLEMS& INTANProd dataset described in Bontadini et al. (2023[68]). The dataset contains information at the country-industry-year level about tangible and intangible investments, value-added, and gross output for 30 countries over the period 1995-2020.[29] The level of industry aggregation is equivalent to the A38 level. As in Corrado et al. (2004[69]), intangible investments are divided into three main components: software and databases, innovation property, and economic competencies. The relative importance of these components out of total intangible investments and their subcomponents are reported in Table 3.1. Tangibles investments are the difference between Gross Fixed Capital Formation and the intangible investments registered in National Accounts.[30]

Table 3.1. Intangible investments components

Main subcomponent	Share of intangible investments	Further disaggregation description
Software and database	13%	Computer software and database
Innovation property	30%	R&D, entertainment and artistic originals, new financial products, design
Economic competencies	57%	Organisational capital, brand, employer-provided training

Source: EUKLEMS & INTANProd dataset.

Openness to trade (OTT) data

100. Openness to trade is defined at the country--industry-year level as the sum of imports and exports divided by production, in line with the OTT variable used to build the taxonomy of industries. As such, it is defined at the same level of aggregation of the taxonomy, i.e., mostly at the 3-digit level (see Trade data).

Product market regulation (PMR) data

101. The OECD PMR sector indicators (see Vitale et al. (2020[70])) measure the impact of regulation in network industries –electricity, gas, telecom, post and air, rail and road transports –, retail and professional services. The measure focuses on burdensome regulatory barriers. The information on PMR in these industries is then fed into an input-output matrix to measure how intensively a downstream industry relies on the inputs produced by the regulated upstream industries, resulting in the OECD REGIMPACT indicator (see Égert and Wanner (2016[71])). In other words, it measures how exposed downstream industries are to regulation in input markets. Data are at the country-industry-year level. The level of industry aggregation is a mix of 2-digit and more aggregated industries.[31]

Digital taxonomy data

102. A further source of information is the degree of digital intensity across industries (which is invariant across countries), as captured by the digital taxonomy built by Calvino et al. (2018[8]). The taxonomy uses different manifestations of the digitalisation process (ICT tangible and intangible investments, intermediate

[29] The list of countries used in regression analysis (either for concentration or for markups) is AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE, and USA.

[30] EUKLEMS& INTANProd dataset reports both intangibles registered in national accounts (such as Software and Database, R&D and entertainment and artistic originals) and those that are not recorded (the remaining part of Innovation property and Economic competencies).

[31] For further details, please refer to Égert and Wanner (2016[71])

purchase of ICT goods and services, stock of robots, share of ICT specialists in the labour force, and share of revenues from online sales) to build an indicator that ranks industries according to their overall degree of digitalisation. This indicator is further aggregated by grouping industries into four quartiles of digital intensity.[32]

Merger and acquisitions data

103. Data on M&A are obtained from the Zephyr dataset, and alternative measures to capture M&A activity are computed. The idea is to relate M&A to concentration and markups evolution. By definition, concentration looks at the four largest business groups in a market while, as shown in Section 5, the growth in markups is driven by the increase in markups of firms belonging to the top decile of markups distribution. Therefore, to understand the impact of M&A activity on the proxies of competition, M&As of firms at the "top" (i.e., relevant in driving the observed patterns) are considered.

104. For the analysis on concentration, the M&As variable is defined as the share of acquisitions carried out by the top four business groups in a market relative to the overall acquisitions that took place in that market. Only acquisitions of targets within the same industry as the acquirer are considered. The shares are computed by looking at the number of acquisitions exclusively (so no minority stake). The variable is geography-industry-year specific.

105. For the analysis on markups, the M&A variable is then defined as the share of acquisitions targeting firms belonging to the top decile of the markup distribution relative to the overall acquisition that took place in that market.[33] The shares are computed looking at the number of acquisitions exclusively (so no minority stake). The variable is country-industry-year specific.

[32] For further details, please refer to Calvino et al. (2018[8])

[33] Looking at target firms allows to understand whether firms that get acquired, exploiting the new linkages with the new parent firm (and potentially the rest of the business group), increase their market power.

4 Methodology

Overview

106. This section describes the methodology used to define the competition proxies considered in the report: concentration; different measures of business dynamism among market leaders; and markups. Each of these proxies provides some information about the competitive environment of the industry in which they are computed. Analysed together, they provide an indication of the extent of market power held by the leading firms and of competition in each industry.

107. Market concentration is the main focus of competition authorities. However, when measuring concentration, a major empirical issue is getting as close as possible to the definition of the "relevant market". First, defining the relevant market can be conceptually difficult. Second, data limitations arise when trying to measure it. As a result, industry concentration measures are often used as a proxy for market concentration.

108. However, industry concentration is related to but distinct from the concept of market concentration. Even if a large share of industry activity is due to a handful of leading firms, it does not necessarily mean that the associated product markets are highly concentrated (OECD, 2021[5]). Market concentration is usually a narrower definition than what is typically reflected in industry concentration measures. Despite the important limitations of industry concentration measures, they continue to be widely used due to data availability.

109. Throughout the baseline analysis, markets are defined using industry classifications. One important innovation of the project is to use more narrowly defined industries than previous cross-country studies, going from the 2-digit to mostly 3-digit level. Moreover, in Section 6, the report shows that concentration at the industry level is correlated with product-level concentration, and they exhibit similar trends on aggregate in Europe between 2012 and 2019. Therefore, in this context, measures of concentration at the industry level are likely to also be indicative of consumer product market concentration.

110. As well as the product or industry scope of a market, another important dimension is the geographic coverage of the market. The world economy is highly globalised, with markets integrated across countries. The value of international trade amounts to more than half of the global GDP each year, and the stock value of outward investments is 44% of the world GDP.[34] "Global firms" operate in many countries, either by trading internationally or establishing affiliates (see for example Bernard et al. (2018[72])). This globalisation of firms affects the appropriate market definition from a geographical perspective.

111. This project innovates with respect to the existing literature by accounting for the international dimension of competition when defining markets, as well as the ownership structure and countries of operation of firms. It uses cross-country data on the activities of firms, size of industries, and international trade in each industry to define the geographical level at which markets compete. Specifically, it constructs a taxonomy of sectors which defines whether each industry competes at the domestic, EU, or international

[34] See World Bank national accounts data, Trade (% of GDP) and OECD data, Foreign direct investment (FDI) stocks.

level. This taxonomy is then used to account for international competition in calculating concentration and the different measures of business dynamism among market leaders.

112. To summarise, in this report, a significant effort has been made to get as close as possible (given data limitations) to a market definition with respect to both the industry-level of aggregation and the geographic dimension of competition. First, most of the analysis is conducted at 3-digit industry-level, allowing a more disaggregated level of analysis with respect to previous representative cross-country studies. Second, regarding the geographic dimension, each industry defines the relevant geography as domestic, European, or global based on the outcome of the taxonomy. For the remainder of the report, the term geography will refer to the regional span determined by the taxonomy, and a market will identify the combination of industry and geography in which firms operate.

113. These methodological innovations are applied to document patterns in multiple proxies for competition in the same setting. First, concentration is evaluated by looking at the concentration ratio, which captures the share of production accounted for by the four largest firms in a market. The second measure is the leadership ratio, which measures the ratio of the sales of the market-leading firm relative to other sets of firms in the market (such as the other top four firms). Third, a group of variables capturing business dynamism among market leaders is considered: entrenchment, which is a dynamic measure capturing the extent of churn in the leading firms in each market; rank persistence, which explores the changes in the ranking of the top four; market share instability, which captures the evolution in the relative importance of the top four' share. Finally, markups, defined as the ratio between firms' output prices and their marginal costs, aim to measure the ability of firms to set prices above the competitive level.

114. This section first describes the methodology used to construct the taxonomy, which defines the geographic level at which each industry competes. Then, it describes the definitions of concentration, entrenchment, and markups measures.

Taxonomy of industries: defining the geographical level of competition

115. This project extends the existing literature by developing a taxonomy of industries which defines the geographical level at which competition takes place. This taxonomy is used to determine the level of *geographic* aggregation industry concentration measures should be calculated to get as close as possible to the definition of "relevant market".

116. For non-tradeable industries, competition takes place mainly domestically.[35] Consequently, concentration measures should be computed at the national level. For tradeable industries, competition takes place mainly internationally, across borders; firms in one country can supply their product to consumers in another. In this case, when looking at concentration trends, it is more relevant to look at the top firms in *international* markets. At the same time, even in industries that show high volumes of trade, there are different boundaries in the international span that firms can reach due to geographical limitations, trade restrictions, and other factors. Thus, in the taxonomy, tradeable industries are defined as competing at either the EU or at the global level, depending on the relevant boundaries of the market.

117. The taxonomy has the key advantage of accounting for international trade, shown to be important for measuring concentration (Amiti and Heise, 2021[6]), without requiring confidential firm-level micro data on trade flows. It does this by aggregating the activities of business groups across countries in industries that are tradeable.

118. Most existing studies compute concentration at the national level for all industries, regardless of the extent to which the product can be purchased across borders. Yet, for markets that are highly integrated

[35] It could be argued that competition for non-tradeable services takes place on a sub-national level. Unfortunately, sub-national data are not available at the necessary levels of industry aggregation across the sample of countries.

due to their tradeability across borders, it is likely that producers can supply products to consumers in many countries. Since, with the exception of Amiti and Heise (2021[6]), no paper has firm-level information on the sales of both exporting and importing firms in a market, this aspect is not taken into consideration by almost any studies based on national measures. However, Bajgar et al. (2023[1]) try to look at the impact of European integration on concentration by providing measures of industry concentration for the European market as a whole. This is likely to capture the relevant market well for tradeable industries, but for non-tradeable industries it is difficult to supply or consume products across borders. The taxonomy is designed to advance on previous measures of industry concentration by identifying the appropriate level of geographic competition and then computing concentration at the corresponding geographic level.

Identifying the geographic level of competition

119. Data on cross-country trade flows are used to identify the geographic dimension at which each industry competes. Trade flows provide a measure of the extent to which firms compete across borders and the availability of foreign products to consumers. Trade flows have been used to determine the geographic level of competition in previous research (Lyons et al. (2001[42])). The characteristics of each industry determine its trade flows, and therefore its geographic level of competition: its technological feasibility of supplying or purchasing the good or service across borders, its ability to separate the location of production from that of consumption, and trade policy barriers drive the distinction between domestic, EU, and global markets. The distinction of tradeable industries between competing at the EU level and globally arises from the observation that EU countries have low costs of trading with each other relative to trading with the rest of the world due to geographical proximity, socio-economic similarity, and the Single Market and Customs Union.

120. The taxonomy is necessarily constant across countries: an industry that competes domestically in one country also competes domestically in other countries, while an industry that competes internationally in one country also competes internationally in other countries. The taxonomy is also time invariant: it is unlikely that a non-tradeable industry in one year becomes substantially more tradeable in subsequent years and vice-versa, and time-invariance is necessary to ensure that the observed trends in the analysis are not driven by changes in the definition of market.[36] In other words, to meaningfully examine trends in proxies of competition over a long time horizon, the level of aggregation needs to be constant over the period considered. Therefore, the taxonomy is compiled using data aggregated over the full sample period from 2000 to 2019.

121. The taxonomy considers both the imports and exports in each industry from the perspective of firms in the EU to construct measures of openness to trade (OTT, henceforth). Analogous measures of OTT are commonly used, especially at the country level (Leamer (1988[73])). Comparing total trade with domestic production provides an estimate of the tradeability of each industry. Specifically, the shares of domestic production, exports, and imports can be decomposed as follows:

Domestic share:

$$\frac{DomesticSales}{DomesticSales + (Exports + Imports)_{EU} + (Exports + Imports)_{non-EU}} \qquad \text{Equation 3}$$

EU share:

[36] Services industries are likely to have become more tradeable over time due to technological advancements and increased integration of trade policy within the Single Market. Therefore, as a robustness check, the taxonomy is constructed on only the later years of the sample (period 2012-2019).

$$\frac{(Exports + Imports)_{EU}}{DomesticSales + (Exports + Imports)_{EU} + (Exports + Imports)_{non-EU}}$$ Equation 4

Non-EU share:

$$\frac{(Exports + Imports)_{non-EU}}{DomesticSales + (Exports + Imports)_{EU} + (Exports + Imports)_{non-EU}}$$ Equation 5

122. Note that "domestic sales" is defined as the value of domestically produced output that is sold to domestic consumers. Conceptually, the three components sum up to one, although because domestic sales are not directly observed in the data and is instead calculated as the total production minus exports, the sum of the three components is very close to one but not exactly one.

123. OTT is a simple and effective measure of the technological and policy-related feasibility of supplying or purchasing a good or service to a foreign market. Accounting for both imports and exports in a balanced manner provides an estimate of the feasibility of cross-border trade in each industry and, therefore, a relevant metric to construct the taxonomy.

124. An alternative definition of the taxonomy would take a consumption-based approach, whereby exports are not incorporated as consumers are only directly affected by goods and services available in their market, which is captured by domestic production and imports. This categorisation is discussed in Annex B and is compared with the baseline taxonomy as a robustness check.

125. The taxonomy is constructed using data for EU countries and is designed to be representative of the aggregate EU.[37] Different periods (only later years) and weightings (production weighted, and unweighted) are tested as robustness on the specification of the taxonomy. Annex B provides the details.

Taxonomy thresholds

126. To assign each industry to a unique category in the taxonomy – i.e., competing domestically, with EU countries or globally – it is necessary to define thresholds on the OTT measures defined above. The methodology implemented for this purpose involves two consecutive steps. First, industries are defined as either competing mainly domestically (non-tradeable) or internationally (tradeable) depending on the OTT domestic share (note that one minus the domestic share is the traded share). Second, the EU and non-EU shares are compared to assign whether a tradeable industry competes mostly at the EU level or globally.

1) Identifying tradeable and non-tradeable industries

127. To define the threshold that determines whether each industry competes mainly domestically or internationally, the proposed methodology begins with the well-established idea that most manufacturing industries are tradeable and hence compete internationally. In many conceptualisations, the entire manufacturing sector is assumed to be tradeable, while services sectors are non-tradeable (see, for example, Besley et al. (2021[57]), Eaton et al. (2016[74])). This notion can be used, along with the distribution of domestic shares for the goods sector, to define a threshold for an industry to be considered tradeable. Goods sectors are defined as those involving physical products and are covered in manufacturing and

[37] Specifically, country-industry-year level data are aggregated across countries and years to reach the industry level. This is equivalent to computing the measures at the country-industry-year level and taking the average for each industry, weighting by the denominator of the measure such that statistics are representative of the EU aggregate.

mining, while services refer to all other sectors included in the sample (excluding finance and government services). Of course, it is likely that not all manufacturing industries are tradeable if, for example, they have high policy barriers to trade, such as dairy, or high physical trade costs, like concrete. Therefore, the assumption is taken that 90% of industries in the manufacturing and raw materials sectors are tradeable. Gervais and Jensen (2019[75]) use a similar approach to define whether each industry is tradeable, assuming that most manufacturing industries should be tradeable to identify a threshold for tradeability that can be applied to all sectors. The 90% threshold used in the present report was chosen after examining the distribution of OTT shares and making qualitative judgements on whether marginal sectors are tradeable or non-tradeable.

128. Looking at the distribution of the OTT domestic share for goods industries in the sample, the 90th percentile industry has a domestic share of 0.88 (shown in Table 4.1). Under the assumption that 90% of goods industries are tradeable, for an industry to be defined as tradeable, it should have a domestic share below 0.88. In other words, an industry is defined as competing mainly domestically if the output sold to domestic consumers is more than 88% of the total output produced, imported, and exported. In these cases, international trade is, therefore, relatively small in the industry. Equivalently, exports plus imports must comprise less than 12% of the sum of the output produced, exported, and imported.

129. Table 4.1 and Table 4.2 present summary statistics for, respectively, only good industries and all industries – both goods and services. Table 4.1, for goods only, is used to determine the threshold for tradeability, while Table 4.2 illustrates how the threshold compares with the overall distribution in all industries. The comparison of Table 4.1 with Table 4.2 shows that, as expected, services industries have, on average, a higher domestic share than goods industries, reflecting that services are typically traded less than goods. Table 4.2 also shows that the threshold of 0.88 also happens to fall at exactly the 75th percentile of the distribution across all industries. Given that industries with domestic shares below 0.88 are considered tradeable, 75% of all industries will be tradeable (recalling that 90% of goods industries were defined to be tradeable).

Table 4.1. Industry-level summary statistics of OTT measures for goods industries only

	Mean	S.D.	min	p10	p25	p50	p75	p90	Max
OTT Domestic Share	0.63	0.19	0.12	0.41	0.54	0.65	0.78	0.88	0.98
OTT EU Share	0.20	0.11	0.01	0.07	0.12	0.19	0.27	0.38	0.46
OTT Non-EU Share	0.16	0.12	0.01	0.04	0.08	0.16	0.20	0.27	0.75
Observations	93								

Note: The table presents industry-level summary statistics on the OTT measures for goods industries only.
Source: OECD calculations

Table 4.2. Industry-level summary statistics of OTT measures for all industries

	Mean	S.D.	min	p10	p25	p50	p75	p90	Max
OTT Domestic Share	0.72	0.21	0.12	0.42	0.57	0.73	0.88	0.99	1.00
OTT EU Share	0.16	0.12	0.00	0.01	0.07	0.13	0.23	0.34	0.46
OTT Non-EU Share	0.12	0.12	0.00	0.01	0.04	0.09	0.18	0.25	0.75
Observations	151								

Note: The table presents industry-level summary statistics on the OTT measures for all industries.
Source: OECD calculations

2) Determining the ratio of the EU to global thresholds

130. Once it has been determined which industries compete internationally, the next step is then to divide them into those competing at the EU level and those competing at the global level. The intuition is to try to identify the relative importance of EU and non-EU trade for each industry. The criterion used here is simple and intuitive. Industries for which the non-EU share is larger than the EU share are defined as global; on the contrary, industries for which the EU share is larger than the non-EU share are defined as competing at the EU level.

Summary of the taxonomy

131. Constructing the measures of OTT and applying the thresholds to each industry determines the taxonomy. Each industry is assigned a unique geographical dimension at which it competes. Measures of concentration, business dynamics of market leaders, and (for some exercises) markups are computed at the level of aggregation determined by the taxonomy, therefore providing pictures of these alternative proxies closer to competition in the relevant market.

132. In total there are 40 domestic industries, 85 EU industries, and 26 global industries. The full list of industries and their associated geographic market dimension are listed in the Data Appendix (Table A B.1).

133. The taxonomy is highly robust to numerous alternative specifications. Table A B.2 shows that under all alternative specifications considered, more than 82% of industries maintain the same taxonomy classification. Weighting by production instead of the OTT denominator, which also includes exports and imports, changes just 3% of industry classifications. Some industries may have become more tradeable over the sample period, especially in the services sector. Using only data from the later sample period (2012-2020) instead of the full period changes 9% of industries' categorisation. An alternative classification of the taxonomy would be to focus on the consumer side of the market, excluding exports. Doing this and using import penetration instead of OTT changes, 13% of industries change categorisation, with most of the switches being between EU and global buckets (so still among industries competing internationally). Finally, computing the taxonomy without weighting to account for the size of each country changes 18% of classifications, with again most of the switches being from global to EU, suggesting, unsurprisingly, that smaller countries may be more likely to trade with the EU than with non-EU countries.

Concentration

134. Industry concentration captures the share of gross output accounted for by the largest firms in an industry market. Its measurement involves a series of crucial methodological decisions. Specifically, it requires accurately defining what a "relevant market" is and what "largest firms" means, measuring the boundaries of a "firm", and defining how to measure output (for both firms and industry). With respect to the existing literature, this project makes some advances in the measurement of industry market concentration, which is detailed throughout this section.

135. The overall size of a market, $S_{s,g,t}$, is defined as the total gross output in an industry *s*, in its relevant geographic level of competition *g*, at time *t*. As already mentioned, industries *s* are mainly defined at the 3-digit level, reaching a more detailed level of disaggregation with respect to previous representative cross-country analyses. Geographies are defined using the taxonomy to capture the relevant geographic dimension at which competition takes place for each industry (domestic, European, global). The classification of each geographic level of competition is specific to each industry.[38] To define the

[38] Technically, the subscript *g* should be written *g(s)* to represent that the geography is fixed to each sector. However, *g* is used to avoid notational clutter.

contribution of the leading firms to the market, this work follows Bajgar et al. (2023[1]) and considers the activities of business groups rather than single firms active in a given industry-geographical region ("market" in this setting). The gross output of the largest four firms is written as $\sum_{f \in Top\ 4} S_{f,s,g,t}$.[39]

136. Therefore, the baseline Concentration Ratio (CR4) – the share of gross output accounted for by the top four business groups in a market – is defined as follows:[40]

$$CR^4_{s,g,t} = \frac{\sum_{f \in Top\ 4} S_{f,s,g,t}}{S_{s,g,t}}. \qquad \text{Equation 6}$$

137. The remainder of this sub-section provides detail on the methodology in computing this concentration measure.

Industry dimension

138. As already sketched in previous sections, when looking at concentration, economists and competition authorities try to understand what the "relevant market" is, i.e., to define the bundle of products or services regarded as interchangeable or substitutable by the consumer. Competition authorities typically identify relatively narrow markets based on product rather than industry classification systems when judging competition cases. Although rather straightforward from a theoretical point of view, in practice empirical analyses are restricted by the availability of data, which is usually collected at the industry level, not at the product level. In addition, existing industry data used to construct concentration measures are normally available at a quite aggregated level, which departs from the notion of the relevant market. As a result, existing cross-national studies rely on data at the 2-digit (or higher) industry-level (for example, Bajgar et al. (2023[1]) and Kalemli-Özcan et al. (2023[34])). Studies on an individual country may have more detailed industries but are unable to account for the cross-border activities of firms and conduct international comparisons. For these reasons, there have been concerns that measuring concentration at the level of industries does not accurately capture true concentration (Berry et al. (2019[9]); Benkard et al. (2021[10]), Shapiro (2018[11]), Werden and Froeb (2018[12])).

139. This project tries to overcome some of these concerns by developing measures of concentration for more detailed industries - typically the 3-digit level, whenever possible - while still incorporating a cross-country dimension and allowing for international activities of firms (see below). In total, industry concentration can be calculated for 127 industries across mining, manufacturing, utilities and non-financial market services sectors (see Annex A for details). Manufacturing industries are almost all defined at the 3-digit level, while some services industries are slightly more aggregated to allow an accurate match with

[39] The numerator is obtained by adding the sales (as a proxy of gross output) of the largest business groups in the relative market, while the denominator is defined using the measured gross output of an industry. Using the sum of sales of all the firms contained in the Orbis dataset would not provide an accurate representation of a market in this setting since Orbis is not representative of all firms, and therefore does not capture the overall economic activity produced in a market (Bajgar et al. (2020[81])). This would lead to an underestimation of the denominator, especially in the initial years of the sample, which in turn would introduce a downward bias in concentration trends (Bajgar et al., (2023[1]). Note that for most industries sales and gross output are very similar and, as such, gross output will be used a synonym for sales when looking at the numerator. However, in certain industries, such as Wholesale and Retail, there might be differences. These concerns are addressed in various robustness exercises. It is important to note that both the possible discrepancy between sales and gross output concepts and the difficulty of measuring industry output at the 3-digit level of aggregation might lead to cases in which concentration exceeds 1.

[40] Note that all over the report "top four firms" refers to the 4 *business groups* (not firms) with the largest gross output in each market. the term "firm" has been preferred to "business group" for simplicity of explanation.

the trade data (see Section 3 for details). The same set of industries is also used to define the different measures of business dynamism among market leaders, described in subsequent sections.

Geographic dimension

140. As described above, the taxonomy defines the geographic dimension at which each industry competes and, therefore, over which the proxies of competition are computed. Technological, physical, and policy-related factors, which differ for each industry, determine the geographic scope of each market. For instance, consumers in markets where it is affordable to supply products across borders can easily purchase products sourced outside their home country.

141. For industries that are defined to compete at the European level, the European activities of business groups are aggregated across all European countries (noting that the activities of non-European subsidiaries are excluded, as discussed in detail in the next sub-section). For example, when defining concentration, the numerator includes the gross output of the four biggest firms across all European countries in each industry and the denominator aggregates industry-level gross output across all European countries. Similarly, for industries defined as global, both firm- and industry-level gross output are aggregated over all countries in the sample.[41] In contrast, for industries defined to compete domestically, the concentration ratio is computed within each country-industry.

142. An advantage of aggregating tradeable industries across countries is that it accounts for trade between countries within the region, even without firm-level data on international trade. Given the importance of trade in shaping concentration trends (Amiti and Heise, 2021[6]) and the lack of detailed firm-level trade data available across countries, this step is very important. For example, in global markets, the full activities of firms in each industry are accounted for, regardless of where production and consumption take place (although note that with the data limitations, some countries remain excluded). By aggregating firm- and industry-level gross output across countries within their geography of competition, it is not necessary to make any adjustments for trade within the region. This is a very relevant point since firm-level data on international trade are not available in the Orbis database (and are almost non-existent in a cross-country setting). This implies that it is not possible to identify exactly, for each firm, the share of gross output to be assigned in the various countries where the firm is active; as a consequence, they are all assigned to the country where it is located. Therefore, the taxonomy provides a conceptually important and empirically practical solution to account for the globalised nature of highly tradeable industries in computing concentration.[42] A later sub-section discusses the incorporation of international trade in the measures of concentration, in addition to the use of the taxonomy.

Identifying activities of business groups

143. Firms operating in the same industry may not be independent of each other but rather be part of the same business group (Altomonte et al., (2021[76])). Such a feature is likely even more relevant when concentration is measured at the global or European level, since business groups often serve each country through a different firm entity. For example, in the sample of this report, the average “top four” business group has seven subsidiaries within the same industry-region. Market power is likely to be determined at the business group-level, because the activities of firms within the same group can be coordinated, and groups may acquire firms in the same industry to consolidate their market share. Therefore, it is crucial to

[41] Recall that, outside the EU, data are available for three additional countries: Japan, Korea, and the United States.

[42] In principle, when looking at industries competing at the domestic level, for example, only the gross output of the top firms sold domestically should be considered in the numerator of concentration, subtracting therefore their exports. On the contrary, when looking at industries competing at the European level, all exports of the top four firms to other European countries are correctly included in the numerator of the CR4.

account for the gross output of business groups when measuring concentration and not to focus on individual firms or any other economic entity.

144. Following the work of Bajgar et al. (2023[1]), (2019[7]) (who, in turn, build on Bloom et al. (2013[77])), this report focuses on the activities of business groups. When measuring concentration, different subsidiaries belonging to the same business group and active in the same market are treated as a unique entity, as neglecting these ownership linkages may lead to an understatement of concentration. Bajgar et al. (2023[1]) show that considering this business group dimension has a substantial impact on the resulting concentration measures. Therefore, accounting for linkages between firms in the same business group is of utmost importance when measuring concentration.

145. To construct the relevant activities of a business group in each market, the unconsolidated gross output of each subsidiary is aggregated across all subsidiaries that operate in the relevant geography and industry.[43,44,45] To provide an intuition of the methodology proposed to link business groups' activities among different markets, Figure 4.1 provides an illustrative example of a business group composed of: i) the headquarter, and ii) five subsidiaries, operating in three different sectors and five different countries. The first information exploited is the unconsolidated financial information of subsidiaries, obtained from Orbis and aggregated according to the ownership information from the Orbis-Zephyr database. Then, for each industry, the unconsolidated gross output is aggregated at the geographic level specified by the taxonomy. This apportioning procedure allows the activities of the same business group to be split across industries-geographies pairs (markets). In the example, assume that the market for Industry 1 is global, for Industry 2 is European, and for Industry 3 is domestic. Then the business group is active in *four* different markets (each represented by a different colour in the figure): i) in industry 1, which competes at the global level, with total gross output equal to 80 (headquarter 70 + subsidiary A 10); ii) in industry 2, which competes at the European level, with total gross output equal to 55 (subsidiary C 25 + subsidiary E 30); iii) in industry 3 in Spain, which competes at domestic level, with total gross output equal to 50 (subsidiary D); and iv) in industry 3 in France, with total gross output equal to 15 (subsidiary B). These are the total gross output that, in the example, would be used to compare total gross output of this group with that of

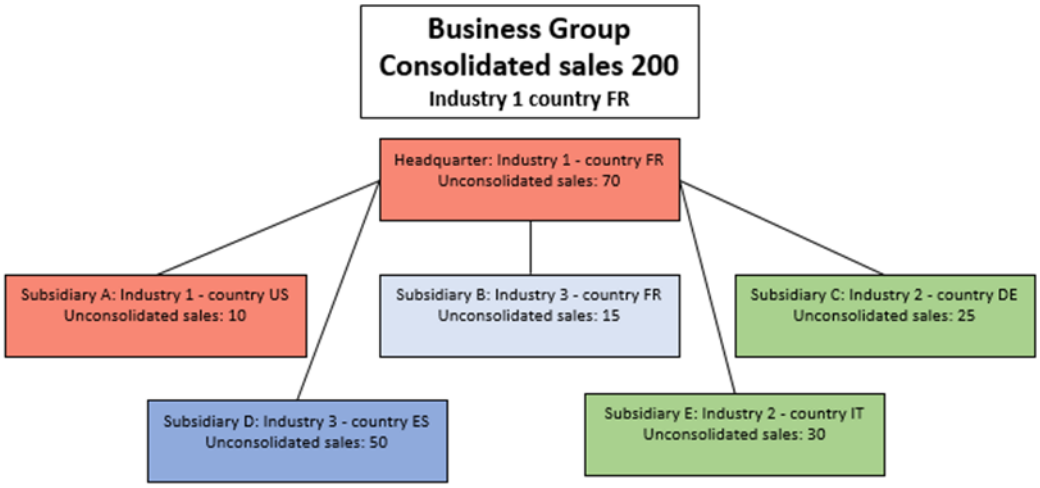
[43] Note that in Orbis all firms are registered as active only in their main industry of activity, although their activities could span across different industries. The consequence of registering all the activities in one single industry might result in an overestimation of the numerator of concentration and potentially in a concentration ratio exceeding 1. While conceptually this can happen even at higher levels of aggregation, this issue must be taken into account even more carefully when working at a more granular level of aggregation, as it has been done in this study with respect to previous analyses (Bajgar et al., 2023[1]). The issue is less severe when using the industry code of individual firms rather than of the entire business group (unconsolidated instead of consolidated accounts).

[44] Consolidated accounts are used only to correct the unconsolidated information in cases where the total subsidiary sales exceed group sales (due to inter-company transactions) or where unconsolidated data are missing. See Annex A for further details. Additionally, consolidated accounts are used directly only in two cases, in which consolidated and unconsolidated accounts coincide: for independent firms (firms that are not part of a business group), and for subsidiaries at the bottom of the ownership hierarchy (subsidiaries not owning any other subsidiary) that do not report unconsolidated accounts.

[45] With the exception of Bajgar et al. (2023[1]), previous studies have mainly followed three approaches to deal with cross-ownership linkages. The first approach is to neglect business groups and focus only on unconsolidated information of individual firms. This method underestimates the concentration if multiple firms in the same market are part of the same group. A second approach is to neglect subsidiaries and focus only on the consolidated accounts of the headquarters. This method attributes the entire activity of the business group to the headquarters, overestimating (underestimating) the concentration in the headquarters' (subsidiaries') market. A third approach is to include both the activity of the business group and the firm subsidiaries and try to address the issue of double counting, dropping the unconsolidated information for headquarters –the most obvious source of double counting – but still including the unconsolidated information of subsidiaries. This method overestimates concentration since it double counts subsidiaries' revenues. See Bajgar et al. (2019[7]) for additional explanations of these alternative approaches.

other groups/firms competing in the same market. For further details, see Annex A and Bajgar et al. (2023[1]), (2019[7]).

Figure 4.1. Example of the apportioning Technique of Business Group activities



Note: The figure depicts an example of a hypothetical group consisting of a parent company from France and operating: i) in industry 1 (global), with a US subsidiary in the same industry; ii) in industry 2 (European) with two subsidiaries, one from Germany and one from Italy; and finally iii) in industry 3 (domestic) with a subsidiary in France and one in Spain. The different colours identify the four different markets in which the group is active: the global market in industry 1 (with total gross output of 80), the European market in industry 2 (with total gross output of 55), the French market in industry 3 (with total gross output of 15), and finally the Spanish market in industry 3 (with total gross output of 50).

Effective market size: accounting for international trade

146. While the taxonomy accounts for international trade between countries within a region, it does not account for trade with countries outside the region (and from countries not included in the sample). Trade can affect both the numerator and denominator of concentration. On the denominator, imports increase the overall size of a market, while the value of goods exported by producers could be deducted from the market size. Similarly, the gross output of top firms sold outside of the region could be subtracted from the numerator, or alternatively, foreign firms serving a market only through imports could be among the top firms in the numerator. Amiti and Heise (2021[6]) use confidential firm-level microdata with unique information on both the identity of domestic and foreign firms for the United States to show that industry concentration is flat when accounting for the gross output of foreign exporters, while it is increasing if the import correction is not made.

147. However, in this setting, there is an important interaction between the taxonomy and the import correction. The taxonomy is defined using data on international trade. Industries with relatively high trade values will be either European or global, and therefore only imports from outside the region will be added to the denominator. For domestic industries, imports comprise a smaller share of production. Hence, in the presence of the taxonomy, the import correction is less impactful.[46]

148. Despite this, as a robustness check, international trade from outside a region *g* is incorporated into the concentration measures. The adjusted measure can be written as:

[46] An important caveat is that, due to data availability, only three additional countries (Japan, Korea, and the USA) are included in the global category. Therefore, the import correction always accounts for imports from other non-EU countries, such as the People's Republic of China.

$$CR^4_{s,g,t} = \frac{\sum_{f \in Top\ 4} S_{f,s,g,t} - \alpha X^{c \neq r}_{s,g,t}}{S_{s,g,t} + M^{c \neq r}_{s,g,t} - X^{c \neq r}_{s,g,t}}.$$ Equation 7

The denominator is adjusted to account for imports into the region ($M^{c \neq r}_{s,g,t}$) and exports from the region ($X^{c \neq r}_{s,g,t}$). Note that imports and exports between countries within a region, such as gross output of Italian firms in Spain for an industry defined to compete at the European level, do not need to be corrected as they are accounted for in the production value of the exporter (Italy, in this example).[47]

149. A further correction can be made in the numerator to account for the value of the top four firms' gross output that are exported to different markets. However, as firm-level data on trade are not available, an assumption must be made on the share of total exports that is accounted for by the top four firms, denoted by α. For example, α could be equal to the share of total production accounted for by the top four firms, although this is likely to underestimate their share as larger firms are more likely to export (Bernard et al (2012[78])).[48]

150. While these corrections use the best possible approximations of imports and exports for each industry with the data in hand, they are only approximations and are likely to be mismeasured. It is not possible to obtain the necessary data to make an accurate correction for the required sample, as cross-country firm-level data on international trade is unavailable. For this reason, the trade corrections are only used as robustness checks and are not incorporated in the baseline. This also highlights a key advantage of the taxonomy which, by aggregating sales across countries in tradeable industries, accounts for trade within the relevant geography at which each industry competes, reducing the need to correct for trade flows.[49]

151. These robustness checks are implemented in two ways. The first only corrects for imports in the denominator, while the second makes a correction for both imports and exports (in both the denominator and numerator).

Leadership ratio

152. CR4 provides information on the share of the top four firms but does not reveal whether, for instance, the market is monopolistic or oligopolistic. In monopolist markets, the market share of the leading firm (top one in each market) significantly outweighs that of the followers, while in oligopolistic markets, the market shares of the top two firms are high but similar. These market structures can have contrasting implications for consumer prices and choice sets, as well as market dynamics and policy design.

[47] Note that the sample of countries is not complete, so imports from countries not included in the sample are also incorporated in the denominator.

[48] Note that, unlike Amiti and Heise (2021[6]), firm level international trade data is not available in the present study. If the foreign exporters ranked in the top four firms, then the measure of concentration would be downward biased. Amiti and Heise (2021[6]) show that exporters into the US market tend to be smaller, which explains why accounting for increases in imports flattens the concentration trend.

[49] For example, consider an industry that competes at the European level. For this industry, the relevant measure of concentration is based on the sales of the top four firms across European countries. Therefore, it is not necessary to subtract a firm's exports to other European countries to have the correct numerator, i.e., the total sales in European countries of each top four business group. Similarly, the denominator for an industry that competes at the European level is given by the sum of the gross output of all European countries in that particular 3-digit industry. Since trade flows are symmetric, all imports/exports between European countries cancel out by construction, and as such the correction for trade flows within Europe is not needed. Accordingly, in this setting, the import and export corrections are only used as robustness and not in the baseline.

153. To explore the relative market shares of the leading firm relative to the following firms, two measures of leadership ratios are computed. These measures are defined using the information on the top four firms included in the numerator of CR4.

154. The first measure is the two-firm leadership ratio, $LR_{s,g,t}^{two-firms}$, defined as the gross output of the leading firm over the gross output of the second leading firm within a market:

$$LR_{s,g,t}^{two-firms} = \frac{GO_{s,g,t}^{First}}{GO_{s,g,t}^{Second}} \quad \text{Equation 8}$$

155. When the leadership ratio is, for example, equal to two, it means that the leading firm has a gross output twice as big as the gross output of the second biggest. A high leadership ratio is associated with a highly monopolistic market, although note that the leadership ratio can be large even if the market share of the biggest firms is relatively small (i.e., if the leader, is much bigger than the second one but does not represent a large share of the market). For the leadership ratio measure to be meaningful, it is therefore important to couple it with the concentration measure.

156. The second measure is the four-firm leadership ratio, $LR_{s,g,t}^{four-firms}$, measured as the gross output of the first firm over the sum of the gross output of the second, third and fourth firm in the ranking:

$$LR_{s,g,t}^{four-firms} = \frac{GO_{s,g,t}^{First}}{GO_{s,g,t}^{Second} + GO_{s,g,t}^{Third} + GO_{s,g,t}^{Fourth}} \quad \text{Equation 9}$$

157. If the ratio is bigger than one it means that the first firm has a gross output bigger than the sum of the gross output of the other three, whereas if the ratio is smaller than one, it means that the gross output of the leading firm is smaller than the sum of the gross output of the other three. When the ratio is below one, the market has more competition among the top four, which can have two explanations: if each of the shares of the four leading firms is large, then the market is oligopolistic, whereas if each of the shares is small, then the market may be competitive (at least in terms of market shares).

Business dynamism of market leaders

158. The concentration ratio and leadership ratios are static measures, as they consider the market shares of leaders at each point in time but do not follow them over time. However, market dynamism is an important feature of competitive markets. Highly concentrated markets could still be contestable if firms at the top compete to get the leadership, such that the identity of the market leader changes over time. On the contrary, even in less concentrated industries, top firms may still be more entrenched. That is, leading firms may be able to remain persistently as market leaders over the long term, with negative consequences for competition.

159. Three measures of dynamism among market leaders are examined in this report and described in this section: entrenchment, rank persistence, and market share instability.

Entrenchment

160. To measure the extent of churning among top firms in each industry, the persistence of firms in the "top four" group is calculated. This entrenchment measure aims to capture the likelihood that market-leading firms remain as market leaders in two consecutive periods.[50]

161. Specifically, market entrenchment is computed as the number of firms in the top four at time *t* that were also in the top four at time *t-1* in each market. In each year, if all the firms in the top four were in the top four in the previous year, then the entrenchment measure is equal to four. On the contrary, if none of the firms in the top four in *t* were in the top four in *t-1*, the measure equals zero. Hence, the entrenchment measure is bounded between zero and four. Note that it is closely related to that of CMA (2022[35]) and Bajgar et al. (2021[16]), and it can be written as:

$$ENT_{s,g,t} = \sum_{\{f \in Top4_t\} \wedge \{f \in Top4_{t-1}\}} \mathbb{I}_{f,s,g,t},$$

Equation 10

162. Where $\mathbb{I}_{f,s,g,t}$ is an indicator equal to 1 if business group f, active in industry s and geography g at time t, was also among the top four in the previous year and in the same market.

163. To check the robustness of the results, the same measure has also been computed for different time horizons: between *t* and *t-2,* and between *t* and *t-3.* In this case, a business group is defined as entrenched in the top four if it is in the top four across all years of the time interval considered (i.e., not just the initial and final period).[51]

Rank persistence

164. The rank persistence measure captures whether there are differences in the ranking of firms (based on their sales) from one year to the next. In the report, this measure is built for industries without entry of new firms in the top four group. It explores, year-by-year, whether there are changes in the ranking of the market leaders.[52] A market with no entries can have, respectively, zero, two, three, or four changes in the relative position of the market leaders. A higher number of changes corresponds to a higher dynamism at the top and, possibly, to a higher contestability among market leaders.

Market share instability

165. An additional measure used to look at market dynamism is market share instability (MSI), which captures variability in the market shares of market leaders. Following Bajgar et al. (2021[16]), the measure of market share instability has been computed as the mean absolute value of market share changes between *t* and *t-1* for the top four business group in each market and year. The firm market share has been computed by dividing each firm's gross output by the sum of the gross output of the top four firms.

[50] In line with the concentration measures, to define the top four firms with the largest gross output in each market the business group level information has been considered and the taxonomy is used to define the geographic market.

[51] For example, in the entrenchment measure over 3 consecutive years, the measure captures the number of firms that are the top four in *t*, *t-1*, and *t-2*. As a further robustness check, a measure of entrenchment based on the methodology developed by Bessen et al. (2020[61]), which considers the displacement hazard, is also constructed.

[52] In principle this measure can also be built to take into account situations in which there is entry in the top four groups. Since in the present study the majority of markets have no entry in the top four group (see Figure 5.17), only the case for zero entry has been defined and explored.

$$MSI_{s,g,t} = \frac{1}{4}\sum_{f \in Top\ 4} \left| \frac{S_{f,s,g,t}}{\sum_{\phi \in Top\ 4} S_{\phi,s,g,t}} - \frac{S_{f,s,g,t-1}}{\sum_{\phi \in Top\ 4} S_{\phi,s,g,t-1}} \right|, \qquad \text{Equation 11}$$

166. Where $S_{f,s,g,t}$ is the output of business group *f* in an industry *s*, in its relevant geographic market *g*, at time *t*. This measure considers the average change in the relative importance of each top four business groups among the market leaders between two consecutive years. A high MSI indicates significant changes in the relative importance of at least one of the market leaders, while a low MSI suggests a relatively stable composition of the output of the top four firms.

Markups

167. Markups, defined as the wedge between output price, P_{ft}, and marginal cost, c_{ft}, are used as an additional proxy of competition as they measure individual firms' market power. Firm-level markups are estimated following the well-known supply-side methodology of De Loecker and Warzynski (2012[13]), which builds on Hall (1988[50]). Since neither prices nor marginal costs are directly observable in the data, this method derives markups from the firm's cost minimisation problem.[53] Specifically, markups correspond to the ratio between the elasticity of output with respect to a flexible input in each industry, α^m ($\hat{\alpha}^m$ being its estimation, see below), and the cost of the flexible input as a share of the firm's revenue, S_{ft}^m. For further details on the derivation of the expression for markups, see Annex A.

168. A transformation of the first-order condition yields the expression for markups:

$$\mu_{ft}^m = \frac{P_{ft}}{c_{ft}} = \frac{\hat{\alpha}^m}{S_{ft}^m}. \qquad \text{Equation 12}$$

Therefore, the cost minimisation problem reveals information on firms' pricing relative to their marginal cost without requiring assumptions on the demand function faced by firms and how they compete. This methodology requires the assumptions that: i) at least one input of production can be adjusted without frictions; ii) firms produce by minimising their costs. In addition, specific assumptions on the production function are needed. The chosen functional form for the production function is the Cobb-Douglas production function with three inputs (capital, materials, and labour) and gross output as output. As standard in the literature, the production function is assumed to be industry-specific. It is estimated at the finest level of granularity possible – the NACE Rev.2 3-digit level – pooling observations across years.[54]

169. In this report, materials are assumed to be the input without adjustment costs. The assumption of a fully flexible input seems more realistic for materials than for labour, especially in consideration of labour market rigidities characterising many European countries. The cost of the materials as a share of the firm's revenue (S_{ft}^m) is directly observable from the balance sheet information of each firm, whereas the elasticity of output with respect to materials (α^m) is obtained by estimating a production function.

170. The production function is estimated in each 3-digit industry using state-of-the-art techniques to control for potential biases due to the simultaneity of productivity shocks and unobserved output prices. The estimation employs the control function approach with a two-stage GMM procedure by Ackerberg et

[53] With this method, markups are derived from the first order conditions with respect to flexible inputs of the firm's Lagrangean function associated with the cost minimisation problem.

[54] This is due to the minimum requirements in terms of observations to compute the production function for each industry. As a robustness check, to allow for the effect of technological change of the production function over time, five-year rolling windows around the year where technology is estimated have also been used. See Annex B for additional details.

al. (2015[79]). This procedure has been widely used in the existing literature on markups (De Loecker et al. (2020[3]); Autor et al. (2020[14]); Calligaris et al. (2024[2]). More details on the estimation procedure are included in Annex B.

5 Trends

Concentration

171. Concentration is measured as the share of gross output accounted for by the four largest firms in a market, as described in Section 4. The geographical dimension of each market is defined using the taxonomy, which assigns each industry to a unique "geographical bucket": domestic, European, or global.

172. The report first presents concentration trends at the aggregate level and then separately for each geographical bucket. For both types of exercises, the evolution of the baseline concentration measure is presented by plotting both levels and the cumulative unweighted average change since the year 2000 (normalised to 0). When looking at the cumulative change in each year, the average yearly change is computed across all industries within a bucket for the European and the global buckets and across all country-industries pairs within the domestic industries. Then, the overall cumulated change is computed and plotted by summing up the yearly changes starting from the base year 2000.[55]

173. To obtain the aggregate concentration trends, i.e., aggregating domestic, EU, and global industries, it is important to note that domestic industry concentration is computed for each country-industry-year. In contrast, EU and global concentration measures are computed at just the industry-year level because country-level data has been aggregated to account for the appropriate level of competition. Therefore, for industries competing at the European and global levels, each industry-year observation is used 15 times (the number of countries in the data) to give them equal importance as the domestic industries (otherwise domestic industries would dominate the statistics). Note that this is equivalent to assigning each country the same concentration value within an industry-year for EU and global industries.

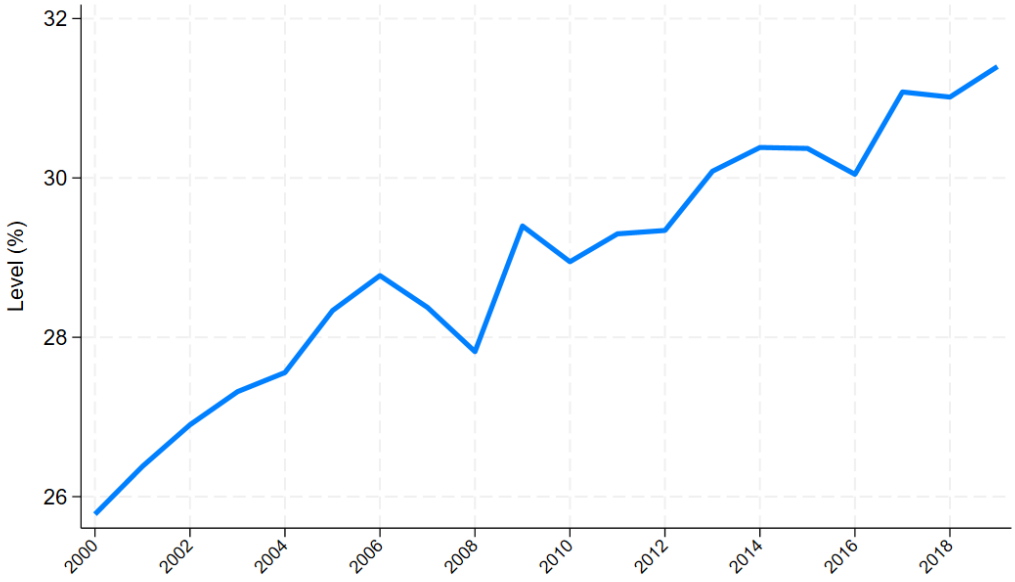
174. The baseline analysis does not weigh by the size of the country-industry-year - instead, the unweighted averages are taken across geographies and industries. The unweighted average is chosen as the baseline for numerous reasons. First, when looking at overall concentration trends in each bucket, giving all units the same weight is preferable to avoid statistics that are only representative of a few big industries and countries. Second and relatedly, due to data limitations, there is substantial heterogeneity in the level of aggregation of industries, and the more aggregated industries would generally get more weight in the weighted trends. As a result, trends would potentially be driven by a few big industries and,

[55] Concentration trends are presented both in levels and by means of cumulative growth. Note, however, that, given that the sample used in the analysis is not fully balanced, the cumulative average changes allow to control for any change in sample composition over time, while trends in levels can potentially exhibit jumps if any of the industries entering/exiting has substantially different levels of concentration with respect to the average level. Therefore, trends of cumulative changes are more methodologically stable and, as such, are the preferred option in the report to show the evolution of concentration over the years. More generally, concentration levels should always be considered with caution due to data limitations. Levels of concentration might be affected by specific data issues for several reasons, including different data sources and definitions for the main variables for the numerator and the denominator, output measures being potentially volatile and difficult to measure at the 3-digit level in certain industries, attribution of all firms' sales to a unique industry, which may lead to an overestimation of the numerator, as discussed in Footnote 43. Each of these caveats might lead to a concentration measure higher than 1 (see also footnotes 39 and 43 for further details).

as such, not very informative of the overall evolution of concentration across economic activities. Third, once the economy is divided into geographic buckets, the weight assigned to each industry within the bucket would not coincide with the share of that industry in the overall economy and, thus, with its relative importance. Fourth, the statistics should be representative of all countries, not just the biggest ones. Fifth, the only available variable that could be used for weighting is gross output, not value added. Gross output includes the value of intermediates, so weighting by gross output would give more weight to downstream industries than upstream industries.[56] Despite these drawbacks, weighted trends are presented as a robustness check in Annex C and discussed later in this section. In addition, this section also provides a qualitative discussion of the heterogeneous evolution of concentration across different countries and industries.

175. Figure 5.1 and Figure 5.2 show, respectively, the aggregate level and the aggregate cumulative changes in concentration across all markets. In the sample considered, the average concentration level, reported in Figure 5.1, starts slightly above 25% in 2000 and ends above 30% in 2019. In addition, Figure 5.2 shows that, on average, concentration increased by 5 percentage points (p.p., henceforth) between 2000 and 2019.

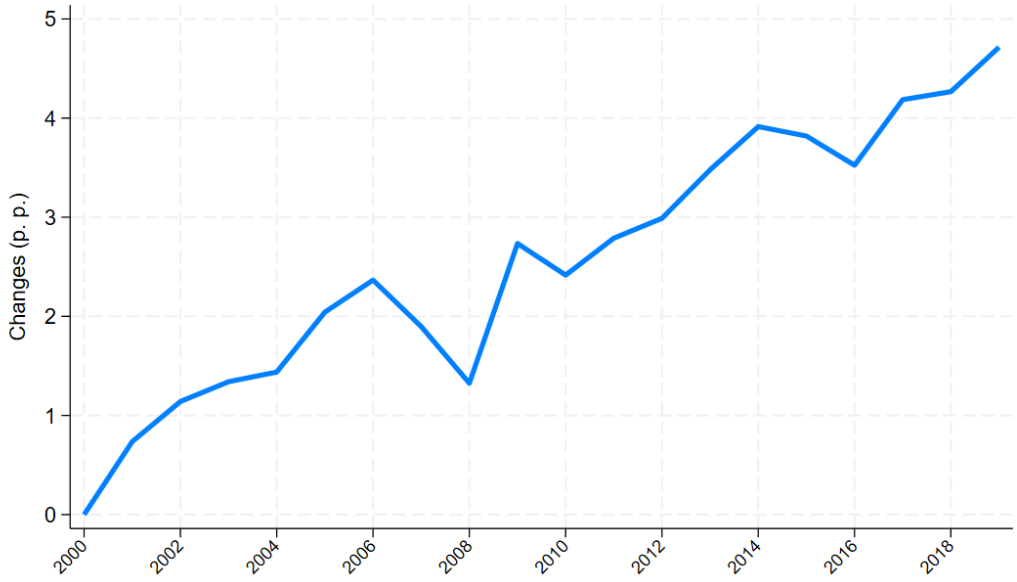
Figure 5.1. Concentration level aggregating across geographical buckets



Note: The chart shows the weighted average across industry-geography combinations of CR4 levels. A weight of 1 is attributed to country-industries cells for domestic industries, while a weight of 15 is attributed to industries belonging to the European and the global buckets. Industries included in the analysis are a mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European buckets, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

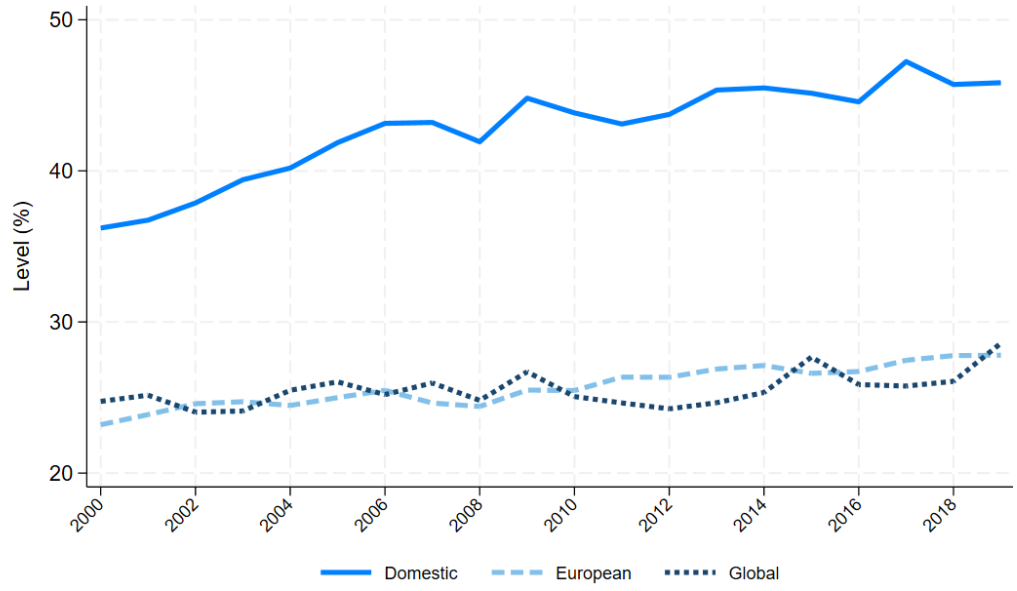
[56] Take the example of two industries with the same value-added but different value of intermediates. At the same value-added, the industry with higher value of intermediates will result in a higher gross output, and hence a higher weight.

Figure 5.2. Concentration cumulative changes aggregating across geographical buckets



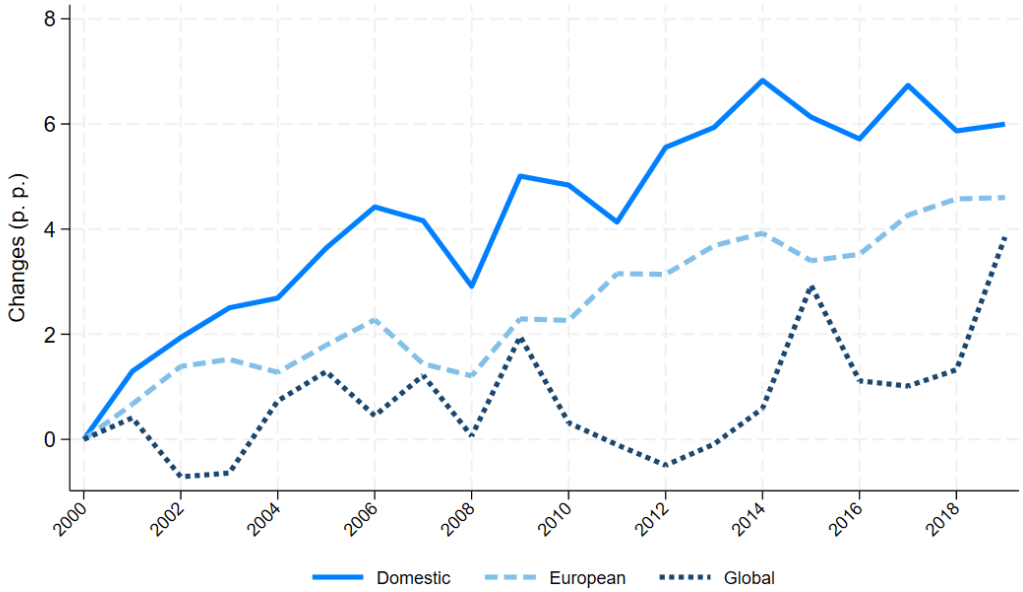
Note: The chart shows the weighted average across industry-geography combinations of CR4 cumulative changes. A weight of 1 is attributed to country-industries cells for domestic industries, while a weight of 15 is attributed to industries belonging to the European and the global buckets. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Figure 5.3. Concentration levels across geographical buckets



Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of CR4 levels. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Figure 5.4. Concentration cumulative changes across geographical buckets



Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of CR4 cumulative change. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

176. Figure 5.3 and Figure 5.4 report concentration levels and cumulative unweighted average changes across the three geographical buckets and disentangle the information contained in the aggregate graphs. The average concentration level is higher in industries competing at the domestic level than in those competing at the European and global levels, which show similar concentration levels to each other. Specifically, the top four firms represent, on average (over the period considered), around 43% of the total gross output of the industry in industries competing at the domestic level and around 26% in the other geographical buckets.

177. Figure 5.4 shows that, on average, industry concentration has increased across all geographic buckets. Industries that compete at the domestic level had the greatest increase in average concentration, by around 6 p.p. between 2000 and 2019. Industries that compete internationally – at the European or global level – increased their concentration by approximately 4 p.p. However, while industries competing at the domestic and European levels see a smooth increase over the period considered, in industries competing at the global level, concentration is relatively stable up to about 2012 and then starts to increase.[57]

178. The aggregate trends reported in Figure 5.3 and Figure 5.4 can hide substantial heterogeneity across industries (and countries, for the domestic bucket). Therefore, extensive sensitivity tests have been performed to understand whether a few observations drive these trends. The main exercise conducted to study heterogeneity across sectors consists of removing industries from the sample one at a time to check

[57] Note that the global bucket includes 20 industries, the European one 80 industries, and the domestic one 27 industries (for 15 countries). The trend for the global bucket is, therefore, slightly more volatile than the trends for other buckets: since it covers relatively fewer observations, it is more sensitive to single industries' changes in concentration.

their relative importance in driving the cumulative change trends.[58] In addition, for industries competing at the domestic level, where the country dimension can also be investigated, a similar exercise has been conducted by removing one country at a time.[59] All in all, the trends appear to be robust to the exclusion of single industries and countries, as no single countries or industries drive the cumulative changes of concentration in any of the three geographical buckets. Figure A C.8. reports the average concentration level across the different countries of the sample for the 27 industries competing at the domestic level.

Further discussion and robustness checks

179. To assess the robustness of the results and further explore aspects of market concentration, several exercises are performed and briefly described in this sub-section. In particular, additional evidence is reported on the role of weighting and additional adjustments for international trade in computing aggregate concentration measures, as well as the evolution of concentration across 1-digit sectors (manufacturing, services, and others), across high versus low digitally intensive sectors (as per the digital taxonomy developed by (Calvino et al., 2018[8])) and the evolution of the distribution of concentration.

180. Figure A C.1 and Figure A C.2 in Annex C show concentration levels and cumulative changes weighted by market gross output (country-industry for the domestic bucket, industry for the European and global buckets) within each geographical bucket. As discussed above, weighting by gross output has a number of disadvantages which should be considered when interpreting the results.

181. The comparison of unweighted levels of concentration (Figure 5.3) with the weighted ones (Figure A C.1) reveals that weighting by market size (in terms of gross output) reduces the level of aggregate concentration in domestic markets, suggesting that concentration is higher in smaller markets (country-industry pairs in this case). On the contrary, the weighting procedure increases the aggregate level in the global bucket and, to a lower extent, in the European bucket, indicating that concentration is higher in relatively bigger industries. In addition, the comparison of unweighted and weighted concentration cumulative changes (respectively, Figure 5.4 and Figure A C.2) shows that, when weighting for the relative size of the market, concentration looks overall flat over the period 2000-2019 for industries competing both domestically and at the European level. In industries competing at the global level, the weighted trend is even decreasing. The combination of these results suggests that for the domestic and European buckets, the increase in concentration mainly occurs in relatively small markets (in terms of gross output). In contrast, the decrease occurs in relatively big sectors for the global bucket.

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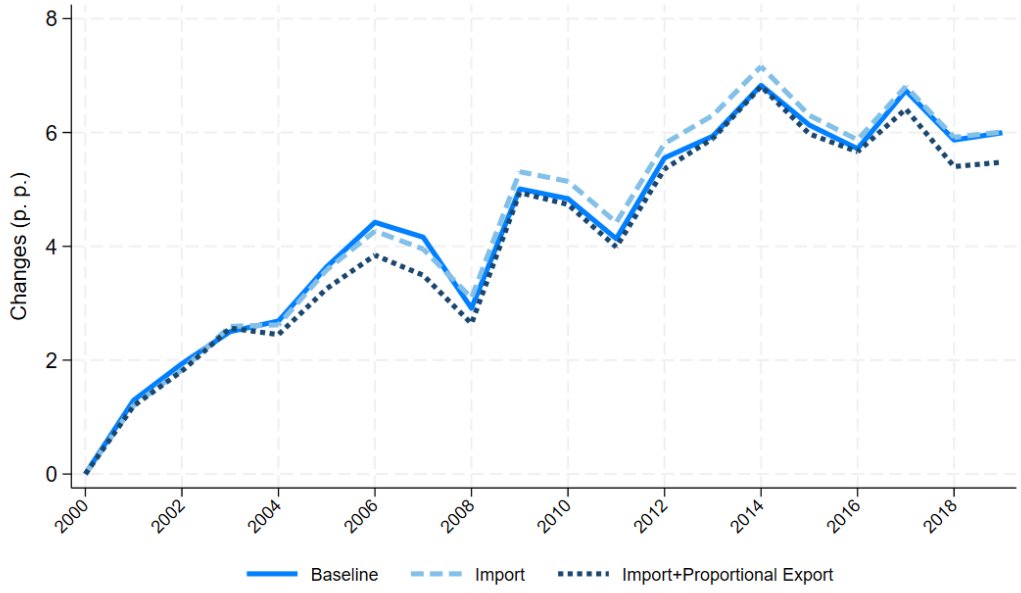
[58] Domestic bucket: only three industries marginally affect the average cumulative change trend when removed, either by decreasing it by 1 p.p. (091, Support activities for petroleum and natural gas extraction; 352, Manufacture of gas, distribution of gaseous fuels through mains) or by increasing it, again, by 1 p.p. (353, Steam and air conditioning supply). European bucket: four industries that make the cumulative change in concentration increase by about 1 p.p. each when removed from the sample (232, Manufacture of refractory products; 242, Manufacture of tubes, pipes, hollow profiles and related fittings, of steel; 781 Activities of employment placement agencies; 783 Other human resources provision) and one that makes the cumulative change in concentration decrease by almost 2.5 p.p. (262, Manufacture of computers and peripheral equipment). While the variation in the last industry is relevant, in terms of the average cumulative change in concentration the net effect is essentially nihil when considering the former four. Global bucket: only two industries marginally driving the trends in two opposite directions. Dropping from the sample industry 151 (Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, and harness; dressing and dyeing of fur) would make the cumulative change of the global bucket decrease by about 1.5 p.p., while dropping industry 303 (Manufacture of air and spacecraft and related machinery) would make the trend increase by about 2 p.p. Note that single data points should be interpreted with caution, as explained in footnote 55.

[59] Only Poland, Portugal, Sweden, and the United Kingdom can be considered as marginally driving the overall growth in the domestic bucket (Poland and Sweden both decrease the cumulative growth by about 1 p.p. each, while for Portugal and the United Kingdom the opposite is true; overall the effect of these countries on the aggregate growth cancels out).

182. A further robustness check regards the computation of the concentration measure using the top eight business groups in the market (obtaining CR8 instead of CR4). Figure A C.3 and Figure A C.4. report, respectively, the average concentration level and the cumulative change for CR8. The trends are consistent with the trends reported for CR4. The average levels (Figure A C.3) are higher by construction, but the comparison across buckets is qualitatively similar to those reported for CR4: the domestic bucket displays the highest level of concentration, with the top eight accounting for about 50% of the market output, followed by the European and the global buckets, where the average concentration level is around 35%. When looking at the cumulative changes (Figure A C.4.), the differences with CR4 are slightly more pronounced, especially for industries competing at the European level: CR8 increased more than CR4 in all the geographical buckets. It increases similarly, about 8 p.p., in the domestic and the European bucket (versus 6 and 4 p.p. respectively, for CR4), and by about 4.4 p.p. in the global bucket (similar to CR4).

183. As explained in the Methodology section, the concentration measure crucially depends on the market's definition. Amiti and Heise (2021[6]) show that accounting for international trade, and, therefore, for the actual market size, significantly affects concentration trends. Following this paper, a robustness check that accounts for the role of import and export is performed (see the Methodology section for details).

Figure 5.5. Trade adjustments, industries competing domestically



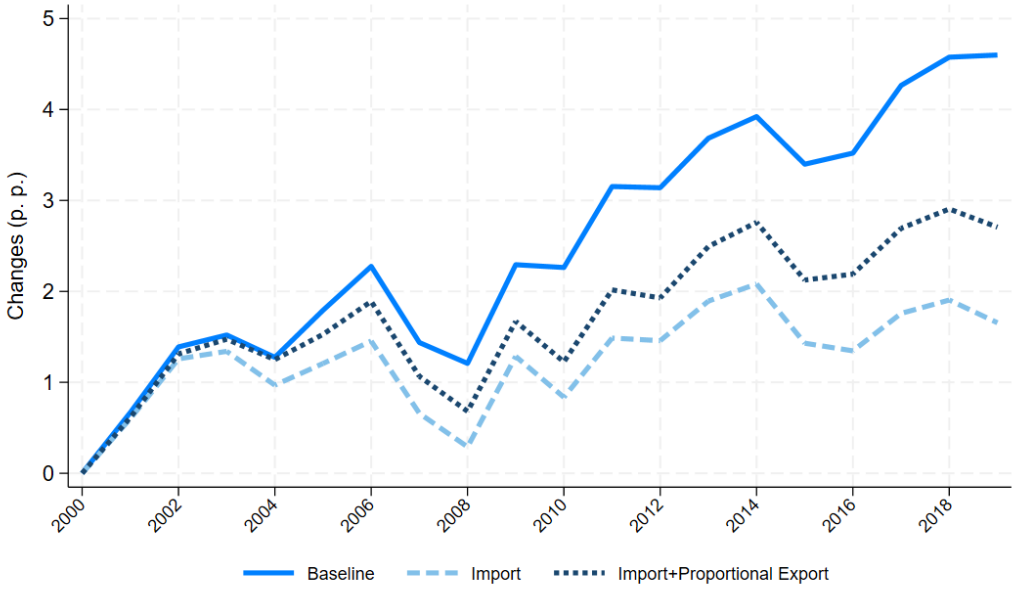
Note: The chart shows the unweighted average across industries and countries of CR4 cumulative change in the domestic geographical bucket for different types of trade adjustments. The solid blue line refers to the baseline average cumulative change (no corrections). The dashed light-blue one to the correction obtained by adding import at the denominator. The dotted dark-blue one to the correction obtained by adding import and subtracting total exports at the denominator, and by subtracting at the numerator a fraction of export given by the share of gross output accounted for by the four largest firms in the market. Industries are a mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

184. In Figure 5.5 (domestic markets), Figure 5.6 (European markets) and Figure 5.7 (global markets), the solid blue line reports the baseline with no correction for international trade (same as in Figure 5.3), the light blue dashed line adds the import correction in the denominator, but no export correction, and the dark blue dotted line accounts for both imports and exports, which are subtracted from both the denominator and the numerator. Specifically, in the import correction exercise, imports in the same industry

from outside the geographical bucket (domestic, European, global) are subtracted. In the exercises in which exports are also accounted for, exports in the same industry to the rest of the world (with respect to the bucket considered) are fully subtracted from the denominator (to account only for the gross output that is consumed in each market), while, at the numerator, a share of exports corresponding to the share of gross output accounted for by the four largest firms in the market is subtracted (this assumption is made because the data do not provide information on the export flows at the firm-level).

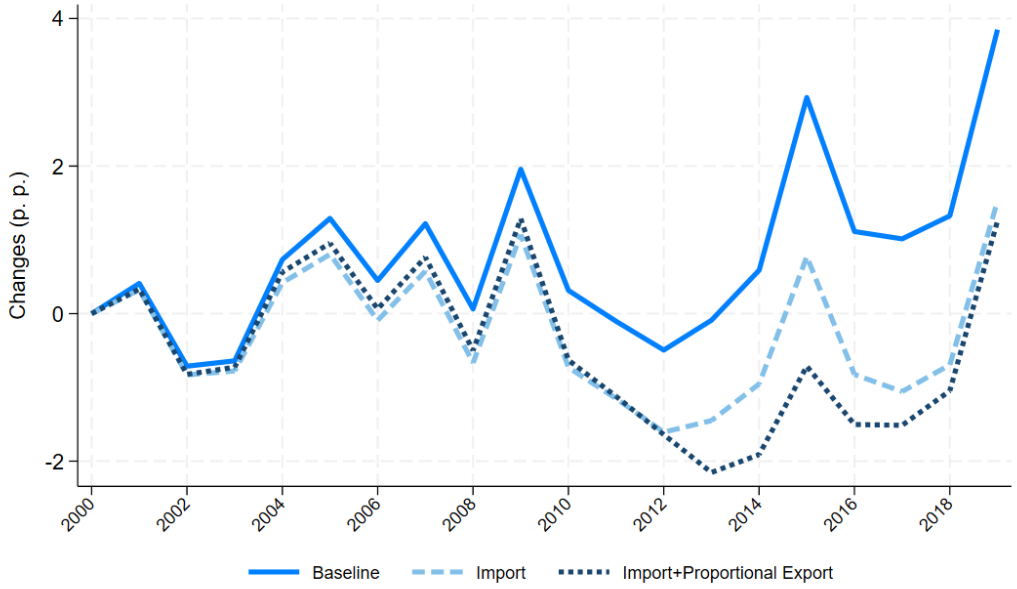
185. In line with Amiti and Heise (2021[6]), trade corrections tend to dampen the rise in concentration. As largely expected, trade corrections have a stronger effect on the trends of cumulative changes in the European and global buckets, which are more tradeable. In contrast, the growth of concentration in the domestic bucket remains virtually unchanged. This adds further support for the cutoffs used to define the taxonomy, as domestic industries appear to indeed be relatively unaffected by international trade (at least on average). Also note that while the taxonomy accounts for trade between all countries included in the relevant geography, not all European and global countries are included in the sample. Trade with countries not included in the sample is accounted for in the trade adjustment exercises, explaining why the further adjustments have a non-trivial effect on the trends (in addition to the caveat that only aggregate, not firm-level, data on trade flows is available so these adjustments are an approximation).

Figure 5.6. Trade adjustments, industries competing at the European level



Note: The chart shows the unweighted average across industries and countries of CR4 cumulative change in the European geographical bucket for different types of trade adjustments. The solid blue line refers to the baseline average cumulative change (no corrections). The dashed light-blue one to the correction obtained by adding import at the denominator. The dotted dark-blue one to the correction obtained by adding import and subtracting total exports at the denominator, and by subtracting at the numerator a fraction of export given by the share of gross output accounted for by the four largest firms in the market. Industries are a mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Figure 5.7. Trade adjustments, industries competing at the global level



Note: The chart shows the unweighted average across industries and countries of CR4 cumulative change in the global geographical bucket for different types of trade adjustments. The solid blue line refers to the baseline average cumulative change (no corrections). The dashed light-blue one to the correction obtained by adding import at the denominator. The dotted dark-blue one to the correction obtained by adding import and subtracting total exports at the denominator, and by subtracting at the numerator a fraction of export given by the share of gross output accounted for by the four largest firms in the market. Industries are a mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, JPN, KOR, NOR, POL, PRT, SVN, SWE, and USA.
Source: OECD calculations.

186. The evolution of concentration may also vary across different sectors. To examine this, the trends are plotted by broad sector groups: manufacturing, non-financial services, and "other sectors" (which includes mining and utilities).[60] The average level of concentration is similar in manufacturing and non-financial services, starting at around 25% in 2000 and ending at around 30% in 2019. "Other sectors" have a higher concentration level, starting at about 40% in 2000 and ending slightly below 50% in 2019. The cumulative growth of average concentration in these sectors is reported in Figure A C.5. In all the sectors considered, average concentration increases over time, with the non-financial services sector exhibiting the smallest increase (1.6p.p.), followed by manufacturing (5.6p.p.), and the others (6.4p.p.). Note that an increase in concentration across all 1-digit sectors is consistent with the finding of Bajgar et al. (2019[7]).[61]

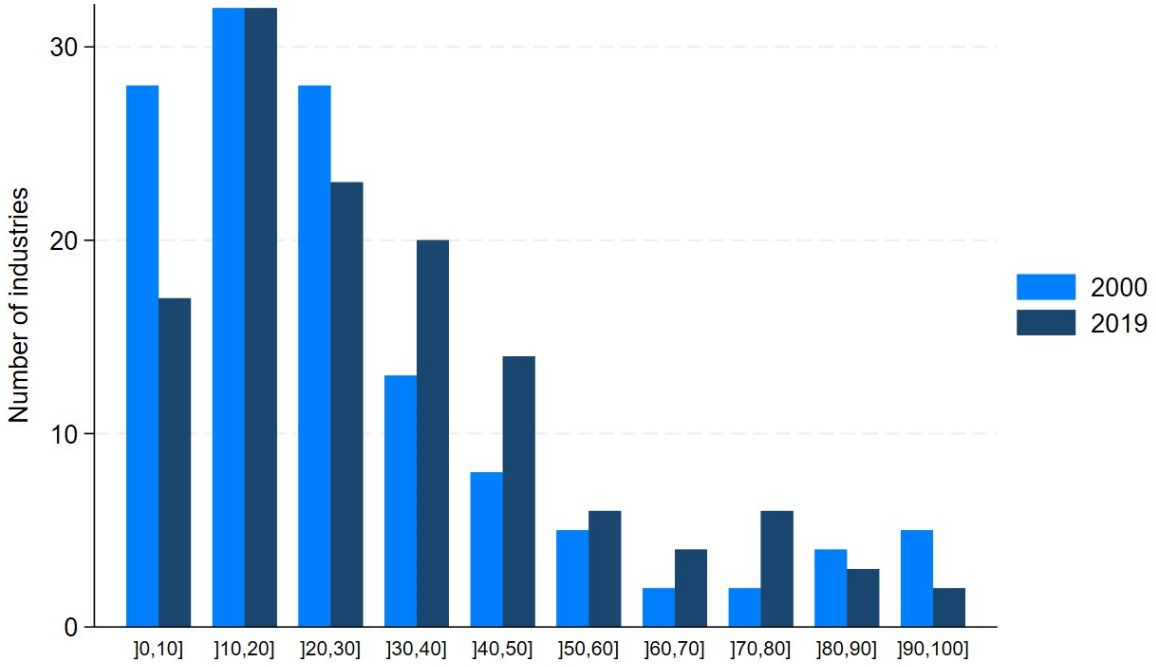
[60] To perform this exercise, the geographic taxonomy has not been used since further splitting the sectors by geographic bucket would have resulted in trends very sensitive to the patterns of individual industries. Similarly to what is done to obtain the aggregate trends in Figure 5.1 and Figure 5.2, to obtain the aggregate trends at the 1-digit level, a weighting procedure has been adopted: given the different numerosity of the sample across geographical buckets, in each year, a weight of 1 is attributed to country-industry pairs in industries competing at the domestic level, while a weight of 15 is attributed to industries belonging to the European and the global buckets.

[61] If one only considers trends until 2014, the final year of the sample analysed by Bajgar et al. (2019[7]), their finding of a stronger increase in concentration in services than in manufacturing is confirmed. However, in the last five years of the sample used in the current report, i.e., between 2015 and 2019, the opposite is true. Note that the comparisons with Bajgar et al. (2019[7]) should be taken with caution, as they rely on a different methodology on the geographic

187. A further exercise that can be informative to understand the heterogeneous dynamics of average concentration is to consider the digital intensity of industries by using the taxonomy provided by (Calvino et al., 2018[8]), which classifies industries by their digital intensity. Industries are gathered into two categories: high digital intensity, if they are above the median of the digital intensity distribution, and low digital intensity otherwise.[62] The average concentration level is very similar across the two categories, and Figure A C.6. shows that the rise in industry concentration was similar for digital intensive and low digital intensive sectors (consistent with the results in Bajgar et al. (2019[7])).

188. While aggregate trends are informative of what happens on average in the economy, it is also worth investigating how the distribution of concentration evolved throughout the years of the sample (2000-2019). From an economic perspective, it is relevant to understand whether the overall increase in concentration comes from industries that had already high levels of concentration or from industries that started with low levels of concentration (see, for example, Koltay et al. (2023[30])).

Figure 5.8. Concentration distribution: number of industries across concentration intervals



Note: The chart compares the number of industries within each interval of the CR4 distribution, respectively, in 2000 and in 2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

189. To perform this exercise, the concentration distribution, which ranges between 0 and 100%, has been divided into ten equally spaced bins (e.g., the first includes industries with a concentration level lower

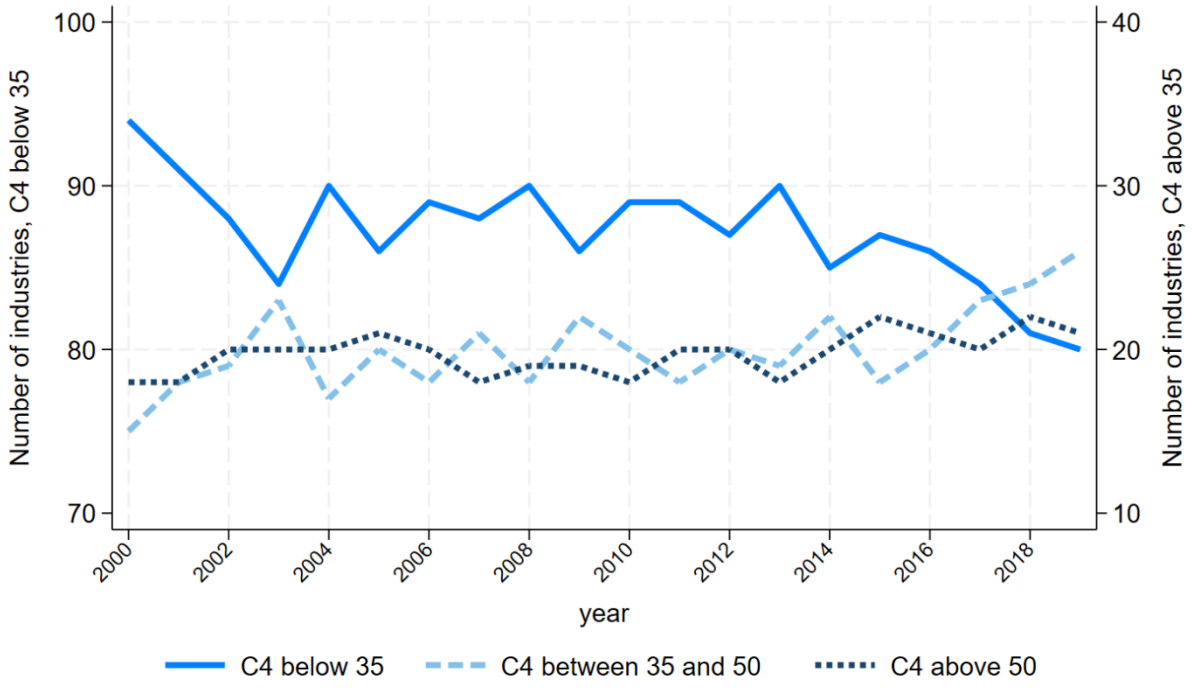
dimension (domestic versus European versus global), level of aggregation (2- versus 3-digit), as well as a different set of countries.

[62] See further details about the digital taxonomy in Calvino et al. (2018[8]). Please note that this exercise also relies on the same weighting procedure used to obtain aggregate trends and trends across 1-digit sectors.

than 10%, the second one with a concentration level between 10% and 20%, and so forth). The histogram in Figure 5.8 reports the number of industries with concentration levels within each bin for the sample's initial (2000) and final (2019) years. The number of industries with a concentration level below 30% has decreased from 2000 to 2019, while there has been an overall rise in the number of industries with a concentration level above 30%. However, the opposite is true for very highly concentrated industries (concentration above 80%), i.e., the number of industries with concentration above 80% was higher in 2000 than in 2019.

190. Further, Figure 5.9 shows the number of industries across three (larger) bins for values of the CR4 measure: CR4 below 35%, between 35% and 50%, and above 50%. The number of industries with a concentration level below 35% has decreased (passing from 94 to 80, left scale on the graph) while the number of industries with higher concentration has been increasing (right scale on the graph). In particular, the number of industries with a concentration between 35% and 50% has increased the most, going from 15 to 26, while the number of industries with a concentration above 50% has only slightly increased, from 18 to 21 (out of 127 industries in total). This last trend might be dampened because the number of industries with a concentration level above 80% has decreased (see Figure 5.8). Note that the number of industries with CR4 below 35% is measured on the left y axis because the level is higher, while the other two categories are measured on the right y axis. The total number of industries is 127.

Figure 5.9. Number of industries across CR4 values



Note: The chart shows the evolution of the number of industries across three different intervals of values of CR4 (0-35%, 35-50%,50-100%) between 2000 and 2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included. Note that the number of industries with CR4 below 35% is measured on the left y axis because the level is higher, while the other two categories are measured on the right y axis. The total number of industries is 127.
Source: OECD calculations.

Analysis of selected 4-digit industries

191. One of the methodological contributions of this report is to bridge a gap between industry and product market concentration analysis as much as possible. To advance in this direction, an analysis at the 4-digit industry-level has been performed for some selected industries, reaching an even more granular level of industry disaggregation. Due to data limitations, the exercise focused only on the manufacture of food and beverages (C10 and C11 at the 2-digit level of aggregation). These industries are a particularly relevant component of the manufacturing sector in terms of employment and value-added. Moreover, in recent years they have been under scrutiny of the European Commission, that has placed substantial attention on these industries with the aim of guaranteeing a strong degree of competition.[63] In addition, the 4-digit industries belonging to the food and beverages industries reach a very granular level of detail, which are very similar to the product level.

192. According to the taxonomy of sectors, all the 4-digit industries belonging to the 3-digit C101, C105, C107, C109, and C110 are classified as competing at the domestic level, while those belonging to the 3-digit C102, C103, C104, C106, C108 are classified as competing at the European level.[64] Concentration is computed at the corresponding geographical level for each 4-digit industry.

193. Figure 5.10 shows the average concentration level across these industries in the domestic and European buckets. The average level in the European bucket (about 27%) is higher than the average level found in the corresponding industries at the 3-digit level of aggregation (about 20%); analogously, the average level in the domestic bucket is higher (around 59%) than in the corresponding 3-digit (42%).

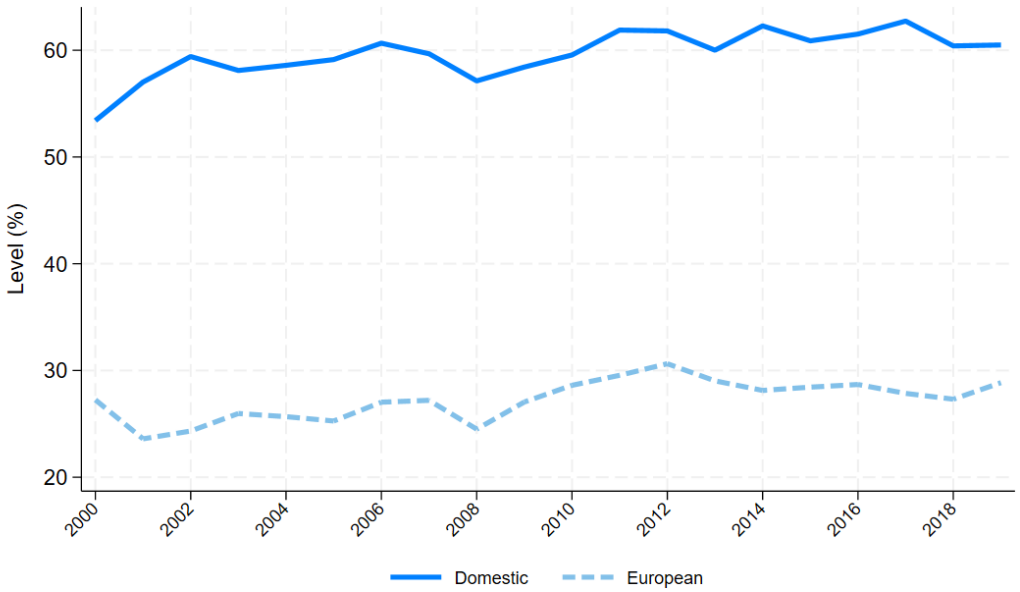
194. Figure 5.11 reports the average cumulative growth in these industries. Analogously to the results at the 3-digit level of aggregation, industries belonging to the domestic geographical buckets experienced, on average, a higher concentration growth than those competing at the European level between 2000 and 2019. The cumulative growth for domestic industries is around 7.5% (higher than at the corresponding 3-digit level), while for European industries, it is around 2% (also higher than at the corresponding 3-digit level).

195. Note that the conclusions drawn from this exercise must be taken with caution, given that with this exercise data have been stretched to their maximum. For example, the range of activities of firms at this level of disaggregation might indeed easily fall into different 4-digit industries, but in Orbis all firms are registered as active only in their main industry of activity. While conceptually this can happen even at higher levels of aggregation, the issue is much more likely when disaggregating at the 4-digit level. Registering all activities in one single 4-digit industry might result in higher market shares and, potentially, a concentration ratio higher than 1. At the same time, denominators are obtained following the same methodology outlined in Section 4. As explained above, several assumptions and imputations have been made to obtain data on gross output consistent across countries and industries over the years at such a disaggregated level. With this caveat in mind, this exercise is interesting because it allows the comparison of industry concentration with a measure of concentration closer to the product level. The evidence suggests that, even though the concentration levels are higher the closer the analysis is to the market level analysis, industry concentration is a good proxy for capturing the evolution of market concentration.

[63] Please refer to the webpage https://competition-policy.ec.europa.eu/sectors/agriculture/food_en for a discussion of these topics and further links to relevant work.

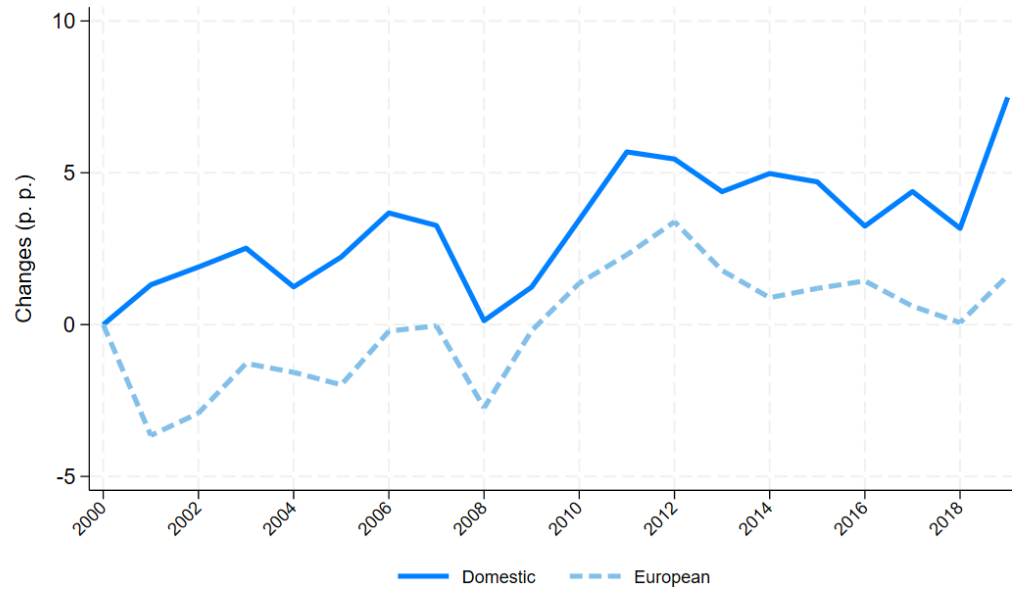
[64] A table with a description of the industries considered is provided in the Annex (see Table A C.1.).

Figure 5.10. Concentration levels, selected 4-digit industries



Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of CR4 levels. Industries included in the analysis are all the 4-digit industries (except for 1042 and 1089 due to data limitations) belonging to the 2-digit industries from C10 (manufacture of food products) and C11 (manufacture of beverages). The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Figure 5.11. Concentration cumulative changes, selected 4-digit industries



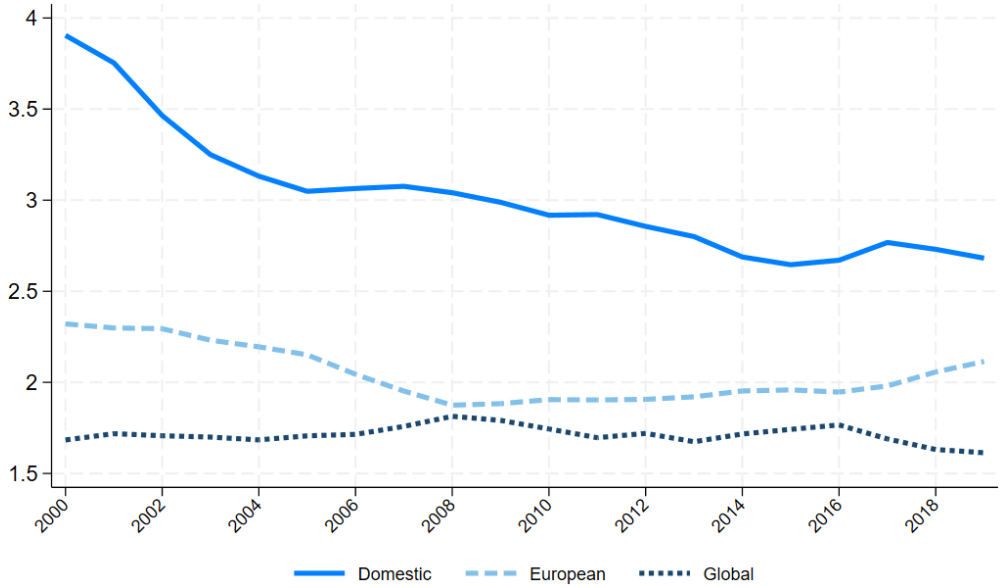
Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of CR4 cumulative change. Industries included in the analysis are all the 4-digit industries (except for 1042 and 1089 due to data limitations belonging to the 2-digit industries C10 (manufacture of food products) and C11 (manufacture of beverages). The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Leadership ratio

196. The concentration ratio measures the average market share of the top four firms but does not reveal information about the relative size of the leading firm with respect to the followers. The leadership ratio is defined as the gross output of the leading firm over the gross output of the second leading firm in a market or, in an alternative version of the measure, as the gross output of the leading firm over the gross output of the three next largest firms.

197. Figure 5.12 plots the moving average of the unweighted leadership ratio by geographical bucket.[65] There are interesting differences in the average level of the leadership ratio in tradeable (European and global) versus non-tradeable industries. Industries that compete at the national level have a significantly higher average leadership ratio than industries competing internationally (recall that domestically competing industries also have a higher average concentration). In 2000, in industries competing domestically, the leading firm is, on average, 3.9 times larger than the following one, whereas in industries competing at the European and global level, the leading firm is, respectively, 2.4 and 1.6 times bigger than the following one. Interestingly, this difference becomes smaller over the period considered: in industries competing domestically, the average leadership ratio falls over time, from 3.9 in 2000 to 2.7 in 2019.I In contrast, in both European and global industries, the trend remains relatively stable over the period. Therefore, in industries competing domestically there seems to be increasing competition between the top two firms over the years. However, the differences in terms of gross output among them remain larger compared to industries competing at the European and global levels.

Figure 5.12. Leadership ratio across geographical buckets (1st over 2nd), unweighted



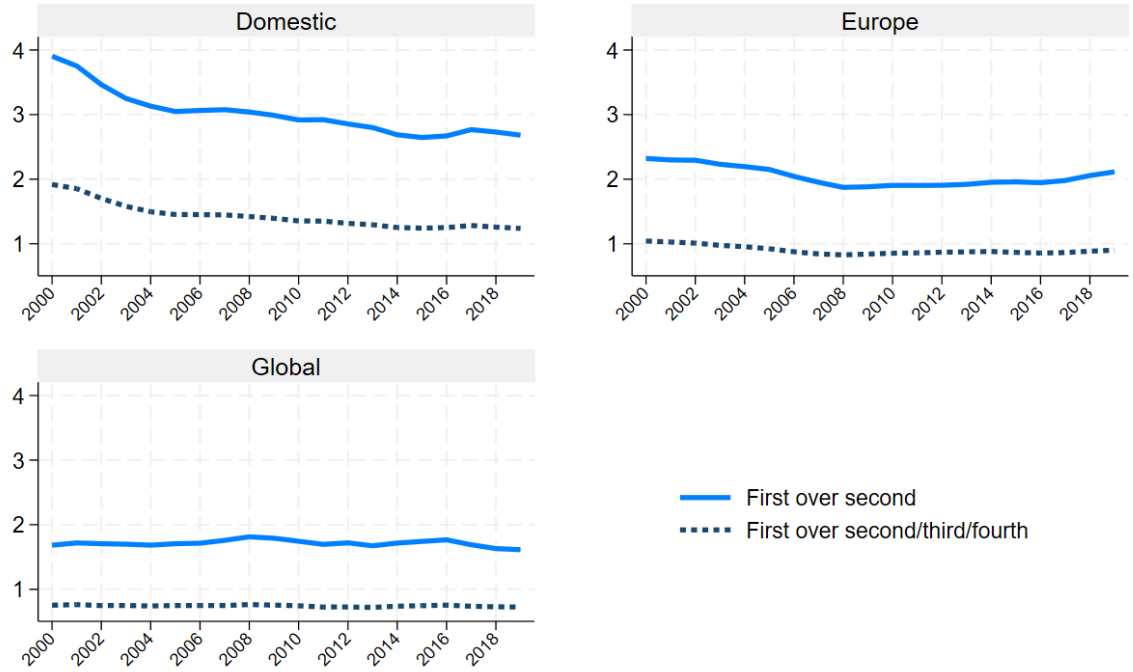
Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of the leadership ratio, which considers the ratio of the sales of the leading firm over the sales of the second firm, between 2000 and 2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

[65] The reason for using the moving average is that the measure appears to be more volatile than the other concentration measures. This is because it is based on only two observations at the business group level for each market and, therefore, is more prone to firms' sales volatility and fluctuations in the business cycle. For each year *t*, the moving average computation uses three years (*t-1*, *t* and *t+1*, that is, one year lag, the actual year, and one year lead) and takes the average among them. For the first (last) year of the time series, only the lead (lag) is considered.

198. Figure 5.13 shows the same leadership ratio presented above alongside alternative specifications of the measure, computed as the gross output of the first firm over the sum of the sales of the second, third and fourth firms within each industry. The alternative measure generally follows a very similar pattern to the original one. In industries competing domestically, the largest firm is about 1.5 times the size of the other three firms together, with the gap having decreased over time. In industries competing at the European and global level, instead, the largest firm has about the same level (or slightly less for industries competing globally) of gross output as the sum of the other firms in the top four.

199. These trends are broadly similar when computing the weighted average instead of the unweighted one, as shown in Figure A C.7. In addition, the unweighted trends are also qualitatively robust to the exclusion of individual industries.[66]

Figure 5.13. Leadership ratio: comparing alternative measures (1st over 2nd, 1st over 2nd +3rd +4th)



Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of the leadership ratio, which considers the ratio of the sales of the leading firm over the sales of the second firm (solid blue lines) versus the ratio of the sales of the first firm over the sum of the sales of the second, third and fourth firm in the ranking (dotted lines), between 2000 and 2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

[66] While individual industries do not drive the evolution of the trends, the levels of the leadership ratio can, of course, change with the exclusion of some specific industries. For example, the leadership ratio trend in the global bucket is partially driven by two industries: “Manufacture of musical instruments” and “Manufacture of weapons and ammunition”, which raise the leadership ratio. In the European bucket, instead, “Manufacture of other general-purpose machinery” increases the leadership ratio even if it does not affect the trend. In the domestic bucket, the leadership ratio trend is not driven by individual markets.

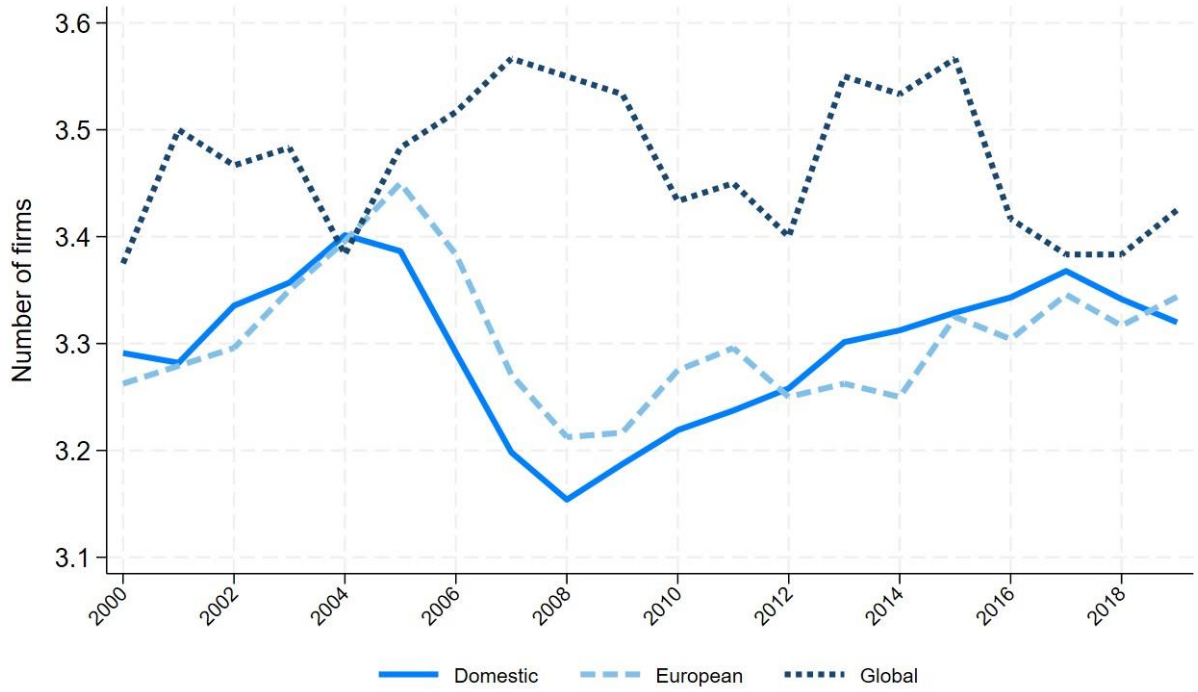
Business dynamism among market leaders

200. This section reports evidence of the evolution of business dynamism among market leaders through three different indicators: entrenchment, rank persistence, and market share instability. The combination of the indicators used in this section suggests that, overall, the level of business dynamism is low and has slightly decreased over the period considered. This tendency became relatively more evident after 2008 and in industries competing at the domestic and the European level.

Entrenchment

201. The entrenchment of top firms as market leaders is an important indicator of market dynamism. Industries may be very concentrated but at the same time have competition among the market leaders, which may be reflected in churn in the firms that are market leaders. As shown in the methodology section, the baseline entrenchment measure is defined as the number of firms that were in the top four in year *t-1* and remain in the top four in *t* in each market. As such, it is bounded between zero and four.

Figure 5.14. Entrenchment across geographical buckets



Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of entrenchment in the top four firms between 1999-2000 and 2018-2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

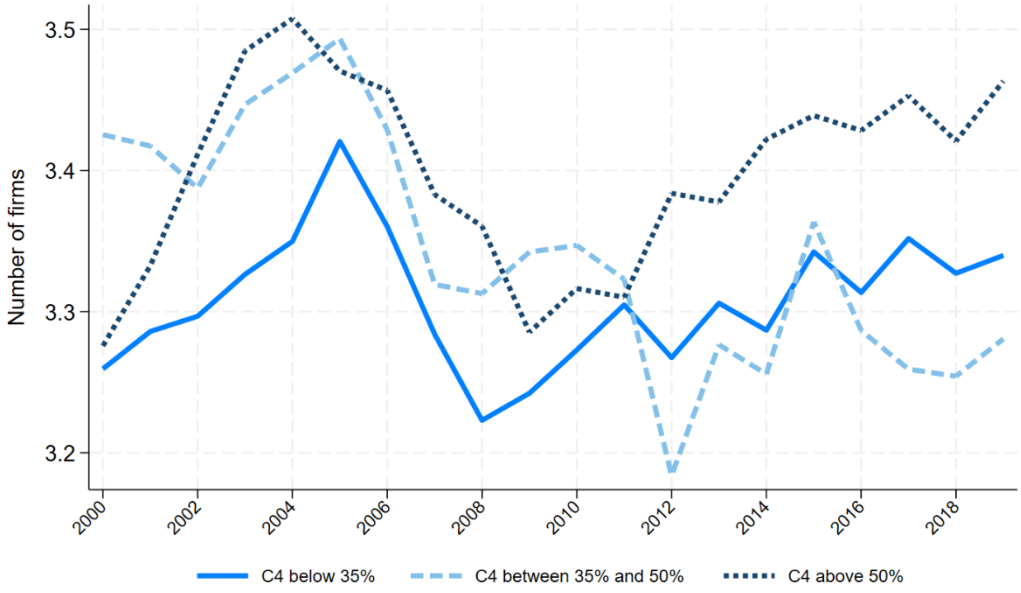
202. Figure 5.14 plots the yearly unweighted average of entrenchment across industries in each geographical bucket.[67] On average, more than three firms that were in the top four in *t-1* remain in the top

[67] The moving average is computed in the same way as for the leadership ratio.

four in *t*. Overall, there is a relatively high level of persistence in the entrenchment rate in all the geographical buckets. Industries competing at the global level have higher persistence on average than those competing at the domestic and European levels. In addition, for industries competing at the domestic and the European level, the entrenchment measure slightly decreased between 2005 and 2008, to restart increasing after 2008 to the pre-2005 levels, while for global industries, the measure remained fairly stable over the sample period.

203. Another interesting characteristic of trends in entrenchment becomes apparent when it is considered jointly with concentration. Figure 5.15 reports the entrenchment measure across different intervals of the concentration distribution (in markets with concentration below 35%, between 35% and 50%, and above 50%). Two main features emerge. First, on average, entrenchment is slightly higher in more concentrated industries. Second, while average entrenchment declines in markets with levels of concentration between 35% and 50%, it shows a mildly increasing trend in weakly concentrated industries, and a more pronounced increase in strongly concentrated markets starting from around 2009. Higher entrenchment in more concentrated industries implies that churning rarely occurs at the top in these industries. Thus, it may be easier for leader firms to create barriers to competition.

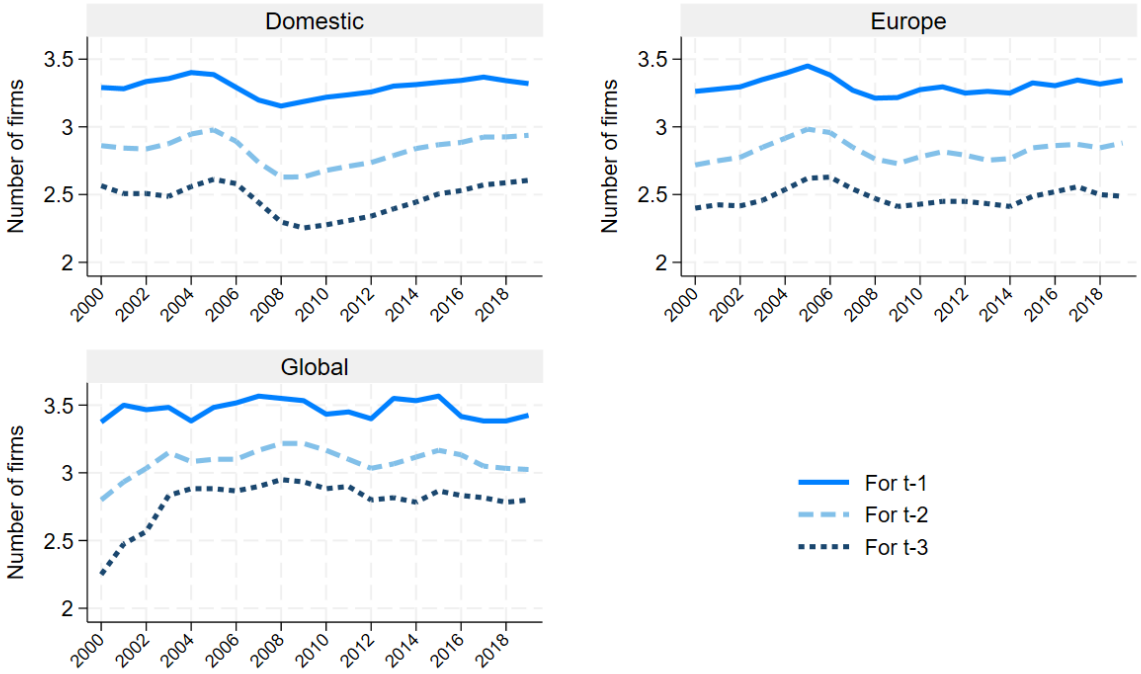
Figure 5.15. Entrenchment by concentration level



Note: The chart shows the unweighted average of entrenchment in the top four firms across different intervals of the concentration level distribution between 1999-2000 and 2018-2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

204. As a robustness check, Figure 5.16 compares entrenchment measures computed for different time horizons: one year before *(t-1)* (i.e., the baseline plotted in Figure 5.14), two years before *(t-2)*, and three years before *(t-3)*. In this exercise, a firm is considered entrenched in the top four if it is in the top four across all years of the time interval considered. The three measures follow very similar patterns in each geographical bucket. For all the different time horizons, entrenchment is high and relatively flat over the period. On average, more than two firms are consistently in the top four every year over a three-year time horizon.

Figure 5.16. Entrenchment for different time horizons



Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of entrenchment for different time horizons one year before (*t-1, solid blue line)*, two years before *(t-2, dashed light blue line)*, and three years before *(t-3, dotted dark blue line)*, between 1999-2000 and 2018-2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

205. The baseline trends of entrenchment are not driven by any single industry, which exhibit only minor changes when industries are removed one at a time. Furthermore, for the measures of entrenchment over two or three years, an alternative specification is considered whereby the firm is only required to be in the sample in the initial period (*t-2* or *t-3),* respectively, and in the final one (*t).* The results (not reported for brevity but available upon request) are consistent with this alternative specification. Finally, the results are consistent when measuring entrenchment with a measure that follows Bessen et al. (2020[61]).[68]

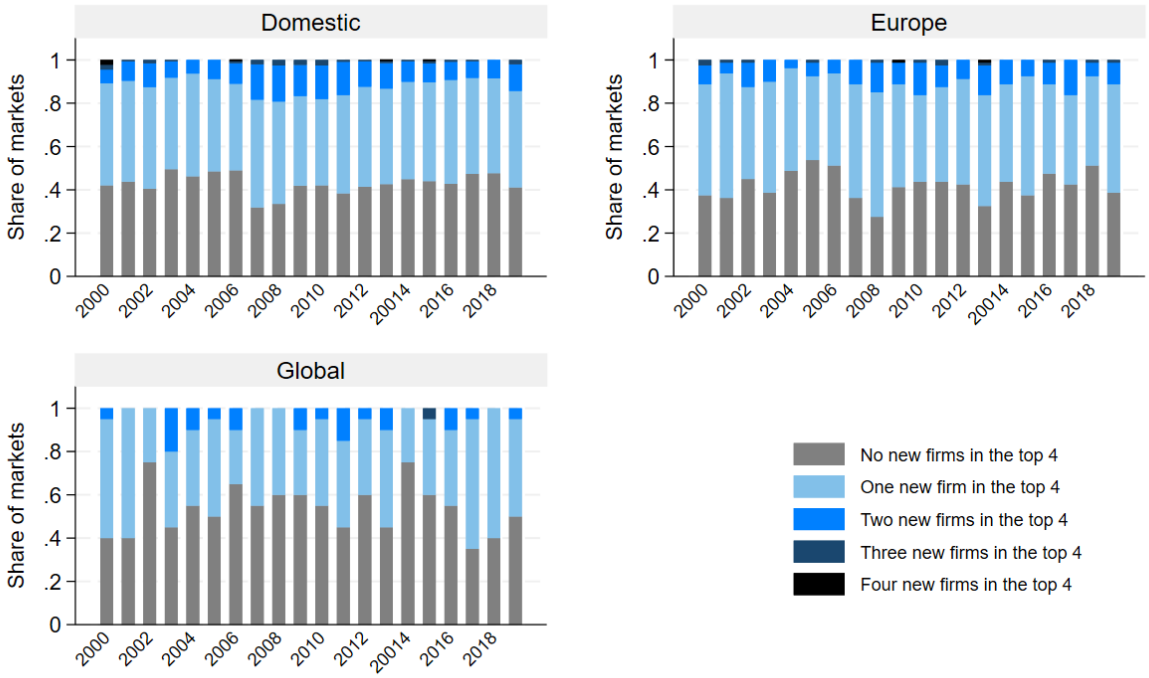
206. A complementary perspective on entrenchment can be drawn by dividing markets into five categories according to the number of new firms entering the top four group every year.[69] The share of markets falling in any of these five categories is computed for each year within each geographical bucket.

[68] Conceptually, entrenchment and the measure used in Bessen et al. (2020[61]) are very similar. The latter, being a hazard function, also considers the probability that firms 'entry and exit and, as such, to be reliable must be built on a sample with the population of firms, while entrenchment measures only require information on the largest 4 firms. The preference accorded to the entrenchment measure in this report derives from the fact that – as explained in Section 3 – it is built using data from Orbis. As it is well known (Bajgar et al., 2020[81]), Orbis has limited coverage of the population of firms (especially small and medium enterprises) and significant coverage differences over time. Therefore, Orbis is not well suited for an analysis that needs to account for the entry and exit of firms.

[69] These categories correspond to markets where each year, with respect to the previous one, there are, respectively, zero, one, two, three, or four new firms in the top four group.

Figure 5.17 shows that, on average, more than 80% of the markets have either no entrance of new firms in the top four from one year to the other (about 40%) or just one new firm (an additional 40%) in the top four, in all geographical buckets. Global markets have the lowest share of new firms entering in the top four.

Figure 5.17. Share of markets by the number of new firms in the top four within each geographical bucket

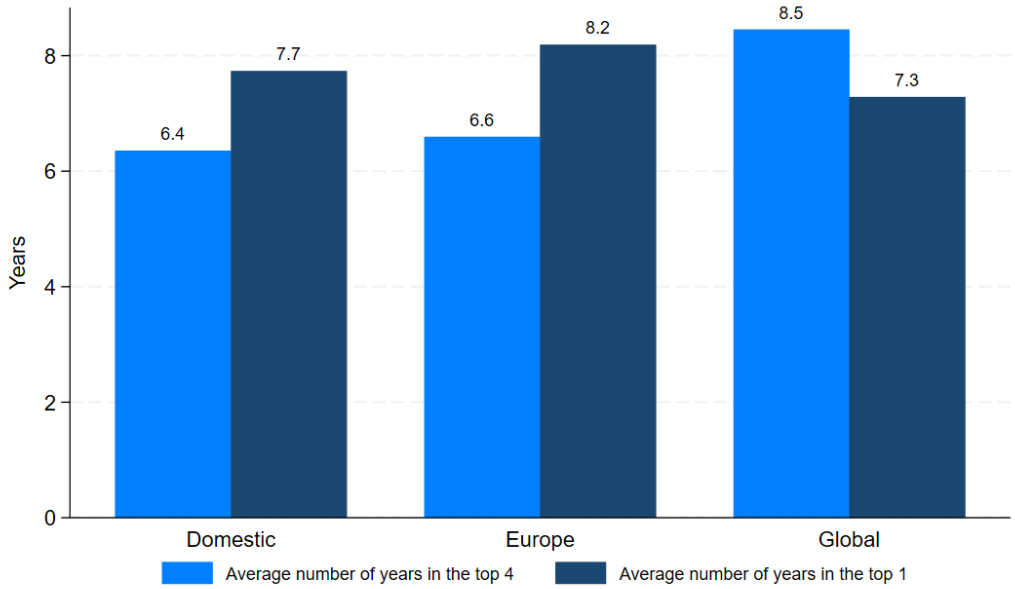


Note: The chart shows the share of markets between 1999-2000 and 2018-2019 within industries (and countries, for the domestic bucket) by five categories: no new firms in the top four, one new firm in the top four, two new firms in the top four, three new firms in the top four, and four new firms in the top four. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

207. The high share of markets in which at most one new firm enters every year reflects low dynamism at the top. This trend is reflected in Figure 5.18, which shows the average number of years a firm remains at the top, either in the top four or as market leader (top one). Overall, the number of years a firm remains at the top is high, between six and eight years, suggesting low contestability among the top firms. In industries that compete at the European and the domestic level, on average, a firm remains more as a market leader than in the top four (European: 6.6 in the top four versus 8.2 years in the top one; Domestic: 6.4 in the top four versus 7.7 years in the top one), suggesting that these industries might be characterised by a dominant firm, which is rarely challenged as a leader, and exhibit relatively more churn among the other firms in the top four. Conversely, for industries competing at the global level, the average number of years a firm remains in the top four is higher than the average number of years that a firm remains as leader, 8.5 versus 7.3 years, respectively. Overall, these results suggest that industries competing at the global level might be characterised by big firms that are persistently among the top four and are competing

with each other to be the largest firm, while industries competing at the European and domestic levels have more competition for the top four but less competition for the market leadership.

Figure 5.18. Average number of years that a firm is in the top four and top one across geographical buckets



Note: The chart shows the average number of years a firm remains in the top four (light blue) and top one (dark blue) across industries (and countries, for the domestic bucket) between 1999-2000 and 2018-2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Rank persistence

208. Entrenchment measures the persistence of firms in the top four group, but it does not consider whether there is competition and dynamics among them. This sub-section further investigates the latter point, exploring the changes in the ranking of the top firms.

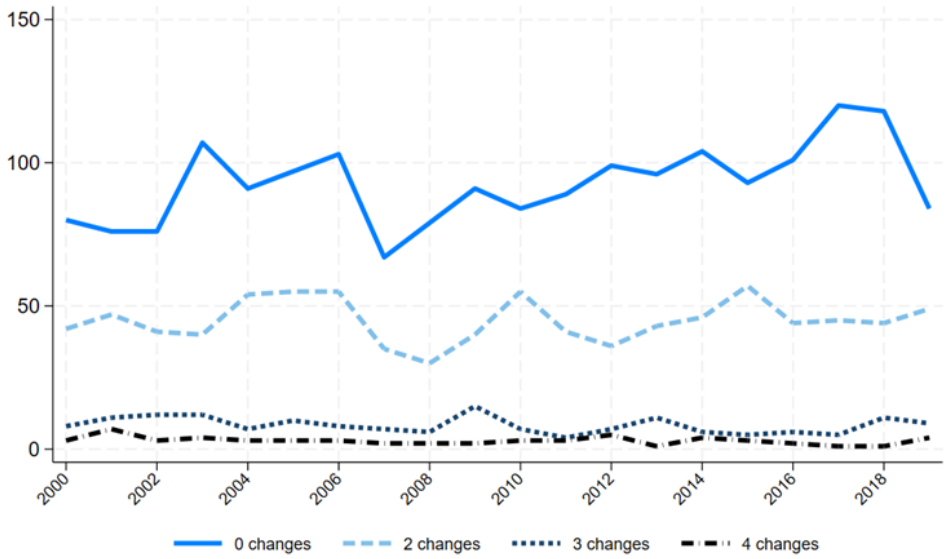
209. Even if there are few changes among the firms in the top four, a market could be highly contestable if there is high competition among the leaders and they constantly challenge each other. Evidence of this is reported in Figure 5.19 and Figure 5.20. In these figures, the focus is on industries competing at the domestic level without entry into the top four and on industries competing at the European level with no new firms in the top four, respectively. These combinations represent the industries belonging to the grey bins in the top left graph of Figure 5.17.[70] This exercise zooms in on these categories to understand, given that there have been no new entries in the top four group, how many ranking changes there have been among the top four.

[70] Among all the possible markets and combinations of new firms in the top four (see Figure 5.17), this exercise reports results only for these 3 categories not only because they represent most of the markets in each category but also because they reveal the most interesting trends. Charts on the remaining categories are excluded for brevity and are available on request.

210. Figure 5.19 shows that, for industries competing at the domestic level in which there has not been entry of new firms in the top four, most of the markets have no changes in the ranking position of the top four firms, about 95 of 150 markets. If there are changes in the top four, in most cases, they only involve two firms that switch their position (about 45 markets). Another relevant aspect represented in the graph is that the number of markets with no changes in the overall ranking of the top four group has been increasing since 2006, passing from around 75 to about 110 in 2018.

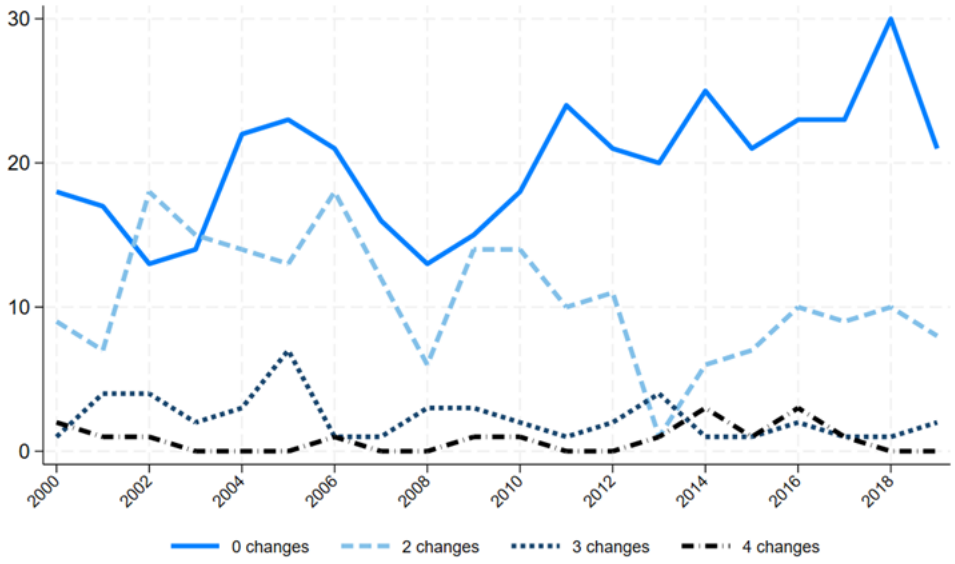
211. For industries competing at the European level, Figure 5.20 shows that when no new firms enter the top four group, most industries also have no changes in the ranking of the top four firms. Analogously with the trends for the domestic bucket (Figure 5.19), the increasing trend of this line compared to the others reported in the same figure suggests that, increasingly often, not only is there no change in the top four group composition, but the ranking of the firms remains constant (suggesting low ranking contestability). Overall, the evidence reported on entrenchment and rank persistence suggests some lack of dynamism at the top, with few firms contending the top four positions and low levels of contestability among the market leaders.

Figure 5.19. Number of changes in the top four ranking in markets with no entry into the top four, domestic bucket



Note: The chart shows the number of changes in the ranking for markets (country-industry couples) competing domestically in which there is no new firm entering the top four group. Each line represents the number of industries in which there where, respectively, zero, two, three, and four changes in the ranking of the top four firms. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market belonging to the domestic bucket. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE
Source: OECD calculations.

Figure 5.20. Number of changes in the top four ranking in markets with no entry into the top four, European bucket



Note: The chart shows the number of changes in the ranking for industries competing at the European level in which there is no new firm entering the top four group. Each line represents the number of industries in which there where, respectively, zero, two, three, and four changes in the ranking of the top four firms. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market belonging to the European bucket. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

212. As a last exercise to investigate market dynamism among the top firms, a transition matrix of the rankings of firms from *t -1* to *t* is studied. Table 5.1shows the probability of transitioning from a given position in *t-1* (shown in the rows) to a different ranking in *t* (shown in the columns). The probabilities are computed by pooling together all geographic markets and years. The table, once more, suggests a rather high persistence among market leaders. Firms in a certain position are more likely to remain in their position than to switch to any other one (the diagonal of the matrix). For market leaders, the likelihood of remaining a leader, consistently with the high values of leadership ratio reported in Figure 5.12 and the previous evidence from Figure 5.18, is very high (above 80%). As expected, there is lower persistence in the lower rankings (the probabilities are more evenly distributed across the different columns) because firms that exit the top four (last column) and firms that enter the top four (last row) are more likely to do it at lower ranking. For example, firms that enter the top four will do so in 50% of the cases in the fourth position, 24% of the cases in the third position, 15% in the second position and 10% of cases in the first position. Finally, the probability of a firm going to a lower ranking is higher than going up.[71]

[71] In an unreported robustness check, available upon request, the transition matrix has also been computed by geographical buckets separately. The results for the transition matrixes of each geographical bucket are qualitatively similar to the results from the transition matrix with all the geographical buckets aggregated and suggest the same underlying patterns in the ranking movements in the top four. As an additional check, the transition matrix was computed by looking at rank changes using a different time horizon, such as between *t-3* and *t*. While the probabilities are, of course, different and the likelihood of exiting the top four (last column) is now much higher, the relative probabilities of transitioning within the top four are qualitatively similar to Table 5.1.

Table 5.1. Transition matrix for the ranking position from *t-1* to *t*

From *t-1* \ to *t*	Ranking: 1	Ranking: 2	Ranking: 3	Ranking: 4	Exit top 4
Ranking: 1	0.807	0.094	0.021	0.007	0.071
Ranking: 2	0.093	0.636	0.138	0.036	0.097
Ranking: 3	0.020	0.129	0.520	0.166	0.165
Ranking: 4	0.008	0.032	0.152	0.430	0.377
Out of top 4	0.104	0.155	0.237	0.503	-

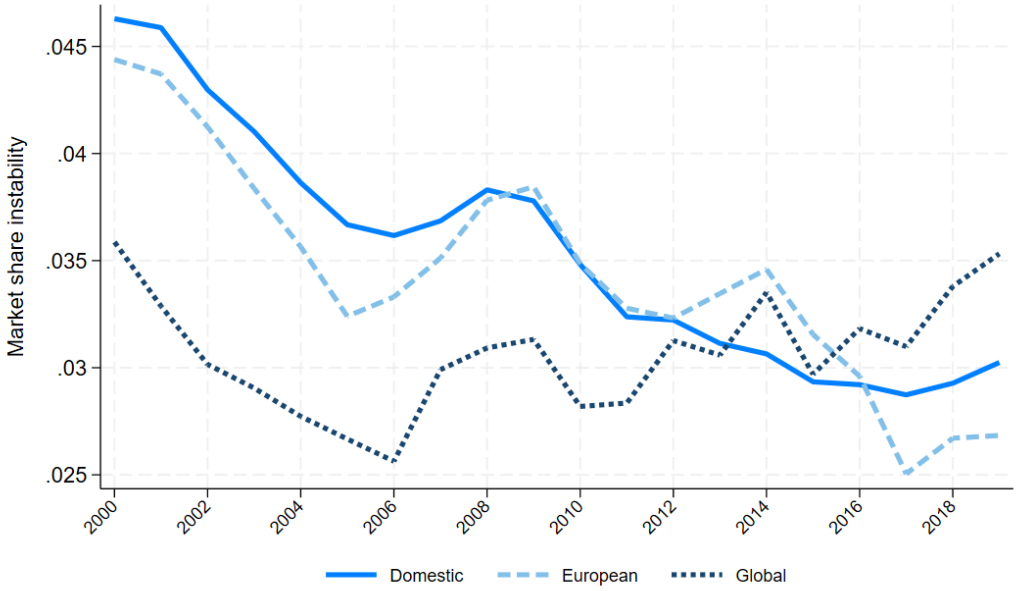
Note: The table shows the probabilities, for firms, of transitioning from one ranking position in year t-1 to another position in year t, between 1999-2000 to 2018-2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included. The probabilities are calculated aggregating all geographical buckets and years.
Source: OECD calculations.

Market share instability

213. An alternative indicator of the persistence of firms' market shares at the top is the "market share instability" measure, which is given by the mean absolute value of market share changes between *t* and *t-1* for the top four firms. It captures the variability in individual firms' market shares among the market leaders. Figure 5.21 shows the evolution of this measure across geographical buckets. In the domestic and European buckets, the trend is decreasing, showing that in the sample, there is progressively less year-on-year variation in the shares of the total output of the top four firms produced by each individual firm. These trends, together with a relatively high entrenchment (Figure 5.14) and an increasing number of markets with no changes in the rank of the top four business groups (Figure 5.19 and Figure 5.20), suggest a decrease in market dynamism among the market leaders.

214. For industries competing at the global level, the situation is less clear-cut. In the initial years of the sample, market share instability is relatively low, decreasing at first and then becoming stable. After 2010, the indicator increases again. The relatively different pattern in the measure of market share instability between industries competing at the global level with respect to domestic and European industries seems to be consistent with the evidence reported in Figure 5.18, which shows that the top four firms in global industries spend more years among the top four but less as a market leader. Both figures suggest that, in industries belonging to the global bucket, there is more competition among the same top four firms for market leadership, possibly leading to high market share instability.

Figure 5.21. Market share instability across geographical buckets



Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of the Market Share Instability measure, which is defined as is the mean absolute value of market share changes between *t* and *t-1* for the top four firms, between 1999-2000 and 2018-2019. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Markups

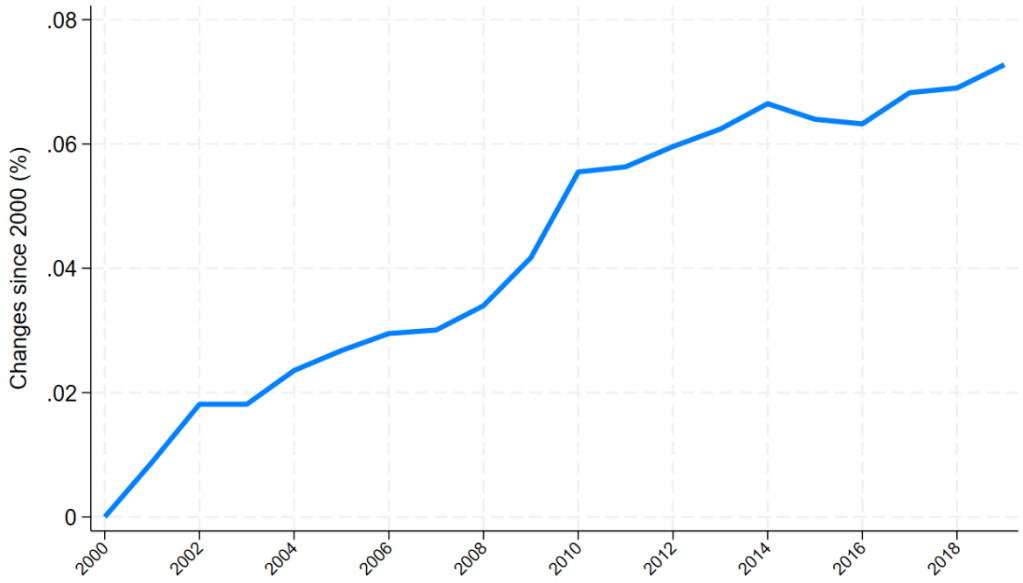
215. This section reports trends in average markups, computed at the firm-level, over 2000-2019 across 23 countries. As explained in Section 4, markups aim to measure the ratio between the price set by the firm and its marginal cost and, therefore, provide a measure of the ability of firms to charge prices above the level compatible with perfect competition.

216. The results in Figure 5.22 show that, in the sample of European countries, the unweighted average markup has increased by slightly more than 7% between 2000 and 2019.[72] Except for 2015 and 2016, the trend has been increasing throughout the period of analysis, and especially in the aftermath of the Great Financial Crisis. This trend is in line with existing studies on markups, which also make use of the Orbis

[72] Note that the results on markups are reported as log differences and, therefore, can be interpreted as growth rates. On the contrary, trends for concentration are reported as cumulative changes and, as such, represent the change in percentage points with respect to the initial year of the sample. In this report it has been chosen to present the results of each measure in a consistent way with respect to its own relevant literature, even if this choice may make the comparison between the two trends less immediate. The aim is to facilitate the comparison of the results with previous findings rather than between the two proxies. While the figures are not directly comparable, note that the results are often reported as percentage changes in the main text, thus offering an immediate comparison between the different proxies.

data and find increases in markups of around 6% for the sub-period 2000-2015 in a cross-country setting (Calligaris et al. (2024[2]) and Díez et al. (2021[56])).[73]

Figure 5.22. Unweighted average of firm log markup: growth 2000-2019



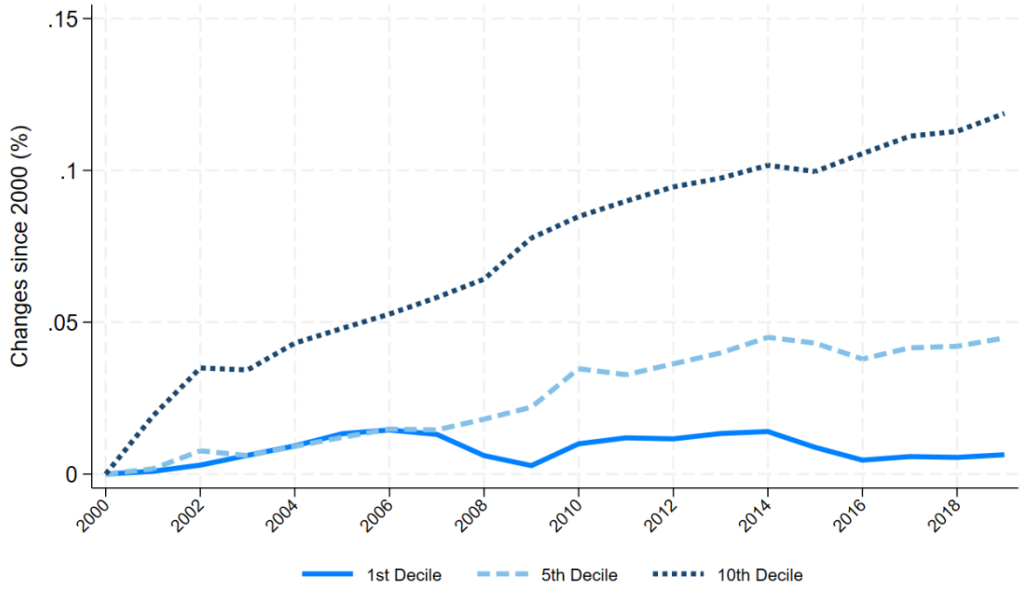
Note: The chart shows log changes of unweighted average markup across firms in the sample. It plots log markups and indexes the 2000 level to 0. Hence, the vertical axes represent log-differences from the starting year and approximate percentage growth rates. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included: AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculations.

217. Figure 5.23 shows trends in markups at different deciles of the markup distribution: it plots the average percentage changes in markup in the top, the bottom, and the middle decile of the markup distribution. Deciles are computed each year across countries and industries.[74] As shown in the figure, the growth in average markups is mainly driven by firms at the top of the markup distribution. Figure 5.23 shows that the average markup of firms in the top decile of the distribution rose by around 12%, almost twice the increase of the sample average of 7%. On the contrary, firms in the bottom decile exhibit virtually no increase. These findings imply that the wedge between firms at the top and bottom of the markup distribution has widened over analysis period. Firms close to the median of the distribution (the 5th decile) also increased their markups by 5%. Overall, the average growth reported in Figure 5.22 is driven by sustained markup growth of firms at the top half of the markup distribution, which increasingly enjoy larger markups with respect to firms belonging to the bottom half of the markup distribution.

[73] The increase is lower than that found for publicly listed US companies reported by De Loecker et al. (2020[3]) over a longer time horizon.

[74] It implies that the firms belonging to each decile can potentially change every year. As a robustness check, Figure A C.9. in 0 shows that results are robust to defining markups deciles separately for each industry-year (rather than each year).

Figure 5.23. Log Markups growth over time (2000-2019) in different parts of the distribution



Note: The chart shows log changes of unweighted average markup in the chosen part of the distribution of markups. It plots log markups and indexes the 2000 level to 0. Hence the vertical axes represent log-differences from the starting year and approximate percentage growth rates. Deciles of markups are computed separately by year. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculations.

218. To sum up, looking at unweighted average changes of markups over time, markups have increased over the period 2000-2019, and that this growth is mainly driven by firms in the top half of the markup distribution.

219. The evolution of markups weighted by industry size is also reported.[75] Specifically, this analysis reports average markups weighted by industry gross output each year.[76] This weighted average markup should increase more than the unweighted one in two cases: i) if industries with bigger gross output increase their markups relatively more than smaller industries; or ii) if industries with high markups gain in gross output relative to industries with low markups. Furthermore, to distinguish between changes in aggregate markup due to shifts in economic activity between industries and changes due to average markups within industries, the decomposition reported in Haltiwanger (1997[80]) and De Loecker et al. (2020[3]) is applied to changes in weighted markups:

[75] As an alternative, the economic literature (De Loecker, Eeckhout and Unger, 2020[3]) has also investigated markups weighted at the firm level. Unfortunately, Orbis is not a suitable dataset to perform this kind of exercise, as there is a substantial increase in the coverage (Bajgar et al., 2020[81]) which makes the weighting across the years unreliable.

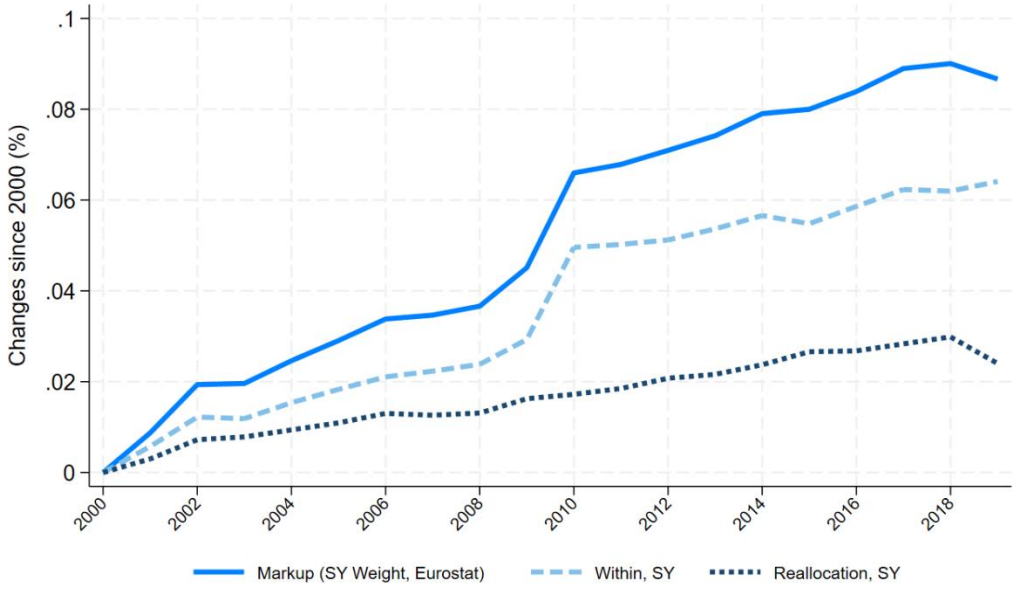
[76] In this exercise, gross output is obtained from the OECD STAN database, and, therefore, the analysis is carried out at A64 level (which corresponds mainly to the 2-digit industry level). It has not been possible to use the production data built for the analysis on concentration and entrenchment, which would have allowed a more disaggregated analysis because the sample used for markups includes more countries, for which it has not been possible to obtain consistent gross output granular data. See further details in Section 3 and Annex A.

$$\Delta\mu_t = \sum_s m_{s,t-1}\Delta\mu_{s,t} + \sum_s \tilde{\mu}_{s,t-1}\,\Delta m_{s,t} + \sum_s \Delta\mu_{s,t}\Delta m_{s,t}$$

Equation 13

220. Where μ_{st} is the average markup of industry s in year t, m_{st} is the industry's share in total gross output and $\tilde{\mu}_{s,t-1} = \mu_{s,t-1} - \mu_{t-1}$ is the industry's markup in $t-1$ demeaned with the overall average markup in $t-1$.[77] Then, $\sum_s m_{s,t-1}\Delta\mu_{s,t}$ represents the *within* industry component of markups, that corresponds to the change in markups that would have occurred in the economy had the share of economic activity of all industries remained constant at their $t-1$ level. Conversely, $\sum_s \tilde{\mu}_{s,t-1}\,\Delta m_{s,t}$ represents the *reallocation* component, which corresponds to the change in markups that would have occurred from pure reallocation of economic activity between industries, keeping average markups at industry-level fixed at their $t-1$ level. The cross term $\sum_s \Delta\mu_{s,t}\Delta m_{s,t}$ captures the simultaneous change of average markups and industry shares. As in De Loecker, Eeckhout and Unger (2020[3]), this component is presented grouped with the reallocation term, as it is close to zero in this analysis.

Figure 5.24. Decomposition of markup changes at industry-level (2000-2019)



Note: The chart shows changes of aggregate weighted markup, that is the weighted average of industry-year level average markups weighted by industry-year level production in OECD STAN. The figure reports also the decomposition of the aggregate weighted markup among a reallocation component between industries and a within industry component, according to Haltiwanger (1997[80]) and De Loecker and Eeckhout (2020[3]). The cross term is included in the reallocation component. Since there is no entry or exit at the sector level the net entry term is zero and omitted. The figure plots log markups and changes in their components and indexes the 2000 level to 0. Hence the vertical axes represent log-differences from the starting year and approximates percentage growth rates. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included: AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculations.

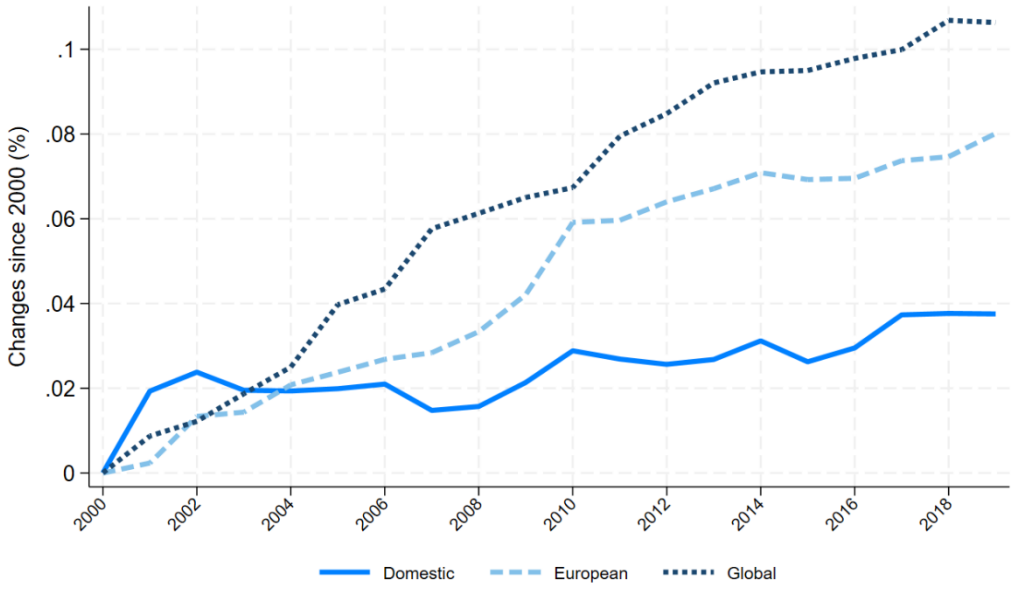
221. Figure 5.24 shows the overall increase in the weighted average markup in solid blue, the within-industry component in dashed light blue, and the reallocation component in dotted dark blue. The weighted

[77] In the decomposition of De Loecker et al. (2020[3]) a net entry component captures changes in aggregate markups due to the contribution of firms entering and leaving the market (net entry). Note that in this analysis there is no net entry component as all NACE 2-digit industries are present throughout the period.

average markup increases by 8.6% over the period from the weighted average markup in 2000. Slightly less than half of this increase happened in 2009 and 2010 following the financial crisis. First, the increase is similar to the pattern of the unweighted average markup. Second, it reveals that, while both the within and the between industry components contribute positively to the rise in weighted average markups, about two-thirds of the increase is due to within industry. Interestingly, the sharp rise in aggregate markups during the Great Financial Crisis is almost entirely due to within-industry increases in markups. This exercise is largely in line with De Loecker et al. (2020[3]), who show that the within-industry component explains more than two-thirds of the increase in markups among US-listed firms.

222. As an additional exercise on the evolution of markups, their trends are presented by the geographic taxonomy of industries. Industries are assigned to their geographic bucket, and then the increase is computed separately for each of them.[78] The exercise is informative to understand how markups have evolved in more globalised industries versus those that tend to compete at the domestic level. As shown in Figure 5.25., the greatest increase in markups is experienced by industries competing in global markets, which rose by almost 12%, and then by industries that compete at the European level, which had an average markup increase of 7%. Domestically competing industries, characterised by lower OTT, have seen little growth in their markup, which increased by about 3% over the period considered.

Figure 5.25. Markups changes across geographical buckets (2000-2019)

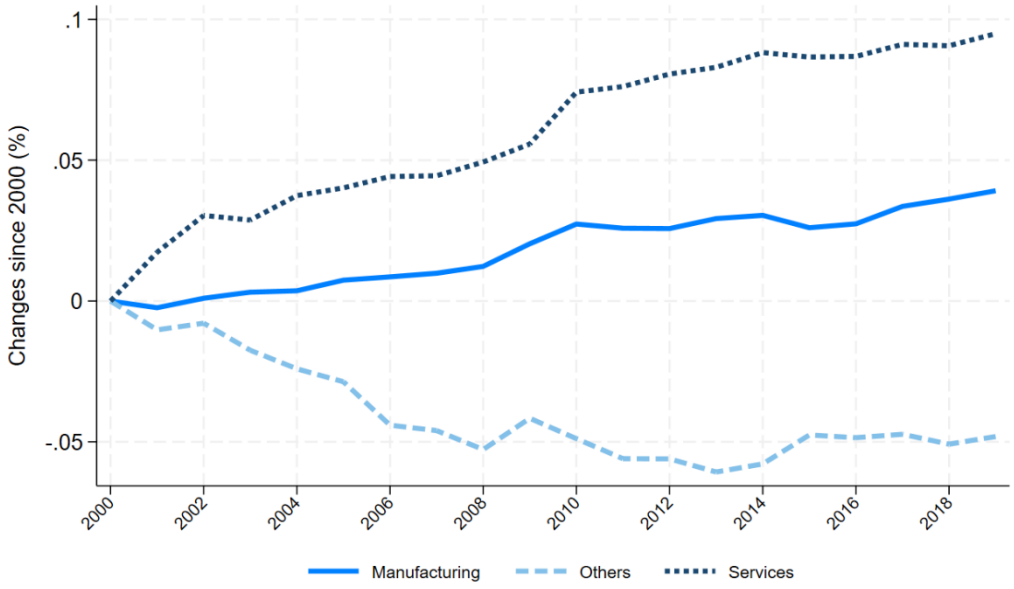


Note: The chart shows log changes of unweighted average markup across firms in sample. It plots log markups and indexes the 2000 level to 0, hence the vertical axes represent log-differences from the starting year and approximate percentage growth rates. Log changes are computed as the difference of the log of average markups in a given year and geographical bucket with the log of the average markup in the initial year (2000) of each geographical bucket. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculations.

[78] Note that, differently from the previous exercises, the European and global markets for markups include the same sample of countries (i.e., the global bucket does not include JPN, KOR, and USA) since markups at the firm level are not available for extra-EU countries.

223. In a similar way, the markups of manufacturing, non-financial market services and "other sectors" (here utilities and mining sectors aggregated) can be compared. Figure 5.26 shows that markups in industries belonging to the services sector have risen by 9.5% between 2000 and 2019, whereas markups in the manufacturing sector have only risen by 3.9%. The markups of the utilities and mining sectors instead decreased by 4.8% over the period. The results are in line with Calligaris et al. (2024[2]), who find an increase until 2014 of approximately 4% in the manufacturing sector and 7% in the market services, and are also consistent with De Loecker et al. (2020[3]) and Díez et al. (2021[56]), who find a relatively flat trend for manufacturing and an upward trend in the service sector (using a different sample of countries and industries).

Figure 5.26. Log markups growth over time (2000-2019) by aggregate sector



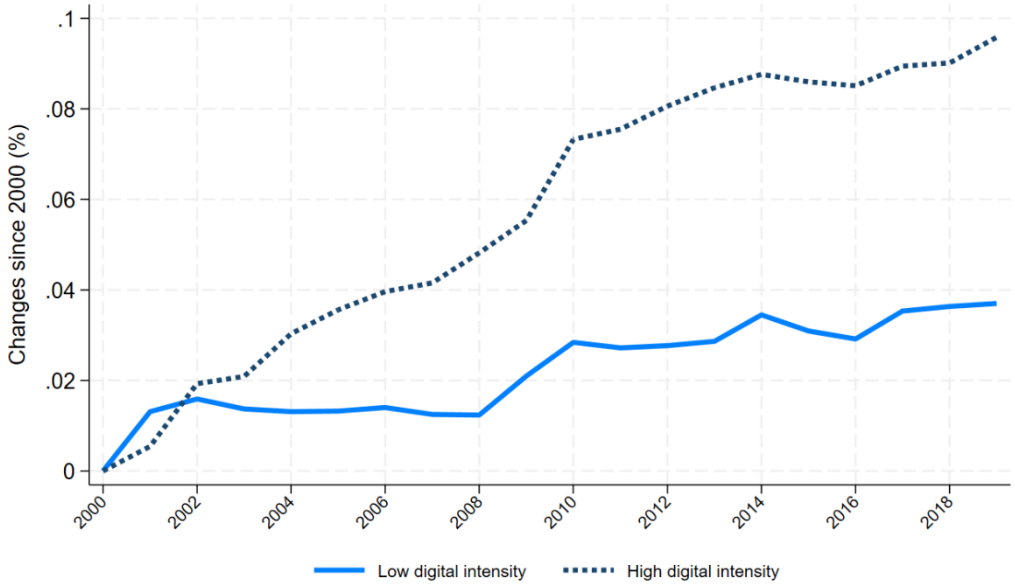
Note: The chart shows log changes of unweighted average markup for aggregate 1-digit sectors (A7) where utilities and mining sectors are treated as one category (others). The figures plots log markups and indexes the 2000 level to 0. Hence the vertical axes represent log-differences from the starting year and approximate percentage growth rates. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculations.

224. Figure A C.13. reports markup trends by country. This graph should be interpreted with caution since the coverage of firms included differs substantially across countries. For some countries, the sample of firms available only captures a small proportion of the entire economy (see Bajgar et al. (2020[81]) for a detailed discussion about the Orbis dataset and how to use it best).[79] Overall, most countries seem to experience a mild increase in markups trends, with no individual country driving the aggregate trend reported in Figure 5.22.

[79] In the figure, some countries that have lower coverage have been aggregated together, and others with holes in the coverage have been represented only for few years. In addition, as described in Bajgar et al. (2020[81]), any cross-country comparability that relies on Orbis should be interpreted with caution.

225. One potential explanation for this result is the higher digital orientation of services as opposed to manufacturing, utilities, and mining industries (Calligaris, Criscuolo and Marcolin, 2024[2]).[80] Markups are therefore broken down by their digital intensity, as classified by Calvino et al. (2018[8]). Figure 5.27 shows that, on average, firms belonging to highly digital-intensive industries increased their markup by 9.6% between 2000 and 2019. Firms belonging to less digitally intensive industries also increased their markups, on average, but only by 3.7%. The results are once again very much in line with Calligaris et al. (2024[2]).

Figure 5.27. Log markups growth over time (2000-2019) by digital intensity of sector



Note: The chart shows log changes of unweighted average markup by the level of digital intensity of the industry. The figures plots log markups and indexes the 2000 level to 0. Hence the vertical axes represent log-differences from the starting year and approximate percentage growth rates. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE. High digital industries belong to the High and Medium-High quartiles of the taxonomy provided by Calvino et al. (2018[8]), while Low digital industries belong to the Low or Medium-low quartiles of the digital distributions.
Source: OECD calculations.

226. Figure A C.10. compares the baseline markup change – in which firm-level markups are trimmed at the 3rd and 97th percentile, as is standard in the literature – to the trend of untrimmed markups and alternative trimming thresholds (e.g., De Ridder, et al. (2021[82]) apply trimming at the 1.5th and 98.5th percentile).[81] Unsurprisingly, untrimmed markups have a steeper rise with an increase of 14% (7% in the baseline). However, the overall pattern seems consistent between the two alternative specifications.[82] The conclusion that there has been a substantial rise in markups over the period remains unchanged.

[80] Using the digital taxonomy provided by Calvino et al. (2018[8]), no industries belonging to utilities and mining sectors are ranked as high digital industries, 45% of manufacturing industries are classified to have a high digital intensity, while the share rises to 72% of service sectors.

[81] See Data Appendix for details on the trimming procedure and examples from the literature on standard trimming practices.

[82] The cleaning procedure cuts the left side distribution of markups to 0. Therefore, when trimming symmetrically the left and right tails of the markups' distribution, it is expected that the resulting sample will have a lower mean. This is

227. The markup estimation procedure is also robust to different assumptions on the production function estimation, compared in Figure A C.11. (See Annex B: Additional details on the methodology for a discussion on alternative methodologies). Whereas the baseline estimation computes the production function in each 3-digit industry pooling together all years and including year fixed effects in the first stage of the estimation procedure, the following alternative specifications are also considered: i) estimations for each 5-year rolling window at the NACE 2-digit level (no year fixed effect); ii) pooled estimations at the NACE 2-digit level (no year fixed effect); iii) 6-year rolling windows at the NACE 3-digit level (no year fixed effects). While, for the pooled estimations, the increase in markups is higher than for the rolling window estimations, the patterns are rather similar under all these alternative specifications, and the main message remains unchanged.

228. Finally, the markup distribution across firms is positively skewed and centred close to 1, as expected. More interestingly, comparing the distribution in 2019 with respect to the one in 2000, Figure A C.12. shows that the distribution has slightly shifted to the right. This means that, on average, more firms have high markups in 2019 relative to 2000.

because, while lower values are constrained to be above 0, high values of markups can be potentially very high. So, removing the right (unbounded) tail is likely to have a stronger impact on the mean than removing observations close to zero, resulting in a distribution shifted to the right with respect to the initial untrimmed distribution. Note that, given the data quality and all the assumptions needed to compute markups, trimming the sample is a standard practice in the literature to remove outliers and guarantee the quality of the results obtained.

6 Product and industry concentration

229. Recently, questions have been raised over whether measuring concentration at the industry-level is informative about competition at the level of the relevant market (Berry et al. (2019[9]); Benkard et al. (2021[10]); Shapiro (2018[11]); Werden and Froeb (2018[12])). Industry classifications are constructed to capture industrial processes, whereas product markets are designed around final goods and services and are the main focus of competition authorities. Put differently, industrial classification systems take a production-based approach, while product classification systems take a demand-based approach. Competition authorities, who are often primarily interested in consumer welfare, consider product market concentration the most appropriate outcome of interest in understanding the level of market power.

230. Despite this, most studies on concentration and business dynamics use industry-level data due to limitations and quality concerns of more disaggregated data. The extent to which industry concentration captures well product concentration is still unknown. Trying to fill in this gap in the literature, this section presents evidence on the relationships between concentration and business dynamics when measured at the product and industry levels. It shows that product and industry-level concentration are strongly positively correlated, suggesting that the evidence drawn from industry-level studies is likely to be informative on product market power.

231. The extent to which product and industry classification systems are different is a key factor in determining how similar their respective concentration ratios will be. Often, narrowly defined industries and products can overlap, but in other cases, the different perspectives can lead to discrepancies between the definitions based on industries versus products. For example, the product market for floor covering relates to many industries depending on the material used for production (e.g., manufacture of wood products versus manufacture of plastic products). A contrasting example is the 4-digit industry for dairy products, which corresponds to many product markets, such as milk, butter, cheese, cream, and yoghurt.

232. Overall, industries also tend to be broader than product markets. Firms that operate in a single industry (or are assigned a single industry in a dataset) may sell products in multiple product markets. If it has become less costly for firms to expand into new product markets, as argued by Benkard et al. (2021[10]) and Aghion et al. (2023[43]), then measured industry concentration could increase even while product market concentration does not. Benkard et al. (2021[10]) found exactly this result using data from product markets in the United States.

233. The relationship between product and industry concentration is examined using data from Euromonitor. In total, there are 371 product markets matched to 46 industries (of the 127 industries used in the baseline analysis). Data on each of the European countries in the baseline concentration analysis are used for the period 2012-2019. One of the primary aims of this section is to provide evidence on the extent to which measuring industry concentration is informative on product market concentration. Therefore, to align with most of the studies developed in this literature, in this section markets are usually defined at the product-country-year level, treating the relevant geography as domestic, unless otherwise stated.

234. The average product market has a total value of 426 million euros (in 2021 prices), while the average industry of 3,769 million euros.[83] In the Euromonitor data – which reports information on all global ultimate owners (GUOs) with a market share roughly above 0.1%– the average product-country-year contains ten GUOs, while the average industry-country-year has 48 GUOs. On average, the largest product in an industry accounts for 61% of that industry. In the median industry-country-year, there are five products that comprise the full industry. So, as expected, product markets are typically significantly smaller than industries. The average GUO operates in 2.4 distinct product markets compared with 1.3 industries, suggesting that the same GUO is active in different products which are mostly in the same industry.

235. Average concentration, measured as the market share of the top four firms, is higher in product markets than in industry markets. Specifically, the CR4 is 60% in product markets compared with 40% in industry markets.[84] The finding that the concentration level is higher in more narrowly defined product markets than at the 3-digit industry-level is in line with the findings of Benkard et al. (2021[10]) and Affeldt et al. (2021[32]), as well with Section 5, which shows that the concentration level is higher in 4-digit industries than in the associated 3-digit ones.

The relationship between product and industry concentration

236. Comparing product market concentration measures from Euromonitor data with the baseline concentration measures from the remainder of the report reveals that product and industry concentration are strongly positively correlated. Therefore, measuring industry concentration seems to be indicative of product market concentration, at least in terms of the cross-sectional variation.

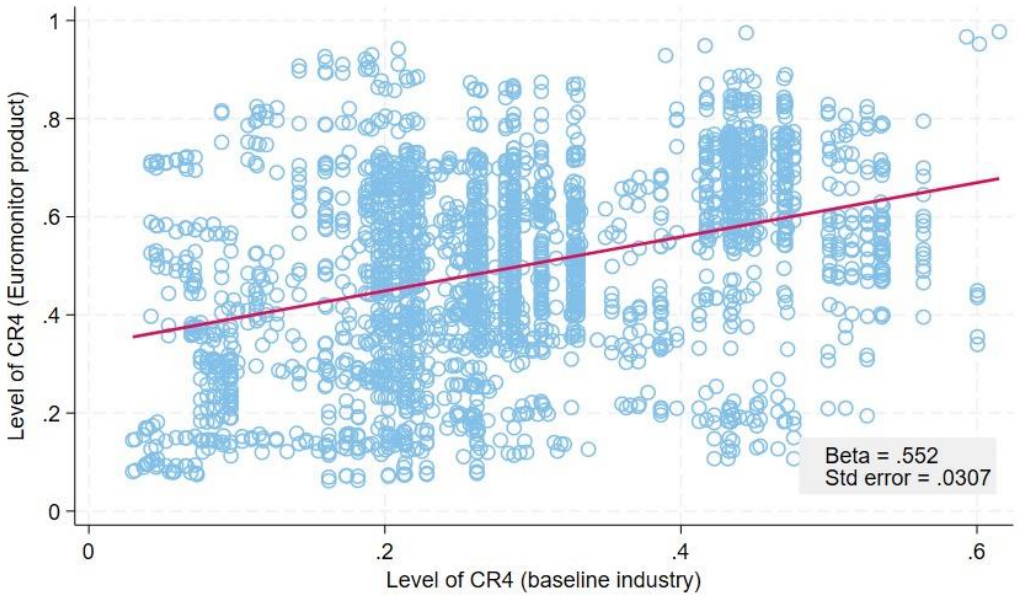
237. In this analysis, industry concentration is based on the measure described in Section 4, and so it is built taking into account the geographical dimension at which an industry competes – national, European, or global. To compare concentration at the product and industry-level, including the baseline measures from Sections 4 and 5, the taxonomy is necessarily used (given that the baseline industry concentration measure of this report is built taking into account the geographical dimension at which an industry competes) and data are presented at the product-geography-year level.

238. Figure 6.1 shows that the concentration level in product markets, measured using Euromonitor data, is positively correlated with the baseline industry concentration measure of this report. The slope of an Ordinary Least Squares (OLS) regression line is 0.55 (and statistically significantly different from 0). The relationship is stronger when weighting by market size, measured by total gross output, as shown in Figure 6.2, suggesting that larger product markets have, on average, more similar concentration to their corresponding industries. This may be because larger product markets proxy more closely for industry markets. Finally, the relationship also holds when constructing industry concentration using Euromonitor data instead of the baseline dataset (Figure A D.1).

[83] Restricted to only include markets with information on monetary values available.

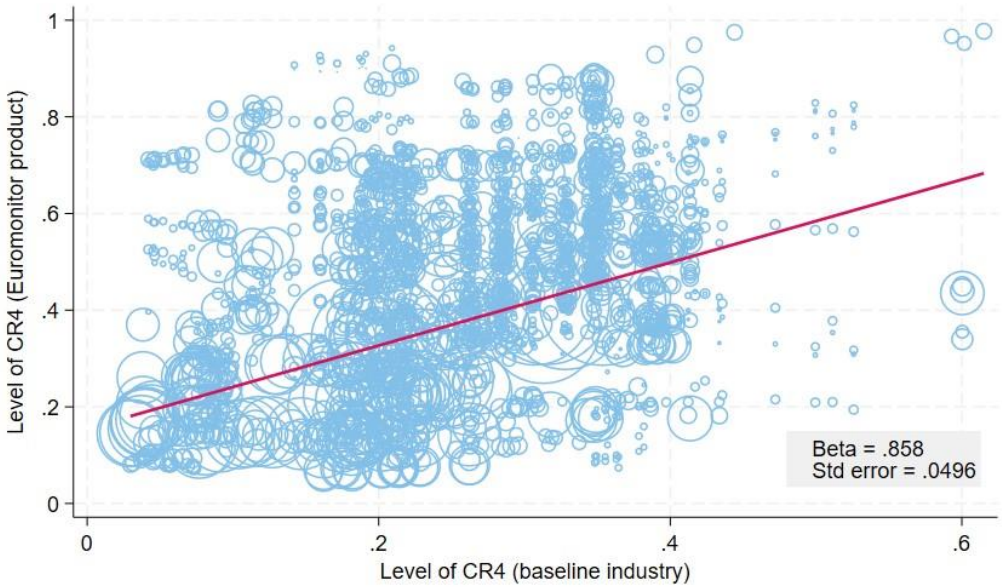
[84] See Table A D.1, Table A D.2, and Table A D.3 for summary statistics on product markets, industries, and GUOs, respectively, including their distribution across industries.

Figure 6.1. Product and industry concentration are positively correlated



Note: The chart shows CR4 computed at the product-year level and the industry-year level. Both concentration measures are computed incorporating the taxonomy. Industry concentration is computed using the baseline measures. Products included are those in the Euromonitor data, while the industries are those that correspond to these products. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Figure 6.2. Product and industry concentration correlations, weighted by size



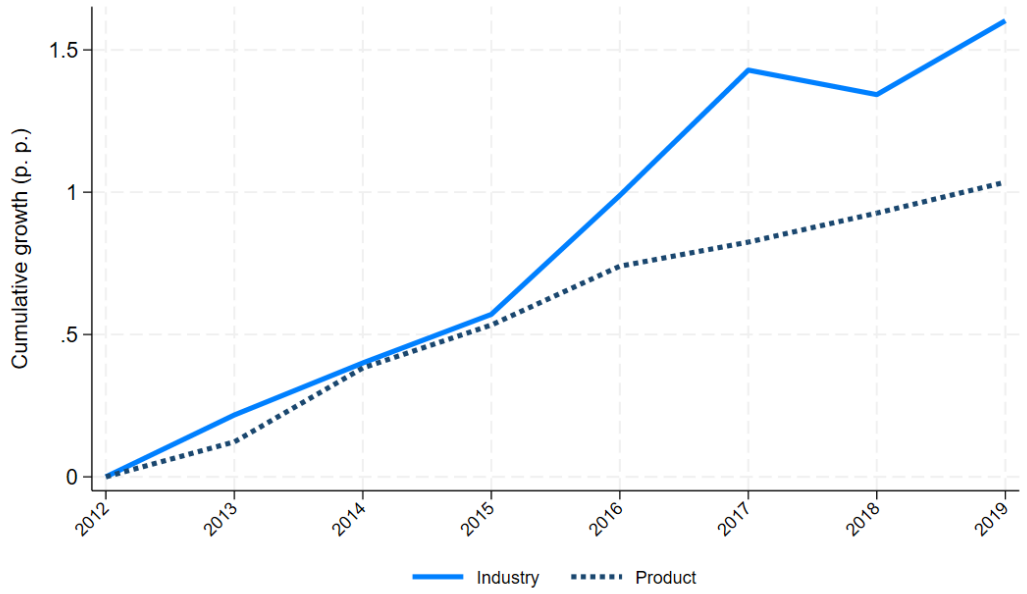
Note: The chart shows CR4 computed at the product-year level and the industry-year level. Both concentration measures are computed incorporating the taxonomy. Industry concentration is computed using the baseline measures. The regression line is weighted by size, measured by total gross output.
Source: OECD calculations.

Trends in product and industry concentration

239. While the levels of industry and product concentration differ, as noted in the introduction to this section, this does not necessarily imply that their trends would also differ. Figure 6.3 shows that both industry and product concentration have increased in Europe between 2012 and 2019. Note that for this exercise the baseline trends are unweighted and computed at the national level without considering the geographical buckets arising from the taxonomy (i.e., concentration is computed at the national level for all products/industries). This is to be in line with previous studies and, in particular, to allow a direct comparison with trends in Benkard et al. (2021[10]) for the United States, as discussed below. The data used to compute both product and industry concentration are from Euromonitor, where industry-level data are obtained aggregating the available product markets associated with that industry.

240. In the sample considered, industry concentration increased by 1.6 p.p. between 2012 and 2019, while product concentration increased by 1.0 p.p.[85] Figure A D.2 in Annex D plots concentration trends weighted by market size, measured as the total value of gross output. In this case, both industry and product concentration follow similar trends, increasing by 1.6 and 2.1 p.p., respectively.[86] Overall, concentration trends are broadly similar at the industry and product levels, suggesting that industry concentration may approximate well product level concentration. This result is similar to that reported in Section 5 where concentration trends at the 4-digit level broadly reflected trends at the 3-digit level.

Figure 6.3. Concentration trends in industries and product markets in Europe



Note: The chart shows the unweighted average across industry- or product- country combinations of CR4 cumulative changes. Products included are those in the Euromonitor data, while the industries are those that correspond to these products. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.

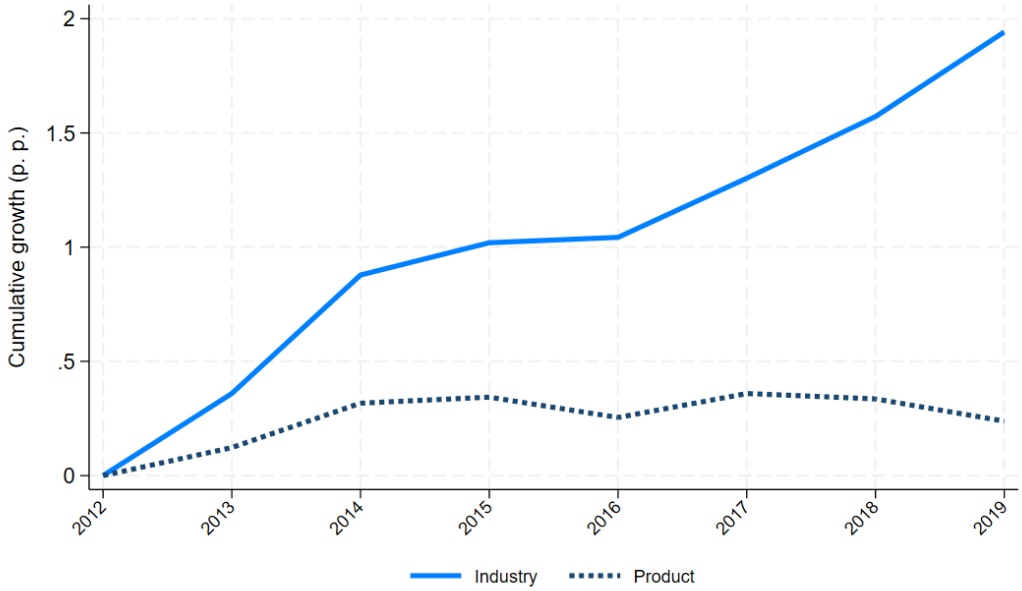
[85] Note that, here, concentration is measured differently from the baseline analysis: industries, level of aggregation, and exclusion of the taxonomy are different to the baseline. Therefore, any comparisons should be interpreted with caution.

[86] Furthermore, when incorporating the taxonomy, both product and industry concentration have increased over the period (charts available on request).

Source: OECD calculations.

241. In line with the study of Benkard et al. (2021[10]), which is based on US data, industry concentration has increased more than product concentration (Figure 6.3). However, the difference is much less pronounced for Europe than for the United States since, in contrast to the evidence for the United States, average product market concentration has also increased in Europe. Replicating the equivalent chart on US data, Figure 6.4 reveals an almost-flat average trend for product market concentration and an increasing trend for industry concentration in the United States, in line with results from Benkard et al. (2021[10]).

Figure 6.4. Concentration trends in industries and product markets in the United States



Note: The chart shows the unweighted average across industry- or product- country combinations of CR4 cumulative changes. Products included are those in the Euromonitor data, while the industries are those that correspond to these products. The plots are for USA only.
Source: OECD calculations.

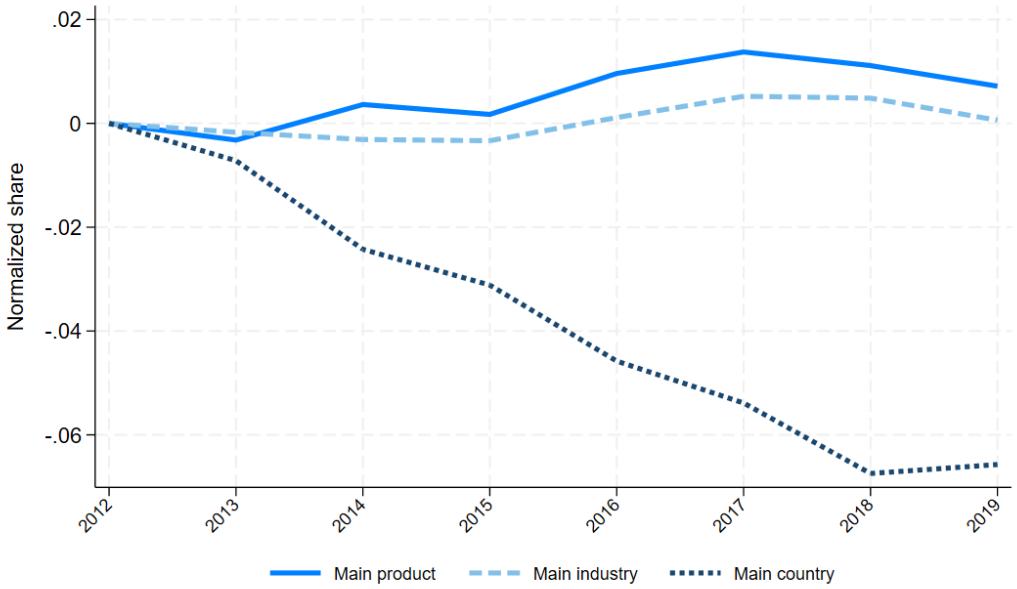
242. Benkard et al. (2021[10]) argue that, in the United States, the divergence between product and industry concentration is driven by leading firms expanding to new product markets in the same industry due to a decrease in the cost of supplying adjacent markets. If this is the case, then it would be expected that the share of leading firms' output of their main product would decrease, as other products become more important. Meanwhile, their share relative to competitors in the same industry would increase if the other products produced by leading firms are in the same industry as their main product, for example due to economies of scope, scale, and synergies.

243. However, in Europe, the share of leading firms' output accounted for by their main product has remained rather stable over time, as shown in Figure 6.5. Interestingly, Figure 6.5 also reveals that the share of leading firms' gross output from their main country of operation has decreased over time.[87] This

[87] Note that the figure is restricted to include only the top four firms in an industry-country in each year. Figure A D.3. in Annex D, as a robustness check, plots the evolution of gross output for the top four firms in their industry in the

is in line with standard trade models with heterogenous firms (Melitz, 2003[83]), which predict the expansion of the largest firms into foreign markets. This finding re-enforces the importance of the taxonomy, in which concentration is computed at the European or global level for tradeable industries. With the taxonomy, the expansion of firms through increasing shares in foreign markets is well captured in the concentration measures.

Figure 6.5. Shares of GUOs' gross output in their top country, product, and industry for top four firms



Note: The chart shows the average share of GUOs' value in their main country, product, and industry, defined as that with the highest share of their value. The chart is restricted to include ranked in the top four of their main industry. Products included are those in the Euromonitor data, while the industries are those that correspond to these products. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

244. A detailed analysis of the margins of growth of sales by leading business groups is presented in Annex F. It decomposes the growth of sales by products, countries, and brands. This decomposition provides insight on how leading firms are growing and, therefore, possibly on the channels through which concentration has grown. Most of the growth is within country-product markets in which business groups already operate. However, decomposing growth by business groups' main product versus other existing products reveals that an important share of total sales' growth is in non-main products. Even more growth is through the expansion of the business groups into new countries. Finally, the analysis reveals that a large share of growth in sales is through new brands, which may have been acquired from other business groups or newly developed ones. When leading GUOs enter new product or country markets, they typically do this through a new brand rather than an existing one.

initial year (that is, it holds the firms fixed over time). The results are similar, with the share of initial industry leaders' gross output in their main country decreasing over time on average.

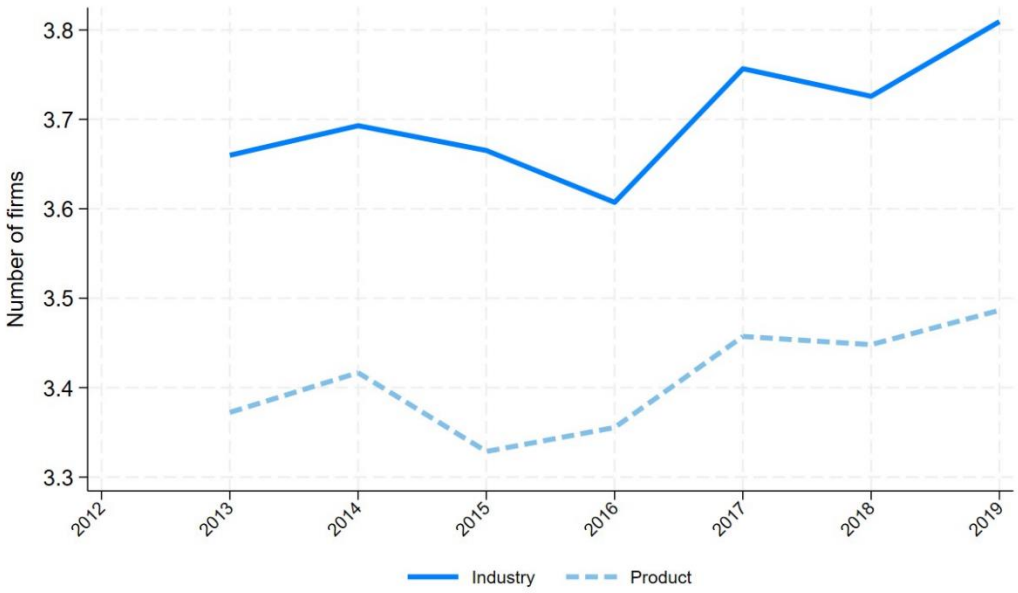
Trends in entrenchment and market share instability at the product level

245. To better understand the comparison between market dynamics at the industry and product levels, it is also possible to compare the trends in entrenchment and market share instability at the product and industry levels. If the rise in industry concentration had been driven by leading firms expanding to new product markets, it might be expected that industry entrenchment would have increased more than product entrenchment.

246. Entrenchment is defined in line with the baseline analysis; it captures the number of business groups in the top four of a market at year *t* who had also been leaders in year *t-1* (it is bounded between 0 and 4). Figure 6.6 plots average entrenchment from 2012-13 to 2018-19 measured both at the product and industry levels, using Euromonitor data only.

247. Entrenchment is higher in industries than in product markets, although both follow similar trends and have generally increased over the period, suggesting that in recent years there is less churn among market leaders.

Figure 6.6. Entrenchment is higher in industry than in product markets

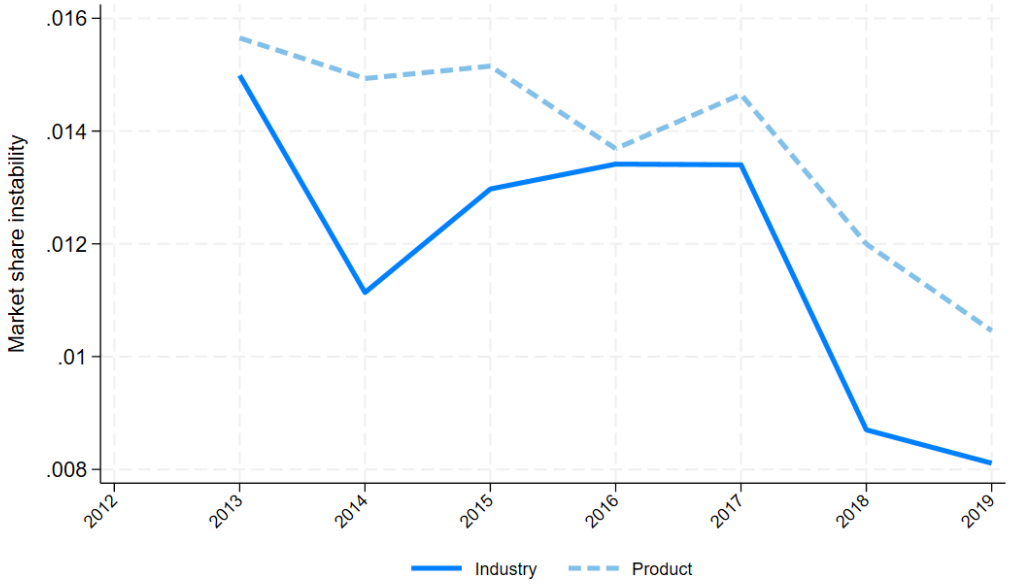


Note: The chart shows the unweighted average across industry- or product- country combinations of entrenchment in the top four firms between 2012-13 and 2018-2019. The products included are those available in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

248. Market share instability measures changes in market shares among the leading business groups in a market. It is defined as the mean absolute value of market share changes between *t* and *t-1* for the top four business groups, as in the baseline analysis. A higher value of instability in market shares suggests more competition among the leading firms.

249. Figure 6.7 shows that average market share instability has decreased for both product and industry markets and has declined to a greater extent in industries than in product markets. The levels are slightly lower in industries, which aligns with the evidence in Figure 6.6 that there is more entrenchment in industries than in product markets.

Figure 6.7. Average market share instability declined more in industry than in product markets



Note: The chart shows the unweighted average across industry- or product- country combinations of market share instability in the top four firms between 2013 and 2019. The products included are those available in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

250. Overall, the trends of entrenchment and market share instability seem to confirm that industry-level data provide a good approximation of product market trends and that there is, on average, suggestive evidence of less churn among market leaders at the end of the period relative to the beginning, broadly in line with the analysis in Section 5.

251. Finally, there is evidence that industries are more entrenched and have more stable market shares than products. This suggests that larger firms may be increasing their market shares in existing products as well as expanding into new product markets (as suggested in the growth decompositions in Annex F), leading to relatively more churn in product markets than in industries, and suggesting that there is an important role for producer-side efficiencies in the dynamics of both industry and product markets. This is likely to contribute to increasing concentration, especially when measured at the industry-level, where there is less disruption. For example, if Ferrero – a market leader in the chocolate product market and its corresponding industry – increases its sales in the ice cream product market to become a leader, it may be increasing product market churn while becoming more entrenched as an industry leader.

Relating product and industry concentration to merger control interventions

252. Industry concentration is potentially of interest to economists and policymakers as it is a proxy for (the lack of) competition. Another indicator of the lack of competition is merger control interventions by the EU Commission (EC). The Commission carefully scrutinises potential mergers between large players on a case-by-case basis, carrying out thorough investigation both into the firms involved and of the market structure. Therefore, markets that have more interventions are likely to be less competitive.

253. In this section, measures of both product and industry concentration are related to merger control cases by the EC. Data on merger interventions are provided by DG COMP at the EC (see Section 3 for further detail). Two measures are used to define the prevalence of merger control interventions. The first

measure is the number of interventions made by EC or national authorities divided by the total number of decisions made. The second one is the count of interventions; in which case the economic size of the market is controlled for in the regression analysis. These are defined at the industry-year level, using the assignment of each case to its relevant industry or industries. Industry-years in which no decisions are made are not included in the baseline analysis; in a robustness check, they are treated as having a zero-intervention rate and count.

254. To examine the relationship between interventions and concentration at the product and industry-level, linear regressions are used. Results are presented in Table 6.1.

Table 6.1. Industry and product concentration are correlated with merger interventions

	(1)	(2)	(3)	(4)
	Intervention rate	Intervention rate	Intervention count	Intervention count
CR4 Baseline		0.0550**		0.334***
		(0.0235)		(0.0963)
CR4 Product (EM)	0.312***		0.737***	
	(0.0840)		(0.169)	
Log Market Value			0.0629**	
			(0.0310)	
Log Production				0.178***
				(0.0234)
Observations	220	1470	212	1470
Year FE	N	N	N	N
Sample	Euromonitor	Full	Euromonitor	Full

Note: The table shows OLS regression results and associated standard errors. Columns (1) and (2) use the intervention rate as the dependent variable, while columns (3) and (4) use the count of interventions as the dependent variable and additionally control for the economic size of the market. Columns (1) and (3) relate product market concentration from Euromonitor to interventions. Columns (2) and (4) relate industry concentration from the baseline measures, covering all industry-years. Industry-years in which no decisions were made are not included. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE. Standard errors are robust to heteroskedasticity and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

255. Columns (1) and (2) show the relationships with the intervention rate, while Columns (3) and (4) use the count of interventions and additionally control for the economic size of the market. In Columns (1) and (3) interventions are related to product concentration from Euromonitor, while in Columns (2) and (4) to industry concentration from the baseline measures. Given that interventions are defined at industry level, the regressions are estimated at the industry-year level considering, for each industry, the average concentration across products within an industry-year.

256. The key takeaway is that both product and industry concentration are positively correlated with interventions made by the EC, providing additional evidence on the informativeness of industry-level measures of concentration. The results are statistically significant at the 5% level in all cases. Focusing on Column (2), for instance, an increase in the concentration rate of 10 p.p. (for example, from 30% – the average value –to 40%) is associated with a 0.55 p.p. higher intervention rate. Given that the average intervention rate in the sample is 5.7%, this constitutes an economically meaningful increase in merger interventions.

257. This positive correlation is robust to including industries where no decisions are recorded (shown in Table A D.4 of Annex D) and to the inclusion of year fixed effects. Given that the intervention rate is bounded between 0 and 1 while the count of interventions is a non-negative integer, additional robustness

checks have been performed estimating Probit and Poisson regressions, respectively: reassuringly, the results hold.[88]

[88] Results not reported for brevity but available upon request.

7 Regression analysis

258. This section uses regression analysis to help understand some of the potential mechanisms that may explain the emerging trends in concentration, markups and, exploiting data at the product level, average prices. The first sub-section looks at correlations between these measures, i.e., between concentration and markups and between concentration and prices. The second sub-section correlates these measures against other market and industry characteristics, such as intangible intensity and openness to trade. The relationship of concentration with total factor productivity, labour share and investments is also explored. These correlations reveal additional information on the structural changes that may be related to the trends shown in the previous sections.

Correlations among concentration, markups, and prices

259. Aggregate trends for concentration and markups are informative as they provide an indication of the average state of competition over time. However, they do not provide information on the relationship between these variables. Unveiling these links can be relevant to better understanding which facets of competition are captured by the different proxies. For example, industries exhibiting high concentration and low markups may still be contestable, with competition occurring among firms with high market shares.

260. It should not come as a surprise that in cross-country-industry-level regressions, such variables can exhibit very weak correlations. The variables measure different facets of competition and are also affected by fundamental market characteristics. To this end, theory suggests that concentration and markups could have positive (standard Cournot model), negative (models with high goods differentiation and products substitutability, such as in the seminal work of Melitz and Ottaviano (2008[84])), or no correlations at all (see Syverson (2019[4]) for a discussion). In less competitive markets, markups may still be low due to x-inefficiencies, worse management practices (Bloom et al., 2015[85]), or rent-seeking activities (Zhou, 1995[86]). Low markups do not necessarily imply low market power, while low concentration is likely to imply low market power. On the other hand, high and persistent markups can only be sustained under a lack of competition, while high concentration may be a competitive outcome, for example in dynamic oligopolistic markets. Therefore, as discussed by Berry et al. (2019[9]), Syverson (2019[4]), and Schmalensee (1989[87]), cross-country and cross-industry comparisons of these proxies might lead to apparently counterintuitive messages, as different industries and countries can have very different fundamentals (such as demand, costs, and technology), meaning that competition (or a lack of it) manifests itself differently.

261. Despite this, it may still be informative to look at these correlations, especially when disaggregating across the distribution of markups and when examining tradeable and non-tradeable industries separately. Therefore, to assess the degree of correlation between proxies of competition, these measures are regressed against each other. Moreover, at the end of the section, additional data from Euromonitor are used to relate average market prices with concentration, with the caveat that the sample of industries included in this analysis differs significantly from the baseline. Note that these regressions provide descriptive evidence of the extent to which these measures go hand-in-hand, but do not imply any causal relationship.

Comparisons of concentration and markups from baseline analysis

262. Several measures of markups (described in Table 7.1, along with the other variables used in this exercise) are used as a dependent variable and regressed against concentration. The rationale for looking at different moments of the markups distribution across firms is that the relationship of concentration with markups may vary along the markup distribution. Therefore, in each market-year, the distribution of firms' markup is divided into different quantiles (e.g., bottom, middle and top) and the natural logarithm of the average markup within that quantile is used.[89]

Table 7.1. Variables used in the regressions

Variable	Description
Log average markup	Log of average firm markups
Log average j^{th} decile	Log of the average firm markups in the j^{th} decile (j = 1, 5, 10)
Log 90/10 markup ratio	Log of the ratio between average firm markups in the 90^{th} and 10^{th} percentiles (dispersion)
CR4	Share of gross output accounted for by the four largest firms in a market
Production and Log production	Gross output and its logarithm
Log price	Log of average price computed using product level data

Note: All the variables are defined at the market-year level; concentration is measured in percentage points. "Log" refers to natural logarithms. For further details on the methodologies used to build each measure, see Section 4.
Source: OECD calculations.

263. All the regressions in this subsection include geography-year fixed effects, which control for unobserved patterns within each relevant geographic market and year that are constant across industries, as well as industry fixed effects, that remove unobserved variation across industries that is common across geographic areas and years.[90] In addition, the regressions use the logarithm of market-year level production to control for market size. Standard errors are clustered at the market level.[91] To simplify the interpretation of the results, the baseline taxonomy of industries by geographical bucket is redefined by aggregating into a single geographical bucket (called "tradeable") industries belonging to the European and the global buckets. As a result, industries are gathered into two categories: domestic and tradeable.[92,93] As a robustness exercise, regressions using the baseline taxonomy of industries are performed as well, and these additional results are reported in Table A E.1. Finally, regressions are

[89] Logs are preferred to levels both to take into account the positively skewed distribution of markups and to ease the interpretation of the results.

[90] Note that the relevant geographic market in this setting is the country level for industries competing at the domestic level and European or global level for industries competing at the European and global level, respectively.

[91] The results (available upon request) are robust to different combinations of fixed effects, such as year, geographical bucket, and industry fixed effects. In addition, the results are robust to the exclusion of (log) production as a control.

[92] The variables CR4 domestic and CR4 tradeable, used in the regressions shown in Table 7.2, are defined as the interactions, respectively, of the CR4 variable with dummies indicating whether an industry is domestic or tradeable (e.g., CR4 domestic = CR4 if the industry is domestic and CR4 = 0 if the industry is tradeable).

[93] The regressions also include a dummy for tradeable industries, which is absorbed by the industry fixed effect and so it is omitted.

weighted to account for the different number of observations in domestic industries with respect to tradeable industries.[94]

264. The results are reported in Table 7.2. First, the relationship between average markups and concentration is examined. Column (1) of Table 7.2 shows no statistically significant relationship between the two variables. As mentioned in the introduction, this should not come as a surprise: the two measures capture different facets of competition, and looking at the overall average markup in a market might hide substantial heterogeneity.

Table 7.2. Regressions of markups on concentration

	(1)	(2)	(3)	(4)	(5)
	log avg markup	log average 1st decile	log average 5th decile	log average 10th decile	log 90/10 decile ratio
CR4 domestic	-0.0002	0.0000	-0.0000	-0.0001**	-0.0001**
	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CR4 tradeable	0.0002	0.0000	0.0000	0.0005***	0.0004**
	(0.0002)	(0.0001)	(0.0003)	(0.0002)	(0.0002)
Observations	35904	36945	36945	36945	36945
Adj. R-Square	0.8422	0.8392	0.9406	0.9395	0.9510
Controls	Yes	Yes	Yes	Yes	Yes
Geography-year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

Note: OLS regressions of different measures of average markups (defined in Table 7.1) on CR4 domestic and CR4 tradeable, defined in footnote 92. A dummy for tradeable industries and the logarithm of production, defined at the market level, are included as controls. Regressions are weighted: a weight of 1 is attributed to each country-industry pair if the industry is domestic, while a weight of 15 is attributed to each tradeable industry. The sample used in the regression is made by a mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market. The coverage in terms of countries is the intersection between those contained in the concentration sample and in the markup sample (see Data Appendix). Standard errors are clustered at the market-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

265. The relationship between the two proxies is further explored across different deciles of the markup distribution. Column (2) and Column (3) of Table 7.2 show that concentration is not correlated with the average markup in the bottom (first) and the mid- (fifth) decile of the distribution. When looking at the top of the distribution (tenth decile), a (mild) relationship emerges: Column (4) shows that the average markup in the top decile of the distribution is correlated with concentration negatively in domestic industries, and positively in tradeable ones. Regarding the magnitude of the relationship, the coefficients provide the following interpretation. Since CR4 is measured in p.p. and markups are expressed in natural logarithms, a 10 p.p. increase in concentration is associated with an increase of 0.5% of average markups of the 10th decile in tradeable industries and a decrease of 0.1% of average markups in the 10th decile in domestic ones.[95] This magnitude is economically small.

[94] Given that for each industry-year there are 15 markets (and hence observations) if an industry is domestic and only 1 if it is tradeable, a weight of 1 is attributed to each country-industry pair if the industry is domestic, while a weight of 15 is attributed to each tradeable industry. This is equivalent to expanding the European and global industries observations to the country level with the average of the variable.

[95] To give a sense of the magnitude, a 10 p.p. increase in concentration corresponds, for instance, to the difference in concentration levels between industries in the 25th percentile of the concentration distribution and the median industry. An increase of 0.5% in the average markup in the top decile of the markups distribution corresponds to an increase of markups of about 0.1 points, given that the average markup in the top decile is 2.15.

266. The relationship found in the top decile of the distribution is also reflected in the relationship between concentration and markups dispersion: Column (5) shows that an increase in concentration is associated with higher markup dispersion in tradeable industries but with less dispersion in domestic industries.[96]

Comparison of average market prices with concentration using Euromonitor data

267. To explore the relationships between average market prices and concentration, additional data from Euromonitor are used. Euromonitor has the advantage of providing information at the product level and contains data on average market prices. However, the sample of industries covered is severely limited relative to the baseline analysis. Notably, it primarily covers consumer product markets, which mainly relate to manufacturing sectors, and omits many services industries, especially those used as intermediate inputs like computer services (a full list of products and industries covered can be found in Table A A.11).

268. Despite these drawbacks, it is interesting to examine the correlation between concentration and average market prices. The correlations, presented in Table 7.3, come from regressing log average unit price against concentration interacted with a dummy for tradeable sectors from the taxonomy of industries. The regressions are run on data at the product-country-year level and include country-year and product fixed effects. The latter captures unobserved variation of each product that is common across countries and years. The regressions control also for log production, and standard errors are clustered at the product-country level. The specifications are designed to be in line with the regressions above. Concentration can be computed at the product level (Column (1)), at the industry-level using data from Euromonitor only (Column (2)), or at the industry-level using data from the baseline analysis in this report (Column (3)). In all cases, concentration is defined using the taxonomy, meaning that for industries that compete at the European or global level, there is no variation across countries in the value of concentration for each product or industry-year combination.

The results suggest that higher concentration is associated with higher average unit prices, especially in domestic sectors (Columns (1), (2) and (3)). For tradeable sectors, there is a positive relationship between concentration and average prices, but it is not statistically significant when measuring concentration at the product level (Column (1)) or using the baseline measure of concentration at the industry-level (Column (3)). While the results should be interpreted cautiously, they suggest that concentration may be indicative of market power, especially in domestic sectors that are more shielded from international competition. However, since the previous section shows that there is no strong correlation between concentration and markups, it may simply reflect that more concentrated markets have higher marginal costs (for example due to x-inefficiencies) or differences in quality.[97]

[96] Robustness checks further distinguishing between European and global among tradeable industries, reported in Annex E, show that the results obtained for tradeable industries are an average of the effects coming from the European and the global geographical buckets.

[97] Note that these results, finding positive correlations between concentration and prices, do not necessarily contradict those of Ganapati (2021[27]), who shows that industry-level increases in concentration are uncorrelated with changes in prices using US data. There are important differences between this study and Ganapati (2021[27]): the sample of countries used here is different; prices are measured at the product level and do not cover all industries; here, there is a distinction between domestic and tradeable industries; and, perhaps most importantly, these regressions do not estimate within-unit changes and instead exploit cross-sectional variation.

Table 7.3. Regressions of average price level on different concentration measures

	(1)	(2)	(3)
	Log Price	Log Price	Log Price
CR4 Domestic	0.328***	0.452***	0.313***
	(0.0829)	(0.103)	(0.0474)
CR4 Tradeable	0.0866	0.487***	0.0571
	(0.0615)	(0.102)	(0.0377)
Observations	22565	22655	22346
Controls	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes
Product FE	Yes	Yes	Yes
CR4 measure	Product	Industry (EM)	Industry

Note: OLS regressions of log price on concentration, interacted with a tradeable dummy variable. The sample used in the regression is products available in the Euromonitor data that can be matched to the sample in the baseline analysis. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE. (see Data Appendix). Standard errors are robust to heteroskedasticity and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

Correlations of concentration, markups, and prices with economic factors

269. This section explores correlations between relevant economic factors and concentration, markups, and prices (the latter using product market data from the Euromonitor dataset). Five possible factors are explored: the intensity of intangible investments, globalisation, exposure to burdensome regulatory barriers in upstream industries, M&A activities, and competition enforcement actions.

270. The first potential explanation behind the increase in concentration and markups is the rise of intangible investments. Intangibles – comprising investments in software, R&D, data, marketing, and training – have become increasingly important in today's economies, surpassing the importance of tangibles investments in some industries (Haskel and Westlake (2018[88])). The increasing importance of intangibles may have disproportionately favoured larger firms, who have the financial resources needed to cover the initial investment and the scale needed to exploit the gains granted by intangible assets fully. Intangibles are generally non-rivalrous and easily scalable. In addition, intangibles offer opportunities for synergies and spillovers and require complementary investments or skills to be fully exploited. These characteristics are more likely in larger and more productive firms, enabling them to scale up further and thus increase concentration. Markups dynamics might have also been influenced by the increased importance of intangibles: models à la De Ridder (2024[17]) suggest that large firms incur the fixed cost of investing in intangibles assets, which in turn leads to a reduction in marginal costs. Therefore, intangibles can increase within-firm markups, as well as cause a shift of market shares towards higher markup firms (Autor et al., 2020[14]). In the present report, the relationship between intangibles and both concentration and markups are tested using the intangible investment intensity (investment in intangibles divided by value added at the sector level).

271. The second channel explored is related to globalisation. The last two decades have seen a sustained increase in trade flows between countries and a deepening in the interconnections of global supply chains. This process has opened additional markets for exporting firms, increased the efficiency of supply chains, lowered marginal costs, and increased the incentives to make additional investments. Globalisation also exposes firms to more intense import competition due to the expansion of more efficient foreign firms into new markets (Amiti and Heise (2021[6])) and puts downward pressure on prices. Openness to trade (OTT), defined as the sum of imports and exports divided by production at the market-year-level, is adopted to capture the correlations between globalisation and concentration, markups and prices. In addition, the complementarity between globalisation and intangible intensity is tested. The

rationale is that access to foreign markets allows for larger scales of operations, which potentially increase the incentive to invest in intangibles, and the subsequent efficiency gains obtained from them.

272. Third, while regulation is often implemented to ensure competition, poorly-designed regulations can introduce unnecessary barriers to entry and potentially increase costs. These regulations would directly affect firms in the regulated sectors and indirectly affect firms that use inputs coming from those sectors. Stricter regulation may render inputs from regulated sectors more expensive, causing an increase in marginal costs and, thus, possibly lower markups and (or) higher prices (depending on passthrough) for firms in downstream sectors. At the same time, if inputs are relatively more expensive, bigger firms may be advantaged relative to small firms: they may be able to run operations at a larger scale or diversify their inputs by importing them from less regulated industry-countries, meaning they are more shielded from the higher costs induced by the regulation. The OECD REGIMPACT indicator, which captures the degree of dependence of single industries on the use of inputs from sectors with burdensome regulations, is used to test these hypotheses.[98]

273. Another interesting channel to explore is the relationship between M&A activities and competition, which is ex-ante ambiguous since several different channels could be at play. On the one hand, M&A activities can lead to substantial efficiency gains among the entities involved, for example, by exploiting synergies in supply chains, or they can lead to higher innovation by fostering knowledge spillovers (Guadalupe et al. (2012[89]), Bena and Li (2014[90])). On the other hand, recent evidence has linked the role of M&A to a decrease in competition through market leadership consolidation and a reduction in technology diffusion (De Loecker et al., (2020[3]); Bajgar et al. (2021[16])). To assess their relationship with concentration, the share of within-industry acquisitions involving the top four business groups in a market relative to the overall acquisitions in the market is used as an explanatory variable. The idea is that a high share of M&A activity by the leading firms in a market could point to the risk of anticompetitive practices. For this reason, only acquisitions of target firms belonging to the same market as the acquirer have been considered. Similarly, to study the relationship between markups and M&As, a variable expressing the share of acquisitions of firms belonging to the top decile of the markups' distribution relative to the overall acquisition in the market is used.

274. Finally, the competition enforcement actions by the EC may relate to concentration.[99] The recent increase in market power has, at times, been associated with the different behaviour of antitrust authorities across different jurisdictions (Gutierrez and Philippon, 2023[33]). Therefore, it is interesting to assess how enforcement actions relate to concentration and its changes over time. Comprehensive data on competition interventions were obtained directly from the European Commission and can be grouped into antitrust, cartel, and merger interventions.[100]

275. Given that concentration is defined at the market-year level while markups are available at the firm-level, different empirical strategies are implemented to assess their potential correlations with the different proxies of competition. The empirical strategies adopted are coherently designed to fully exploit

[98] The variable focuses on regulatory burdens, i.e., those regulations that generate barriers to entry and competition, ranging from licensing and public procurement to governance of state-owned-enterprises and price controls, among others.

[99] Competition enforcement actions are related only to concentration and not markups because, by definition, these measures take place to tackle anticompetitive behaviours of a few large firms and directly affect only them. So, looking at the relationship of the enforcement actions with markups at firm-level, without being able to identify the firms involved in the enforcement action, does not seem relevant.

[100] For antitrust interventions, the regulatory references are, respectively, Article 101 of the Treaty on the Functioning of the European Union (TFEU) and Article 53 of the Agreement on the European Economic Area. For cartel interventions, the Article 101 of the TFEU. For mergers interventions, the references are, respectively, articles 8(3), 6(1), and 8(2) of Council Regulation (EC) No 139/2004)

the most disaggregated level of information available in the data. Importantly, this analysis provides descriptive correlations without establishing causality. Causation is notoriously difficult to identify when studying competition measures such as concentration, as it is itself both an outcome and a cause of market characteristics. As such, identifying the necessary exogenous shocks to establish causality is very complicated. Nevertheless, this evidence, supported by economic theory and recent findings of the economic literature, can provide interesting evidence to interpret the trends reported in Section 5.

Concentration

276. To provide evidence on how these economic factors are linked to concentration, the following specification is estimated:

$$CR4_{s,c,t} = \alpha_0 + \boldsymbol{X'_{s,c,t}\beta} + \boldsymbol{Z'_{s,c,t-1}\delta} + \rho_{c,t} + \varepsilon_{s,c,t},$$

Equation 14

where $CR4_{s,c,t}$ is the measure of concentration in industry *s*, country *c*, at time *t* used throughout the report. Recall that concentration only varies at the industry-year level for European and global industries. To exploit more variation in the data for the explanatory variables (mainly defined at the country-industry-year level), concentration is included at the country-industry-year level: for each industry belonging to the European and the global geographical bucket, the same level of industry concentration is attributed to all countries. In this way, the cross-country variation of the explanatory variables can be exploited.

277. The economic factors of interest are denoted by $\boldsymbol{Z'_{s,c,t-1}}$ (i.e., intangible investment intensity, OTT, product market regulation, M&A intensity of top performing firms, competition enforcement actions), each lagged one period to reduce the presence of reverse causality. The regressions include a set of control variables, $\boldsymbol{X'_{s,c,t}}$. These are: tangible intensity (defined as the investment amount divided by the value added of the same industry) and log of production. The specification also includes country-year fixed effects, $\rho_{c,t}$, which control for unobserved patterns within each country-year and constant across industries, such as country-specific macroeconomic trends.[101] Standard errors are clustered at the country-industry A38 level, reflecting the level of variation in most of the explanatory variables of interest.

278. Table 7.4 shows that concentration is positively correlated with intangible investments (Column (1)). A 10 p.p. increase in intangible investments is associated with 3.7 p.p. higher concentration.[102] The specific features of intangible assets (the so-called 4-S: sunk, scalable, synergies and spillovers; see Haskel and Westlake (2018[88])) are likely to disproportionately benefit large firms, consistently with higher concentration levels. In line with this theoretical prior and previous evidence (Bajgar et al. (2021[16])), industries experiencing higher levels of investments in intangible assets are associated with higher concentration levels.

279. OTT is negatively correlated with concentration (Column (2)), even though the magnitude is small. This finding is consistent with the concentration trends reported in Section 5, where concentration levels are higher for industries competing at the domestic level than those competing at the European and global

[101] Industry-year fixed effect are excluded from the empirical specification due to the nature of the concentration data used in regressions: this fixed effect would exploit the variation across countries, but there is no variation across countries within an industry-year for the European and global buckets by construction.

[102] In this setup, both concentration and intangible investments intensity are measured as shares so that their values range between 0 and 1. To give an idea of the order of magnitude, an increase in intangible intensity by 10 p.p. roughly amounts to the difference from the lowest to the median observation (the intangible intensity distribution is positively skewed, with 99% of the observations with values below 0.55). An increase of 3.7 p.p. in concentration in this context can be thought of the difference between the 10th and the 25th percentiles of the concentration distribution.

levels. This suggests evidence of the pro-competitive effects of trade. The more open industries are, the stronger the competitive pressure from foreign producers.

280. At the same time, there is an important interaction between OTT and intangible intensity. When including both variables in the regression, results show that the relationship between concentration and intangible investments is significantly stronger in more open industries (Column (3)). The combination of the negative overall relationship with OTT (Column (2)) and the positive interaction between OTT and intangible intensity (Column (3)) is an important result. The negative relationship between concentration and OTT is in line with previous evidence (Amiti and Heise (2021[6])) and, as mentioned, suggests evidence of the pro-competitive effects of globalisation. At the same time, the positive interaction between intangible investments and OTT hints at the importance of scalability to enjoy the benefits of intangible investments: more open industries allow for a larger scale of operation due to access to foreign markets, increasing the returns from the investment in intangibles.

281. Concentration is also positively correlated with a higher dependence on inputs from sectors with higher regulatory barriers (Column (4)). The magnitude can be interpreted in the same way as investment intensity (also this variable ranges between 0 and 1): a 10 p.p. higher Reg Impact index is associated with a 3.2 p.p. higher concentration. A possible interpretation of this result is that if inputs are more regulated, they may be more expensive, so bigger firms might be relatively more advantaged by running operations more efficiently at a larger scale or by sourcing inputs from less regulated industry-countries abroad, leading, in turn, to higher concentration levels.

282. M&As made by market-leading firms of firms in the same industry are positively correlated with concentration (Column (5)). More specifically, a 10 p.p. increase in the share of M&As accounted for by the top four business groups is associated with a 0.7 p.p. higher concentration. The result is in line with previous literature (Bajgar et al. (2021[16])), showing that M&As might be used by large incumbents to fortify a dominant position and increase their market shares.[103]

283. Finally, Column (6) shows that the correlations reported in each column are robust to controlling for all the possible channels simultaneously. The stability of the coefficients, both in terms of significance and magnitude, suggests that the different channels are relatively orthogonal to each other and capture different mechanisms affecting the evolution of concentration.

Intangible assets include several types of investments, which can be grouped into three main categories (software and database, innovation property, and economic competencies; see Corrado et al. (2004[69])). Since the three groups include distinct types of investments with different economic implications, it is interesting to assess the link between each of these dimensions of intangible assets and concentration.

[103] The results are robust to alternative definitions of the variable. For example, results are not affected whether the variable is computed considering also acquisitions of targets active in different industries, and whether the value of transactions rather than number are considered.

Table 7.4. Concentration, intangibles, openness to trade, regulation, and M&A

	(1)	(2)	(3)	(4)	(5)	(6)
	CR4	CR4	CR4	CR4	CR4	CR4
	CR4	CR4	CR4	CR4	CR4	CR4
Intangible Intensity (t-1)	0.3748***		0.6585***			0.7235***
	(0.0556)		(0.0961)			(0.1034)
OTT (t-1)		-2.4466**	-7.1594***			-4.9930**
		(1.0794)	(1.7390)			(2.1566)
OTT (t-1) # Intangible Intensity (t-1)			0.3338***			0.2434***
			(0.0731)			(0.0798)
Reg Impact (t-1)				0.3259***		0.3179***
				(0.0746)		(0.0979)
Number of acq. by top 4 within their industry (t-1)					0.0701***	0.1235***
					(0.0157)	(0.0168)
Observations	21211	21644	19253	19347	17527	12206
Adj. R-Square	0.1682	0.0526	0.1009	0.1648	0.0978	0.1185
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: OLS regressions of CR4, measured at the market-industry-year level, on Intangible Intensity (Intangible investments divided by value added, Column (1)), OTT (the sum of import and exports divided by production, Column (2)), Regulation Impact (the OECD REGIMPACT, ranging between 0 and 100, is an indicator that captures the degree of dependence of an industry on the inputs of regulated industries, Column (4)) and a proxy for M&A activities (number of Acquisitions by top four divided by total acquisitions within their industry at the country-industry-year level Column (5)). Column (3) reports the interaction between Intangible Intensity and OTT, Column (6) uses all the variables simultaneously. The control variables used in the regressions are tangible investments and the logarithm of Production lagged one year, except for the regressions involving OTT, where Production is not included as a control. All the independent variables are one year lagged. Regressions are at the country-industry-year level. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, ITA, PRT, SVN, SWE, and USA. Note that information on Intangibles is not available for BEL, while regulation impact data is absent for the USA. USA data are included only for industries competing at the global level. Standard errors are clustered at the country–A38 industry-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

284. Table 7.5 shows the correlation of concentration with the three subcomponents of intangibles. Software and database (Column (1)), as well as innovative property (Column (2)), are positively correlated with concentration. Software and data require substantial initial investments but then can be used repeatedly at low or zero marginal costs. Hence, the returns from these investments are likely to be positively correlated with the firm scale of operations and are likely to disproportionally advantage large firms. Similarly, innovation property is mainly composed of R&D investments, which often imply high sunk costs that can create barriers to entry, leading to higher industry concentration. In addition, intellectual properties might represent an obstacle to technology diffusion, widening the gap between large firms and the rest.

285. The economic competencies component is instead negatively correlated with concentration (Column (3)). The economic competencies category includes three main groups of activities (see Corrado et al. (2004[69])): i) brand equity, comprising advertising expenditures and market research for brand development; ii) firm-specific human capital, measured as costs for on-the-job training or tuitions for job-related education; iii) organisational structure, including costs for organisational change. A tentative interpretation of this result might be that economic competencies, differently from other intangibles such as software or R&D which mainly advantage big firms, benefit all firms regardless of their size. Additional analysis may be needed to explore such a finding further. Finally, Column (4) shows that the results are consistent when considering the three components simultaneously.

Table 7.5. Concentration and intangible investments subcomponents

	(1)	(2)	(3)	(4)
	CR4	CR4	CR4	CR4
Software and Database Intensity (t-1)	1.5677***			1.1485***
	(0.3695)			(0.3609)
Innovative Property Intensity (t-1)		0.7200***		0.6548***
		(0.0822)		(0.0832)
Economic Competencies Intensity (t-1)			-0.4977**	-1.0008***
			(0.2401)	(0.2417)
Observations	23542	21113	23767	20910
Adj. R-Square	0.1606	0.1793	0.1502	0.1901
Controls	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Note: OLS regressions of CR4, measured at the market-industry-year level, on Software and Database Intensity (Software and Database investments divided by value added, Column (1)), Innovative Property Intensity (R&D, entertainment and artistic originals, new financial products, and design investments divided by value added, Column (2)), Economic Competencies Intensity (organisational capital, brand, and employer-provided training investments divided by value added, Column (3)). Column (4) uses all the variables simultaneously. The control variables used in the regressions are tangible investments and the logarithm of Production lagged one year. All the independent variables are one year lagged. Regressions are at the country-industry-year level. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are DEU, DNK, ESP, FIN, FRA, GBR, ITA, PRT, SVN, SWE, and USA. USA data are included only for industries competing at the global level. Standard errors are clustered at the country–A38 industry-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

286. Table 7.6 presents correlations of concentration with the measures of authority interventions (cartel cases, antitrust cases, and merger interventions) and with a comprehensive indicator that points to the presence of any of the three types of interventions in an industry-year. The analysis is conducted using both concentration levels and 4-year differences since, for these measures, it seems particularly relevant to look at how concentration changes a few years after the authority interventions took place.[104] The relationship between concentration and antitrust interventions is positive when looking at concentration levels (Columns (1) to (4)), suggesting that the activity of the authority focuses more in concentrated sectors.

287. The 4-year differences specification tries to shed light on the effect of interventions on concentration. Negative coefficients would indicate that, following an intervention, there has been a reduction in concentration. The regressions (Columns (5) to (8)) show a significant negative correlation between the change in concentration levels and the presence of merger intervention rates, and not statistically different from zero correlations between concentration and the other authority intervention variables. While merger control is an action mainly undertaken to prevent a further increase in concentration (and so no effect should be expected), it also seems to trigger more competition and ultimately decrease concentration. The stronger link between concentration and merger interventions is expected, as concentration is one of the key measures taken into consideration by antitrust authorities when carrying out their activities on merger cases, while it is not among the main criteria used when dealing with cartel and antitrust cases. Although the evidence reported does not allow for causal interpretations, the results suggest that the antitrust activity is a potentially effective tool in controlling concentration dynamics.

[104] The 4-years differences are forward looking, i.e., *CR4(t+4) – CR4(t)*.

Table 7.6. Concentration and authority interventions

	concentration – levels				concentration – 4 years differences			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cartel Cases (t-1)	5.2243***				-0.2897			
	(1.0460)				(0.5589)			
Antitrust Cases (t-1)		11.3431***				1.9681		
		(2.4294)				(1.2481)		
Merger Interventions (t-1)			8.5742***				-1.1008**	
			(0.8347)				(0.4725)	
Any intervention (t-1)				9.1605***				-0.7896*
				(0.8840)				(0.4501)
Observations	23806	23806	23806	23806	18463	18463	18463	18463
Adj. R-Square	0.1487	0.1511	0.1588	0.1628	0.0018	0.0021	0.0024	0.0022
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: OLS regressions of CR4 in levels (Columns (1)-(4)) and 4-years differences (Columns (5)-(8)), measured at the market-industry-year level, on Cartel cases (a dummy variable indicating the presence of cartel cases, Columns (1) and (5)), Antitrust Cases (a dummy variable denoting the occurrence of antitrust cases Columns (2) and (6)), Merger Interventions (a dummy variable meaning the existence of merger interventions Columns (3) and (7)) and regulation (a dummy variable that equals 1 if there are cartel cases, antitrust cases, or merger interventions, Columns (4) and (8)). The control variables used in the regressions are tangible investments and the logarithm of Production lagged one year. All the independent variables are one year lagged. Regressions are at the country-industry-year level. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, ITA, PRT, SVN, SWE, and USA. Standard errors are clustered at the country–A38 industry-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

Markups

288. This sub-section explores how the same economic factors analysed before are linked to markups. Markups are computed at the firm-level, so a firm-level regression framework is adopted to exploit potential heterogeneities across firms. The relationship to be estimated is:

$$\ln(\mu)_{f,s,c,t} = \alpha_0 + \boldsymbol{X}'_{\boldsymbol{f,s,c,t}}\boldsymbol{\beta} + \boldsymbol{Z}'_{\boldsymbol{s,c,t-1}}\boldsymbol{\delta} + \rho_{c,t} + \vartheta_{s,t} + \varepsilon_{f,s,c,t},$$

Equation 15

where $\ln(\mu)_{f,s,c,t}$ is the log markup of firm *f* in industry *s* and country *c*, at time *t*. $\boldsymbol{X}'_{\boldsymbol{f,s,c,t}}$ are firm-level controls including capital intensity, size class in terms of employment, and age class. As before, $\boldsymbol{Z}'_{\boldsymbol{s,c,t-1}}$ are the country-industry-year economic factors of interest (i.e., intangible investment intensity, OTT, product market regulation, M&A intensity of top performing firms). As in the previous specification, the explanatory variables are lagged to reduce the presence of reverse causality. The specification includes country-year fixed effects, $\rho_{c,t}$, which allow to control for unobserved patterns within each country-year and constant across industries, such as macroeconomic trends. Exploiting the higher variation in the data provided by the firm-level setup (with respect to the previous industry-level analysis for concentration), this specification also includes industry-year fixed effects, $\vartheta_{s,t}$, which capture common trends across countries within the same A38 industry-year (which may include technology shocks, for example). Standard errors are clustered at the country-industry A38 level, reflecting the variation in most of the explanatory variables of interest.

289. Table 7.7 reports the results. Column (1) shows that, on average, the level of markups is (weakly) positively correlated with the intensity of intangible investments at the industry-level. A 10 p.p. higher

intangible intensity is associated with 2.5% higher markups on average.[105] This is in line with the findings of Calligaris et al. (2024[2]).[106]

290. As explained above, most intangible assets will likely benefit larger and more productive firms. To examine this relationship, intangible intensity is interacted with a dummy for whether the firm belongs to the top decile of the Total Factor Productivity (TFP) distribution within each industry-year.[107] Column (2) shows that the positive relationship between intangible and markups is stronger for firms belonging to the top decile of the TFP distribution, for which the investment in intangibles is associated with a higher level of markups; the estimated coefficient of intangible assets, instead, is not statistically different from zero for all other firms. A possible interpretation is that for a given level of intangible investments more productive firms are able to increase markups relatively more. However, another possible interesting margin to explore is whether more productive firms are also more likely to invest in intangible assets than other firms. This is an avenue that could be explored in future research. In Table A E.2. , the relationship between markups and intangibles is further explored by looking at three different quantiles of the TFP distribution (1st-50th, 51st-90th, and 91st-100th). Column (2) of Table A E.2. shows a positive and significant relationship between markups and intangibles in the whole upper half of the TFP distribution (although stronger in the top decile).

291. Columns (3) and (4) of Table 7.7 show, respectively, the correlations with OTT and its complementarities with investment in intangibles. When considering the link between globalization and markups, different mechanisms might be at play. First, more productive firms might start exporting or increase their export intensity to increase their scale, thus decreasing marginal costs and increasing markups. However, competition from cheaper or better foreign products can lead to a decrease in firms' prices and, hence, reduce markups. Third, foreign competition can pressure firms to improve their efficiency and provide firms with cheaper inputs, thus decreasing the marginal costs of production and, hence, increasing their markups. There may also be reallocation effects of trade, with more OTT shifting resources from less efficient firms with low markup to more efficient firms with higher markups. The regression results suggest that, in this setting, the role of globalisation in increasing international competition dominates the channels that lead to an increase in markups, as OTT is associated with lower average markups (Column (3)). Given that OTT is measured in logs, the coefficients can be interpreted as elasticities: a 10% higher OTT is associated with about 0.2% lower markups.

292. OTT also seems to reinforce the link between intangible intensity and markups (Column (4)). In industries where OTT is relatively higher, the link between intangible intensity and markups is 50% stronger. This suggests that the increased market size facilitated by greater openness amplifies the relationship between intangibles and markups. As a robustness test, to account for the role of globalisation, a simpler alternative definition of OTT is adopted by dividing industries into domestic and tradeable according to the taxonomy built in this report, and defining a dummy variable that is equal to 1 if an industry is tradeable. The results align with the baseline specification with OTT and are reported in column (3) of Table A E.2.

Column (5) of Table 7.7 shows the relationship between input market regulatory barriers and markups. As before, the variable Reg Impact measures the extent of exposure to regulated input markets. The negative correlation of the coefficient is in line with the hypothesis that the more an industry is dependent on inputs

[105] To give an order of magnitude, an increase in intangible investment intensity of 10 p.p. roughly amounts to the difference between the smallest and the median observation. Such an increase, which is associated with 2.5% higher markups, corresponds to markups higher by 0.03 points, given that in the sample used for regressions, the average firm markup analysis is 1.21.

[106] With the usual caveat of the differences in the sample and the variables considered (e.g., certain intangibles categories or the OTT definition).

[107] The results are robust to alternative ways to look at the distribution of firms, such as computing deciles by markups distribution. See Column (1) in Table A E.2. for further details.

provided by regulated sectors, the higher the marginal costs and, hence, the lower the average markups. Specifically, a 10 p.p. higher level of Reg Impact is associated with 2.7% lower average markups.[108] The impact of regulation may disproportionately affect smaller firms, so the relationship with average markups may be greater than that with markups of large market-leading firms.

Table 7.7. Markups, TFP, intangibles, openness to trade, regulation, and M&A

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Log markup	Log markup	Log markup	Log markup	Log markup	Log markup	Log markup
Intangible Intensity (t-1)	0.2486*	0.2201		0.2426***			0.2140**
	(0.1475)	(0.1418)		(0.0777)			(0.0849)
Frontier TFP		0.1136***					0.0901**
		(0.0307)					(0.0349)
Frontier TFP # Intang. Intensity (t-1)		0.2835**					0.3062**
		(0.1164)					(0.1373)
OTT (t-1)			-0.019***	-0.0339***			-0.0340***
			(0.0052)	(0.0086)			(0.0086)
OTT (t-1) # Intang. Intensity (t-1)				0.1215***			0.1214***
				(0.0398)			(0.0405)
Reg Impact (t-1)					-0.2691***		-0.2197**
					(0.0876)		(0.0936)
Share M&A (t-1)						0.0245**	0.0469***
						(0.0101)	(0.0139)
Observations	3123436	3123436	2516764	2270821	2806609	3497082	2107426
Adj. R-Square	0.1531	0.1662	0.1414	0.1512	0.1366	0.1435	0.1546
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: OLS regressions of log markups, measured at the firm level, on Intangible Intensity (Intangible investments divided by value added, Column (1)), Frontier TFP (a dummy variable that equals to one for firms in the top decile of the TFP distribution within each industry-year, Column (2)), OTT (the sum of import and exports divided by production, Column (3)), Regulation Impact (the OECD REGIMPACT, ranging between 0 and 100, is an indicator that captures the degree of dependence of an industry on the inputs of regulated industries, Column (5)) and a proxy for M&A activities (number of firms acquired belonging to the top 10th percentile of the markup distribution divided by total acquisitions in the same country-industry-year level, Column (6)). Column (4) reports the interaction between Intangible Intensity and OTT, Column (7) uses all the variables simultaneously. The control variables used in the regressions are capital intensity at the firm-level, age class, and size class (defined by number of employees). All the independent variables are one year lagged. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, and SWE. Note that information on Intangibles is not available for BEL and POL. Standard errors are clustered at the country–A38 industry-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

293. Column (6) shows the correlation between average markups and M&A activity in the top decile of the markup distribution.[109] Firms may use M&A to consolidate market shares, increase market power, and, therefore, charge higher markups. In the previous subsection, it was shown that M&A is correlated with higher concentration, which would also be in line with this phenomenon. The results show that a higher share of M&A activities conducted by firms belonging to the top decile of the markup distribution is

[108] An increase of Reg Impact of about 1 p.p. roughly amounts to the difference between the 10th and the 25th percentiles of the Reg Impact distribution.

[109] In Column (6), a dummy that captures if a firm belongs to the top decile of the markup distribution is included to control for differences in average markup levels across the distribution. The estimated coefficient is not reported.

associated with higher average markups. This could suggest evidence of consolidating market power but might also be related to a decrease in marginal costs due to economies of scale that firms expanding their size face. Note also that the magnitude of the effect appears to be small: a 10 p.p. higher share of M&A by top firms is associated with 0.2% higher markups.[110]

Finally, Column (7) shows that the correlations reported remain statistically significant and do not change magnitude when all the explanatory variables are included together, and all the explanatory variables of interest are controlled for at once. The fact that the coefficients remain significant and stable suggests that the different channels capture different mechanisms affecting the markup evolution.[111]

Table 7.8. Markups and intangible investments subcomponents

	(1)	(2)	(3)	(4)
	Log markup	Log markup	Log markup	Log markup
Software and Database Intensity (t-1)	0.4131			0.3755
	(0.2983)			(0.2938)
Innovative Property Intensity (t-1)		0.3797**		0.2888**
		(0.1811)		(0.1402)
Economic Competencies Intensity (t-1)			0.1733	0.1164
			(0.3103)	(0.3503)
Observations	3123555	3310667	3490626	3111195
Adj. R-Square	0.1461	0.1526	0.1432	0.1531
Controls	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes

Note: OLS regressions of log markups, measured at the market-industry-year level, on Software and Database Intensity (Software and Database investments divided by value added, Column (1)), Innovative Property Intensity (R&D, entertainment and artistic originals, new financial products, and design investments divided by value added, Column (2)), Economic Competencies Intensity (organisational capital, brand, and employer-provided training investments divided by value added, Column (3)). Column (4) uses all the variables simultaneously. The control variables used in the regressions are capital intensity at the firm-level, age class, and size class (defined by number of employees). All the independent variables are one year lagged. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, and SWE. Note that information on Intangibles is not available for BEL and POL. Standard errors are clustered at the country–A38 industry-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

294. Similar to the analysis for concentration, Table 7.8 reports the correlations between markups and investment intensity in the different categories of intangibles. The four columns show that the average positive correlation between investment in intangibles and markups reported in Column (1) of Table 7.7 is mainly driven by investment in innovative property.[112] Specifically, coefficients for both software and

[110] The results are robust to alternative definitions of the variable, such as looking at the share of value rather than number of transactions and looking at the number of acquisitions carried out by firms in the top decile rather than acquisitions received by firms in the top decile.

[111] Note that the correlation between markups and competition enforcement actions is not included. As already mentioned, the competition enforcement actions considered here, by targeting a relatively small number of firms, can directly affect the concentration level in the market but are unlikely to affect the average markups in the corresponding country-industry.

[112] Note that when further distinguishing across 1-digit sectors, a positive and significant coefficient in non-financial market services is found for both software and database intensity, and for innovative property intensity. Results are unreported for brevity, but available upon request.

database intensity (Column (1)) and for economic competencies intensity (Column (3)) are positive but not statistically significant and different from zero. The coefficient for innovative property intensity (Column (2)) is instead positive and significant: a 10 p.p. higher level of innovative property intensity is associated with 3.7% higher average markups.

Prices

295. The economic factors discussed so far in this section may also be related to average prices, providing complementary evidence to the correlations with concentration and, especially, markups. Understanding the relationships of prices alongside markups could be informative on marginal costs, as prices approximately reflect the combination of markups and costs (see Section 4).

296. To assess the relationship between prices and economic variables, data on the average unit price in each product-country-year from Euromonitor are used. Importantly, the sample is restricted to consumer product markets, which relate to a subset of industries of the main analysis (listed in Table A A.11). These industries mainly cover manufacturing industries, as well as some consumer services, but omit many high-tech industries that often operate primarily as inputs to other sectors (such as computer services). These sample differences with respect to the baseline should be considered when interpreting the results.

297. The estimating equation is in the form:

$$\ln(price)_{p,s,c,t} = \boldsymbol{Z}'_{\boldsymbol{s,c,t-1}}\boldsymbol{\delta} + \rho_{c,t} + \vartheta_{p,t} + \varepsilon_{p,s,c,t,}$$

Equation 16

for product p associated with industry s, in country c at time t. The dependent variable is the log of average unit price in a product market. The explanatory variables $\boldsymbol{Z}'_{\boldsymbol{s,c,t-1}}$ are available at the A38 industry-country level and correspond to those in the sub-section above (intangible investment intensity, OTT, product market regulation, M&A intensity of top performing firms). Analogously to the analysis for markups, country-year fixed effects are included to control for time varying country-specific shocks such as macroeconomic trends, while product-year fixed effects are included to control for product-specific shocks such as technology changes. Furthermore, the product-year fixed effect is essential to ensure that the units of price of different products are comparable.[113] Note that, unlike the markups regressions, firm-level data are not available so no firm-level controls are included. Within a product-year, the variation that is captured by the regression is across countries, while the country-year fixed effect controls for the average price level in each country at each period. Note that price differences may thus also reflect differences in product quality, or other market characteristics that vary at the product-country level, so the results should be interpreted with this in mind.

298. The results are presented in Table 7.9. Markets that are more intangible-intensive tend to have higher average prices, although the relationship is marginally not statistically significant (Column (1)). There is no statistically significant relationship between log price and OTT, and the relationship between intangibles and price is not statistically significantly stronger for markets with higher OTT (Column (2)), even though the coefficients have the same sign as in the regressions for markups. The combination of these results with that of markups in Table 7.7 (Column (4)), where the coefficient of OTT interacted with intangibles is positive, supports an interpretation suggesting that more internationalised firms invest in intangibles with high fixed costs to reduce their marginal costs.

299. Column (3) shows that higher regulatory barriers in input markets are associated with higher average prices, as expected. Note that the coefficient in the equivalent markups regression was negative,

[113] For example, the unit price of a bottle of water is comparable across countries – the variation exploited in the regressions – but is not comparable with the unit price of a television (a comparison that is not exploited in the regression due to the inclusion of the product-year fixed effect).

hinting to higher marginal costs in industries highly dependent on inputs provided by regulated sectors: the combination of the two results suggests that there may be an incomplete passthrough of regulatory barriers to consumer prices. This is in line with existing research showing high but incomplete passthrough of regulation to consumer prices (see, for example, Bakker et al., (2022[91])). As mentioned for the markups regressions, burdensome input market regulation is likely to impact small firms more than large firms, who can source inputs at a larger scale and adjust their supply chains across countries, so the relationship with the prices of large, leading firms may be smaller than the relationship with market average prices.

300. Finally, a higher share of the market's M&A among high markup firms (using the same variable for M&A as in the markups regressions because firm-level prices are not available in the data) is associated with higher prices, though it is not statistically significant (Column (4)), except when all variables are included together (Column (5)), where the coefficient becomes economically sizeable and statistically significant, suggesting that there may indeed be a relationship between M&A and prices.

Table 7.9. Relationships between prices and intangibles, openness to trade, regulation, and M&A

	(1)	(2)	(3)	(4)	(5)
	Log Price	Log Price	Log Price	Log Price	Log Price
Intangible Intensity (t-1)	0.0930	0.0715			0.147*
	(0.0664)	(0.0774)			(0.0807)
OTT (t-1)		-0.00591			-0.00944
		(0.0110)			(0.0109)
OTT (t-1) # Intangible Intensity (t-1)		0.0440			0.0424
		(0.0453)			(0.0452)
Reg Impact (t-1)			3.689***		3.808***
			(0.819)		(0.933)
Share M&A				0.103	0.253***
				(0.0665)	(0.0869)
Observations	17551	17297	23223	23223	17297
Controls	Yes	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes	Yes
Product-year FE	Yes	Yes	Yes	Yes	Yes

Note: OLS regressions of log of average price, measured at the country-product–year level, on Intangible Intensity (Intangible investments divided by value added, Column (1)), its interaction with OTT (the sum of import and exports divided by production, Column (2)), on Regulation Impact (the OECD REGIMPACT, ranging between 0 and 100, is an indicator that captures the degree of dependence of an industry on the inputs of regulated industries, Column (3)) and on a proxy for M&A activities (number of Acquisitions by top four divided by total acquisitions within their industry at the country-industry-year level Column (4)). Column (5) uses all the variables simultaneously. The products included are those included in the Euromonitor data. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, JPN, KOR, NOR, POL, PRT, SVN, SWE, and USA. Note that information on Intangibles is not available for BEL and POL, while regulation impact data is absent for the USA. USA data are included only for industries competing at the global level. Standard errors are robust to heteroskedasticity and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

Correlations of concentration with other macroeconomic factors

301. In recent years, the evolution of concentration has been linked with other important macroeconomic trends such as declining labour share, declining productivity growth, and investments (see Covarrubias (2019[22]); Autor (2020[14]); Barkai (2020[21]); Ganapati (2021[27]); Cho et al., (2024[92])).

302. On the one hand, the observed increasing trends in concentration may come from what in the literature have been defined "good" sources (Covarrubias, Gutierrez and Philippon (2019[22])), such as an

increase in the elasticity of substitution from the consumer preferences side, or technological change leading to increasing returns to scale and intangible capital deepening. In this case, the increase in concentration would reflect a "winner takes most" situation. For example, the presence of consumers more sensitive to price and quality due to greater product market competition (e.g., due to online comparisons), would favour more productive firms that can charge lower prices or supply higher quality goods. Under this scenario, concentration could be driven by an increase in the competition environment which gives an advantage to larger firms that can react more efficiently to technological changes and, thus, increase their market shares. As shown by Autor (2020[14]), these firms would be the most productive ones and with the lowest labour share. Therefore, as these firms increase their market size, aggregate productivity should increase, and labour share should decline, driven by a reallocation process of economic activity toward these firms.

303. On the other hand, an alternative explanation has put more emphasis on rising barriers to competition, thus associating these trends with "bad" sources of concentration (Covarrubias, Gutierrez and Philippon (2019[22])). Increasing concentration would be driven by the rising influence of economic rents and barriers to competition, with a negative effect on the efficiency – and, hence, productivity - of firms, rather than efficient reallocation of market shares towards more productive firms. In addition, in an economy with stronger barriers to competition, investments should be lower since firms feel weaker competitive pressures and, hence, have less incentive to invest.

304. Importantly, these hypotheses are not mutually exclusive, and the relative importance of each channel can be heterogeneous across industries and countries (Crouzet and Eberly (2019[58]); Covarrubias, Gutierrez and Philippon (2019[22])). For example, the role of intangible investments can be used to spotlight how the two channels are interrelated. The scalability and synergies of intangible investments lead to increasing returns to scale, which allow more productive and large firms to expand further ("good" source). At the same time, intangible assets are often sunk costs, which require large upfront investments, and they need complementary skills to be fully exploited. Therefore, they are not easily accessible to most firms and will likely to create some barriers to competition and technology diffusion ("bad" source).

305. In the following sub-section, concentration is related to labour share, productivity, and investments to provide some descriptive evidence of their relationship. These three variables are computed at the firm-level using the same firm-level sample used to compute markups (see Section 3). Labour share is defined as the employees' compensation over value-added, and the proxy for investment is defined as the difference in capital stock over two consecutive years. Two measures of productivity are computed: TFP and labour productivity. TFP is econometrically estimated at the firm-level using the Wooldridge (2009[93]) control function approach, assuming a Cobb-Douglas production function with value added $VA_{f,s,c,t}$ as a measure of output of firm *f*, in industry s, country *c*, at time *t* and two inputs, capital and labour.[114] A simpler, yet widely used, measure of productivity is labour productivity. This variable captures the amount of output produced by a firm relative to the labour input. It is computed at the firm-level as the ratio between the (real) value added and the employment variable.

[114] The Wooldridge procedure relies on estimating variable inputs with a polynomial of lagged inputs and a polynomial of intermediates, and it allows the identification of elasticities of the inputs with respect to value added. For this exercise, TFP has been estimated assuming a production function with value added as a measure of output and capital and labour as inputs (rather than a production function with gross output as a measure of output and capital, intermediates, and labour as inputs, as done to estimate markups). This choice is to mitigate the endogeneity concerns that arise when correlating TFP with the measure of concentration, which is built on gross output. Productivity is then computed as a residual between the actual and the predicted value added. Similarly, to what has been done for markups estimation (see Section Annex B), the production function has been estimated for each 3-digit industry, in order to allow differences in technology between industries.

306. To provide evidence on how these economic factors are linked to concentration, the following specification is estimated:

$$Y_{f,s,c,t} = \alpha_0 + \alpha_1 CR4_{s,c,t-1} + \alpha_2 D^{tfp}_{f,s,c,t} + \alpha_3 CR4_{s,c,t-1} * D^{tfp}_{f,s,c,t} + \boldsymbol{X'_{f,s,c,t}\beta} + \rho_{c,t} + \vartheta_{s,t} + \varepsilon_{f,s,c,t},$$ Equation 17

where $Y_{f,s,c,t}$ represents the different outcome variables – values of log TFP, log labour share, and investments – for firm *f*, in industry s, country *c*, at time *t*. $CR4_{s,c,t-1}$ is the measure of concentration in industry *s*, country *c*, at time *t-1* used throughout the report and lagged by one year to reduce the risk of reverse causality.[115] To capture different patterns in the relationship between the variable of interest $Y_{f,s,c,t}$ and concentration along the productivity distribution, the interaction of $CR4_{s,c,t-1}$ with a dummy variable $D^{tfp}_{f,s,c,t}$ that indicates whether a firm belongs to the top decile of TFP distribution is included. The estimated coefficient for α_3 therefore indicates whether the relationship of the variable of interest with concentration is different for the productivity "frontier" firms (i.e., belonging to the top decile of the TFP distribution) and the "rest". The regressions include a set of firm-level control variables, $\boldsymbol{X'_{f,s,c,t}}$ (age class and size class). The specification also includes country-year fixed effects, $\rho_{c,t}$, to control for unobserved patterns within each country-year such as country-specific macroeconomic trends, and industry-year fixed effects, $\vartheta_{s,t}$ which captures common trends across countries within the same industry-year (such as technology shocks). Standard errors are clustered at the country-industry-level.

307. The results of the regressions are reported in Table 7.10.[116] Column (1) shows that, on average, firm TFP is uncorrelated with industry concentration. However, Column (2) shows that the overall result in Column (1) hides heterogeneity in the relationship along the TFP distribution: TFP is positively correlated with concentration for the most (top 10%) productive firms (looking at the sum of the first and the third coefficient, -0.1367+0.3455), while the relationship is negative when looking at the rest (bottom 90%) of the TFP distribution (first coefficient, -0.1367). Such a result also suggests a positive relationship between concentration and TFP dispersion.

308. Columns (3) and (4) look at the correlation between concentration and labour share. On average, labour share and concentration are negatively correlated (Column (3)), and this relationship seems to be driven by firms in the top decile of the TFP distribution (Column (4)) since for firms belonging to the rest of the TFP distribution the relation is not statistically significant. Finally, Columns (5) and (6) show that, in this sample, there is no statistically significant relationship between the proxy for firms' investments and concentration.[117]

309. Overall, the analysis seems to point towards a "superstar story" (see Autor et al. (2020[14])), where concentration is related to the increasing importance of large firms that are more productive and less labour-intensive. Such a narrative is consistent with the results of the previous sub-sections on the importance of intangibles, as the latter are likely to favour larger and more productive firms. As a note of caution, these results are likely to hide substantial heterogeneity, and the relationship of concentration with economic variables and proxies of the state of the economy can vary across industries and countries, thus

[115] Recall that concentration only varies at the industry-year level for European and global industries. To also exploit the country dimension in the data, concentration is included at the country-industry-year level: as in the previous sections, for each industry belonging to the European and the global geographical bucket, the same level of industry concentration is attributed to all countries.

[116] The results of the exercise using labour productivity instead of TFP provide analogous results and are reported in Table A E.3. of the Annex.

[117] Although the literature has emphasised the potential relationship between investments and concentration trends, proxies of investments at the firm level are not always accurate. As such, results in Columns (5) and (6) should be taken with caution.

requiring careful analysis in each case. In addition, once again, these regressions provide descriptive evidence of the extent to which these measures are conditionally correlated, but do not imply any causal relationships.

Table 7.10. Relationship of CR4 with Total Factor Productivity, labour share, and investments

	(1)	(2)	(3)	(4)	(5)	(6)
	TFP	TFP	Labour share	Labour share	Investment proxy	Investment proxy
CR4 (t-1)	-0.0530	-0.1367*	-0.0359**	-0.0194	0.0039	0.0064
	(0.0879)	(0.0736)	(0.0172)	(0.0160)	(0.0076)	(0.0081)
Firm's TFP frontier dummy		1.0365***		-0.2527***		0.0058**
		(0.0457)		(0.0071)		(0.0028)
Firm's TFP frontier dummy # CR4 (t-1)		0.3455***		-0.0713***		-0.0047
		(0.0925)		0.0000		(0.0079)
Observations	2936763	2936763	2949946	2909369	2968113	2921845
Adj. R-Square	.606328	.6729718	.088806	.0566699	.0232699	.0239175
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: OLS regressions of log total factor productivity (TFP, Columns (1)-(2)), Labour Share (Columns (3)-(4)), and a proxy for investments (investment-capital ratio, Columns (5)-(6)), all measured at the firm level, on CR4 (measured at the market-year level), Frontier TFP (a dummy variable that equals to one for firms in the top decile of the TFP distribution), and their interaction. The control variables used in the regressions are capital intensity at the firm-level, age class, and size class (defined by number of employees). CR4 is one year lagged. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, HUN, ITA, POL, PRT, SVN, and SWE. Standard errors are clustered at the country–A38 industry-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

8 Conclusions

Summary of the key contributions

310. This report provides new evidence on the state of competition in 23 OECD countries by examining the joint evolution of several proxies for competition over the last twenty years. With respect to the existing literature, it develops several methodological innovations that provide new insights on the evolution of concentration, business dynamics among market leaders (proxied by three different measures: entrenchment, rank persistence and market share instability), and markups in a unified framework. The report also provides an extensive analysis of the channels linked to these trends, drawing a richer and more robust picture of competition than any previous cross-country study.

311. As a first methodological innovation in the measurement of concentration and business dynamics among market leaders, the report defines industries at the most disaggregated level possible in a cross-country study (mainly at the 3-digit level). Second, a taxonomy of industries is developed to determine the geographical boundaries of a market (domestic, European, or global), and the different proxies of competition (with the exclusion of markups, available at the firm level) are computed at the corresponding geographical level determined by this taxonomy. A key advantage of the taxonomy is that it accounts for the role of international trade and cross-border activities of multinationals within each relevant region (i.e., that at which the analysis is carried out, based on the prediction of the taxonomy). This feature is also possible because the analysis considers business groups rather than single firms' information and therefore accounts for cross-border ownership linkages. Increasing the level of industry detail and determining the geographic level at which competition takes leads to a definition of markets more similar to those used by competition authorities when computing competition proxies such as concentration. To this end, a novel dataset on market shares at the product level is also used to show that product and industry concentration and business dynamics of market leaders are closely related, adding weight to the implications that can be drawn from industry-level studies.

312. By applying these methodological innovations, the average level of industry concentration is found to have increased from 2000 to 2019, and more in industries competing domestically (6 p.p.) than in those competing at the European and global level (4 p.p.). When looking at business dynamics among market leaders, the combination of the three indicators considered in the report (entrenchment, rank persistence and market share instability) suggests that, overall, the level of business dynamism is low, and it has slightly decreased during the period considered, especially in industries competing at the domestic and European levels. On average, about 3.3 out of the top four firms in one year remain market leaders in the next year, and more concentrated industries are associated with higher levels of entrenchment. This trend is relatively stable over the sample period. In addition, rank persistence and market share instability point to a reduction in the rate of churn between leading firms over time.

313. Furthermore, the report examines the link between product and industry concentration and shows that the average concentration level in product markets is higher than at the industry level. However, the two are strongly correlated, suggesting that industry concentration is a good proxy for capturing the evolution of market concentration.

314. Another proxy of competition extensively analysed in this report is markups, defined as the difference between price and marginal cost. Over the period considered, markups increased by slightly

more than 7% on average. The result is mainly driven by the increase in firms' markups in the top half of the distribution, while, on average, those in the bottom half remained virtually flat. The average markup increased relatively more in industries competing at the global level (+12%), followed by industries competing at the European (+7%) and at the domestic level (+3%). Markups increased relatively more in services than in manufacturing industries and more in digitally intensive sectors than in less digitally intensive ones. Further, in line with previous results from the literature (see Berry et al. (2019[9]), and Syverson (2019[4])), markups and concentration are broadly uncorrelated, suggesting that there might be different forces at play explaining these trends, although concentration is positively correlated with average unit prices.

315. The report also analyses the relationship between the competition trends and several potential structural factors, such as investment in intangible assets, openness to trade, product market regulation, and M&As.

316. First, investment in intangible assets is positively related to both markups and concentration. Given their inherent characteristics (the so-called 4-S: sunk, scalable, synergies and spillovers; see Haskel and Westlake (2018[88])), intangible assets are likely to bring efficiency gains by reducing marginal costs and disproportionately so to larger firms.

317. Second, the results suggest that globalisation, proxied by openness to trade, is linked to lower concentration and average markups. However, the pro-competitive effects of trade appear to be stronger in less intangible-intensive sectors. The high average markups and the larger market share of the top 4 firms in sectors with high investment in intangible assets are even greater when these sectors are more open. These findings, in line with the economic theory, suggest that global firms – with access to larger markets – might be in a better position to exploit the gains induced by intangibles, which are characterised by higher fixed costs alongside lower marginal costs and, thus, raise markups.

318. Third, the relationship with measures of product market regulation of upstream industries is also explored. More burdensome input market regulation is associated with higher concentration, lower markups, and higher prices. The higher costs induced by input market regulation are likely to disproportionately affect smaller price-taker firms, as larger firms can source at scale and adjust international supply chains to minimise their costs more easily, possibly leading to higher concentration. More costly and less efficient input markets are also associated with higher markups and higher prices.

319. Finally, M&A activity conducted by the top four business groups is positively correlated with concentration. This result aligns with previous literature (Bajgar et al. (2021[16])) suggesting that large incumbents may use mergers and acquisitions to strengthen their dominant position and increase their market shares. Similarly, M&A activities conducted by firms in the top decile of the markup distribution are associated with higher average markups, providing additional evidence that firms may be using M&A to increase their market power.

320. As a final step, the report also explores the relationships of concentration with total factor productivity and labour share. The results show that concentration is positively correlated with total factor productivity of firms at the frontier of the productivity distribution and negatively correlated with productivity for other firms, suggesting that more concentrated industries have higher productivity dispersion. Moreover, firms at the frontier of the productivity distribution have, on average, a lower labour share, in line with Autor et al. (2020[14]), and this relationship is even stronger in more concentrated industries. As these relationships are not causally identified, more work will be needed to investigate causal relationships between the different variables of interest.

Discussion of main findings

321. By drawing together a detailed analysis of the trends of several proxies of competition, this report presents important new evidence on the state of competition in several OECD countries. In addition, looking at the correlation between concentration and markups with key market characteristics, this report provides novel insights on the potential mechanisms behind these trends, as well as an initial exploration of their potential consequences. Overall, the report shows that, between 2000 and 2019, concentration and markups rose on average across the 23 European countries analysed, suggesting that competition has decreased. Moreover, the analysis also suggests that the state of competition is linked to two important structural shifts – the increasing importance of intangible assets and globalisation.

322. Intangibles are less excludable and more scalable than physical capital (Haskel and Westlake (2018[88])) as it is possible to use these assets multiple times at low or near-zero marginal cost. Furthermore, the development or use of intangible assets requires a high initial fixed cost, which can be compounded by the need for complementary organisational investments (Brynjolfsson and Hitt (2000[94]); Tambe et al. (2020[95]); Brynjolfsson et al. (2023[96])). The large overhead cost component of intangible adoption gives large firms an advantage (Lashkari et al. (2019[28])), and there is evidence of these disproportionate benefits (Bajgar et al. (2021[16])) in terms of market share. The rising importance of intangibles, therefore, has important implications for competition.

323. This report shows that markups rose most in digital-intensive sectors, while the regression analysis shows that intangible intensity is positively correlated with both concentration and markups. The economic implications of the rise in concentration and markups potentially resulting from the increasing importance of intangibles are complex. Intangibles disproportionately benefit more productive firms, with improvements in terms of higher allocative efficiency (Autor et al. (2020[14])). However, these firms also tend to have higher markups and larger market shares. The increase in markups and concentration linked to higher intangible investment may increase the market power of the more productive, high markups and large market share firms and slow down long-run growth because of reduced market dynamism (De Ridder (2024[17])) and less innovation (Aghion et al. (2023[43])). This report shows that average entrenchment is high and market share instability has been declining, raising concerns that these obstacles to growth may be at play.

324. Globalisation allows the expansion of the most productive firms towards new markets (Melitz (2003[83])) while also increasing exposure to import competition (Amiti and Heise (2021[6])). Previous evidence (Amiti and Heise, (2021[6])) shows that the surge in trade interconnections across countries has played a role in promoting competition in tradeable sectors through the pressures of foreign firms. Consistently, the evidence shown in the report highlights that concentration has increased less in tradeable sectors than in non-tradeable sectors. When accounting for import penetration in overall market size, the increase in concentration in tradeable sectors is even smaller (Figure 5.6 and Figure 5.7), in line with the study of Amiti and Heise (2021[6]) for the United States. In addition, regressions in Section 7 show that overall openness to trade is associated with lower concentration and smaller markups overall.

325. Despite the pro-competitive effects of trade, the increase in effective market size is associated with a reallocation of production to larger firms (Melitz (2003[83]); Melitz and Ottaviano (2008[84])). Furthermore, when markups change in response to increased trade integration, the pro-competitive effects of trade may be elusive (Arkolakis et al. (2018[97])). The role of trade in increasing the market share and, potentially, markups of leading firms could be particularly pronounced in tradeable industries where intangibles play a more critical role. In these sectors, leading firms can respond to the tougher competition by increasing their intangible investment (Shaked and Sutton (1987[98]); Sutton (1991[99]), Bustos (2011[100]); Antoniades, (2015[65])). Intangibles also allow firms to increasingly fragment their production processes (Bloom et al. (2013[77])), which may be across borders (Fort (2016[101])), and could increase cross-border M&A activity.

326. This report provides further evidence (see also Bajgar et al. (2021[16])) on the importance of the interaction between globalisation – which increases effective market size – and the increased importance of intangibles – which magnifies the importance of economies of scale. The regressions in Section 7 show that the rise in concentration and markups is indeed most significant when the increasing importance of intangibles and globalisation combine: the increased market size from openness to trade seems to amplify the returns from intangible investments. Together, globalisation and intangibles seem to have increased the importance of "superstar firms" (Autor et al. (2020[14])), with high productivity and high markups. These findings align with the fact that markups increased most at the top of the distribution (Figure 5.23), and with regressions results suggesting that concentration is positively correlated with total factor productivity dispersion and negatively correlated with the labour share of the most productive firms.

327. Finally, while these structural shifts – globalisation and intangibles – have played a role in the evolution of concentration and markups, the report also shows that there is also a role for factors that can be directly affected by competition policy. A higher share of M&A activity accounted for by leading firms is associated with higher concentration and higher markups, as expected. Moreover, more stringent regulatory barriers in the input market are associated with higher concentration, lower markups, and higher prices, suggesting that the costs of burdensome regulatory barriers are partially passed on to consumers and partially absorbed by firms. One reason for this is that smaller firms are likely to be more exposed to higher input market regulation because larger firms are able to adapt their supply chains and source inputs at scale. At the same time, merger interventions made by the EC Competition Authority are associated with lower industry concentration.

328. All in all, the increases in industry concentration and markups observed over the last two decades seem to be related to a complex combination of factors, which have varying relationships for different industries and firms with different characteristics. For example, the increased importance of intangible assets and globalisation are likely to disproportionately benefit larger firms (De Ridder (2024[17]); Haskel and Westlake (2018[88]); Melitz (2003[83])). From this perspective, the rise in concentration and markups would be driven by a reallocation process towards those firms that are better equipped to benefit from the recent structural changes (Autor et al. (2020[14])). However, even if the observed reduction in competition is mainly the result of reallocation towards more efficient firms, there are still concerns over market power, especially in the long term, due to less market dynamism (De Ridder (2024[17])) or lower innovation (Aghion et al. (2023[43])). Even if some firms attain their current dominant positions in the short run by out-competing rivals, in the long run, they may use their position to raise prices and entrench their position. Furthermore, the report also provides evidence of a connection between M&A and regulation, on the one hand, with both concentration and markups on the other, suggesting a possible role played by competition policy, as emphasised by Gutierrez and Philippon (2023[33]).

329. Given that several factors are at play in affecting the competition environment, the observed reduction in market competition calls for policy action. The evidence highlighted in the report requires the adoption of a holistic and whole-of-government approach to ensure a competitive and dynamic business environment. In order to achieve a sound competitive environment, appropriate innovation, trade and industrial policies, among others, as well as actions directed to promote knowledge and technology diffusion, should be combined with the efforts of competition authorities. By providing evidence on the evolution of possible competition proxies and some economic and policy factors that may be causing these observed trends, this report offers valuable insights to competition authorities, governmental bodies, and policymakers, prompting contemplation on potential policy challenges aimed at fostering and maintaining a robust competitive landscape.

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Annex A. Data Appendix

Production data

National Accounts (NA)

The variable of interest extracted from NA is the annual value of gross output expressed in millions of Euros for the years 2000-2019. It is available at the Nace2 A*64 level of aggregation, which comprises 66 industries.[118]

The original NA dataset on which the apportioning procedure is based is composed of the 15 countries of the final sample (Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Norway, Poland, Portugal, Slovenia, Spain, Sweden, and the United Kingdom) and by 54 industries. It includes 16200 observations, of which 294 (1.81%) are missing values.

Structural Business Statistics (SBS)

SBS contains information on economic activity of all economic sectors excluding agriculture and personal services, and provides data at different level of aggregation, from 1-digit to 4-digit industry-level.[119] The data is generally collected by national statistical institutes by means of statistical surveys, business registers and other administrative sources.

Statistical Classification of Economic Activities in the European Community was used until 2001, NACE Rev. 1.1 was used from 2002 to 2007, and NACE Rev 2 is used from 2008 onwards. Available data are reported according either to NACE Rev. 1.1 (pre-2008), or to NACE Rev 2 (post-2008). Some data are reported both in NACE Rev.1.1 and NACE Rev. 2 for the year 2008.

The types of variables present in SBS, broadly defined, are business demographic variables, output-related variables, and input-related variables. In particular, the variables used to build the final dataset, all available at the country-industry (3-digit) level, are the following:

- **Production value (millions of Euros)** measures the amount produced by the unit based on sales, including changes in stocks and the resale of goods and services. [120]
- **Turnover (millions of Euros)** comprises the totals invoiced by the observation unit during the reference period and corresponds to market sales of goods or services supplied to third parties.
- **Number of persons employed** is defined as the total number of persons who work in the observation unit, as well as persons who work outside the unit who belong to it and are paid by it.

[118] For the extended documentation, see National Accounts metadata; for further definitions, see European system of accounts - ESA 2010

[119] For further details, please refer to Methodological manual on European Structural Business Statistics – 2021 edition and the SBS website Structural Business Statistics

[120] In this context, a unit refers to the enterprises observed to build the SBS data. In this work, only the final data, aggregated at the industry level (as available on Eurostat website), are used.

- **Number of enterprises**: a count of the number of enterprises active during at least a part of the reference period.

Production value is the main variable of interest. The other variables are used to conduct consistency checks or as regressors during the imputation process (described below). The next two sections report various statistics on the two SBS datasets. They all refer to the final set of 15 European countries (Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Norway, Poland, Portugal, Slovenia, Spain, Sweden, and the United Kingdom) and years (2000-2019).

SBS NACE Revision 1 (pre-2008)

Data on pre-2008 years are reported according to NACE Rev. 1.1 industry classification and cover sections C (Mining and Quarrying), D (Manufacturing), E (Electricity, gas, and water supply), G (Wholesale and retail), H (Hotels and restaurants), I (Transport, storage, and communication), and K (Real estate, renting and business activities) for the years between 2000 and 2008. At the 3-digit level, there are 181 industries and 24,435 observations, of which 5,903 (24.16%) are missing the production variable. The share of missing values varies across countries and sectors, as shown in Table A A.1. At the 3-digit level, sections H, I, and K have the highest share of missing industries.[121]

Table A A.1. SBS NACE Rev.1.1 – Raw Data

Sector	Non-Missing	Missing	Tot. Obs.
C (Mining and Quarrying)	1,118 (63.70%)	637 (36.30%)	1,755
D (Manufacturing)	12,303 (88.48%)	1,602 (11.52%)	13,905
E (Electricity, gas, water supply)	368 (68.15%)	172 (31.85%)	540
G (Wholesale and Retail)	2,461 (95.95%)	104 (4.05%)	2,565
H (Hotels and Restaurants)	91 (13.48%)	584 (86.52%)	675
I (Transport, Storage, and Comm.)	961 (50.85%)	929 (49.15%)	1,890
K (Real Est., Renting, and B. Act.)	1,230 (39.61%)	1,875 (60.39%)	3,105
Total	**18,532 (75.84%)**	**5,903 (24.16%)**	**24,435**

Note: The table presents statistics on missing and non-missing values for 3-digit industries for the sample of countries included in the analysis (BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE).
Source: OECD calculations.

To provide an idea of the quality of the coverage over time, Table A A.2 reports the number and percentages of missing values within country-industry pairs: among a total of 2,715 industry-country pairs (15 countries by 181 3-digit industries), 54.51% are complete time series without any missing observation, 11.68% have only one year missing. For time series interpolation of missing values within a country-industry, the most concerning cases are those with few non-missing observations: 522 (19.23%) industry-countries pairs have less than five years of available data. For these cases, methods other than interpolation (described in the following section) have been adopted to impute some observations.

[121] Sorted by percentage of missing values: Greece (45.43%), Denmark (35.17%), Belgium (32.41%), Slovenia (27.75%), Portugal (27.5%), Sweden (26.97%), Norway (24.74%), Poland (23.51%), Finland (23.08%), France (21.73%), the United Kingdom (20.69%), Hungary (18.85%), Spain (17.62%), Germany (12.95%), and Italy (5.59%).

Table A A.2. Number of missing observations within country-sector pairs

Number of missing years	Number of country-sector pairs	Percent of country-sector pairs (%)	Cumulative share (%)
0	1,480	54.51	54.51
1	317	11.68	66.19
2	108	3.98	70.17
3	184	6.78	76.94
4	104	3.83	80.77
5	29	1.07	81.84
6	31	1.14	82.98
7	22	0.81	83.79
8	43	1.58	85.38
9	397	14.62	100
Total	**2,715**		

Note The statistics refer to the sample of countries included in the analysis (BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE).
Source: OECD calculations.

SBS NACE Revision 2 (post-2008)

Data from 2008 onwards follow the NACE Rev. 2 industry classification and cover sections B (Mining and Quarrying), C (Manufacturing), D (Electricity, gas, steam and air conditioning supply), E (Water supply; sewerage, waste management and remediation activities), G (Wholesale and retail trade), H (Transportation and Storage), I (Accommodation and food service activities), J (Information and communication), M (Professional, scientific and technical activities), and N (Administrative and support service activities). At the 3-digit level, there are 204 industries and 36,516 observations, of which 3,574 (9.79%) have missing production values – a much lower percentage than the pre-2008 sample. As in the pre-2008 SBS dataset, coverage varies across countries and sectors, as shown in Table A A.3.[122] In addition, Table A A.4 reports the distribution of missing values within country-industry pairs. With respect to the pre-2008 dataset, there are much fewer concerning cases: only 5.82% of the country-industry pairs have less than 5 years available in their time series.

[122] Sorted by the percentage of missing values: Finland (17.85%), Denmark (17.69%), Slovenia (16.5%), Sweden (13.03%), Belgium (12.99%), Norway (12.91%), Germany (10.87%), Greece (7.43%), France (6.66%), the United Kingdom (5.53%), Portugal (6.5%), Spain (6.37%), Poland (4.41%), Italy (3.92%), and Hungary (3.8%).

Table A A.3. SBS NACE Rev.2 – Raw Data

Sector	Non-Missing	Missing	Total Observations
B (Mining and Quarrying)	1,178 (65.81%)	612 (34.19%)	1,790
C (Manufacturing)	15,282 (89.87%)	1,723 (10.13%)	17,005
D (Electricity, etc.)	438 (81.56%)	99 (18.44%)	537
E (Water supply, waste, etc.)	968 (90.13%)	106 (9. 87%)	1,074
G (Wholesale and Retail)	3,740 (99.49%)	19 (0.51%)	3,759
H (Transp. And Storage)	1,950 (72.63%)	735 (27. 37%)	2,685
I (Accomod. And Food serv.)	1,235 (98.56%)	18 (1.44%)	1,253
J (Inform. And Comm.)	2,202 (94.63%)	125 (5.37%)	2,327
M (Prof. and tech. activities)	2, 6413 (98.36%)	44 (1.64%)	2,685
N (Administrat. And supp. Act.)	3,308 (97.27%)	93 (2.73%)	3,401
Total	**90,21 (90.21%)**	**3,574 (9.79%)**	**35,516**

Note: The table presents statistics on missing and non-missing values for 3-digit industries for the sample of countries included in the analysis (BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE).
Source: OECD calculations.

Table A A.4. Number of missing observations within country-sector pairs

Number of missing years	Number of country-sector pairs	Percent of country-sector pairs	Cumulative share (%)
0	2,283	74.61	74.61
1	210	6.86	81.47
2	116	3.79	85.26
3	77	2.52	87.78
4	66	2.16	89.93
5	46	1.5	91.44
6	44	1.44	92.88
7	40	1.31	94.18
8	27	0.88	95.07
9	21	0.69	95.75
10	34	1.11	96.86
11	34	1.11	97.97
12	62	2.03	100
Total	3,060	100	

Note: Total 3-digit industries for the sample of countries included in the analysis (BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE).
Source: OECD calculations.

The imputation procedure for missing SBS data

Several imputation procedures are used to fill missing values whenever possible. The aim is to fill the gaps in the data while being as conservative as possible in terms of the imputed values. This section describes the steps used to impute the missing values and reports the number of cases filled in by each of them. The steps used to fill in gaps in the data within each country-industry time series – implemented in sequential order are the following:

1. **Accounting Identities:** the hierarchy of industry classifications is used here. Whenever there is only 1 missing 3-digit industry within a 2-digit industry, the difference between the industry and the sum of the non-missing sectors can be assigned to the missing industry. Analogously, in the case

of a missing 2-digit industry, the value of the sum of the 3-digit sectors can be imputed if they are all non-missing.

2. **Interpolation:** if production is missing in one year, the average between the previous and the following year's value is imputed if they are both non-missing.
3. **Pseudo-Propensity Score Matching (Pseudo-PSM):** production is missing in *t* but present in *t-1* and *t-2* so that the growth rate from *t-2* to *t-1* can be computed. First, the growth rate in *t* is proxied using the average growth of that industry in *t* in the five countries that had the closest growth rate in *t-1*. Subsequently, the production value in *t* is imputed by attributing the imputed growth rate in *t* from the first step to the non-missing value in *t-1*.
4. **Regressions:** production is regressed on one of the other available relevant variables (turnover, persons employed, and number of enterprises) within each country-industry. The prediction from the estimated regression coefficients is then used to fill the production missing values. This procedure is carried out separately for each relevant industry-country pair.

Over an initial average of 15.68% missing observations, the imputation procedure adopted allows for the filling in of 10.7% of observations, leaving a final sample with 4.88% missing observations[123]. Whenever possible, accounting identities and interpolation, being more conservative than the other steps, have been used to impute missing values. On average, across NACE Rev.1.1 and NACE Rev.2, these two methods account for about 4% of the imputation of missing values. Pseudo-PSM is used to further fill in 3% of missing observations. This method was chosen among others after a careful assessment in terms of out-of-sample prediction: compared with other regression-type prediction methods, it introduces smaller errors.[124] Finally, regressions, which exploit information from other relevant variables (turnover, persons employed, and number of enterprises), accounted for about an additional 4% of observations.

The following two tables show the number of observations to which each imputation method is applied, as well as the number of observations that are originally non-missing and the number that cannot be imputed. Table A A.5 shows the pre-2008 data, while Table A A.6 shows post-2008 data.

Table A A.5. Imputation on pre-2008 SBS

Imp. Method	Frequency	Percentage	Cum.
Original	18,532	75.84	75.84
Still Missing	2,823	11.55	87.4
Pseudo PSM	1,074	4.4	91.79
Regressions	866	3.54	95.33
Hierarchy	698	2.86	98.19
Interpolation	442	1.81	100
Total	**24,435**	**100**	

Note: these figures are relative only to 3-digit industries in the 15 countries of the final sample (BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE).
Source: OECD calculations.

[123] The weights are given by the relative size of the two samples (pre-2008, 0.41%, and post-2008, 0.59%) in the total SBS sample.

[124] To compute out of sample prediction errors, some original non-missing variables are set to zero, and the error is defined as the difference between original observation artificially removed and the value imputed with the different methods under assessment.

Table A A.6. Imputation on post-2008 SBS sample

Imp. Method	Frequency	Percentage	Cum.
Original	32,939	90.2	90.2
Regressions	1,549	4.24	94.45
Pseudo PSM	878	2.4	96.85
Hierarchy	647	1.77	98.62
Interpolation	407	1.11	99.74
Still Missing	96	0.26	100
Total	**36,516**	**100**	

Note: these figures are relative only to 3-digit industries in the 15 countries of the final sample (BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE).
Source: OECD calculations.

Getting disaggregated and harmonised gross outputs

To obtain harmonised time series for gross output that span over a long time period, are expressed in the same industry classification, and at a very disaggregated level of aggregation, three main steps are implemented. The first two steps, which involve the filled SBS data, aim at getting for each country-industry pair a continuous time series expressed in a single classification, i.e., NACE Rev. 2, for the entire period of interest, 2000-2019. In order to do so, first, the pre-2008 sample is converted from NACE Rev. 1.1 to NACE Rev. 2. Second, to increase the quality and consistency of the data pre- and pos-2008 time series, the converted to NACE Rev. 2 pre-08 data have not been used directly. Instead, they have been used to compute growth rates in each country-industry, and then these growth rates have been used to fill backwards the NACE Rev. 2 series. Finally, 2-digit level NA data were apportioned to the corresponding 3-digit industries using the detailed 3-digit SBS data as weights. These steps are described in more detail in the paragraphs below.

The Conversion Procedure

The conversion of industry classifications from NACE Rev. 1.1 to NACE Rev. 2 follows the correspondence tables available on Eurostat – RAMON, and additional details can be found in the NACE Rev. 2 documentation.[125] Many of the NACE Rev 1.1 industries uniquely map to a single NACE Rev. 2 industry (they are 1-to-1 or n-to-1). However, importantly, there are also many cases where a single or multiple NACE Rev 1.1 industries map to multiple NACE Rev. 2 industries (1-to-m or n-to-m), and these cases represent the most problematic situations to deal with when trying to classify the whole dataset with NACE Rev. 2 classification. The four possible types of correspondences are:

- 1-to-1 correspondences: 195 classes in NACE Rev. 1.1 correspond exactly to one class in NACE Rev. 2 and vice-versa (38%)
- n-to-1 correspondences: 86 cases where two or more classes in NACE Rev 1.1 correspond to one class in NACE Rev. 2 (17%)
- 1-to-m correspondences: 18 cases where one NACE Rev. 1.1 class is split into two or more classes in NACE Rev 2 (3%)
- n-to-m correspondences: 215 cases where two or more classes in NACE Rev. 1.1 correspond to two or more classes in NACE Rev. 2. (42%)

[125] Please refer to Europa - RAMON - Correspondence Tables List; NACE Rev. 2 - Statistical classification of economic activities - Products Manuals and Guidelines - Eurostat (europa.eu)

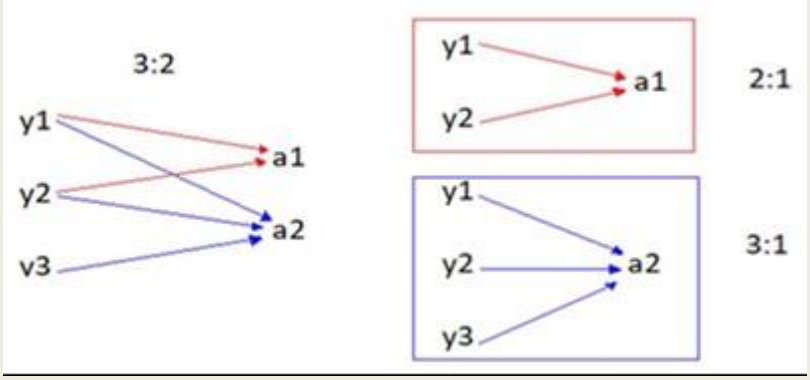
Filling Backward

It is not straightforward to obtain a consistent time series of production for each country-industry for the whole timespan (2000-2019): even for the easiest cases of 1-to-1 or n-to-1 correspondences, the values in the overlapping year in the two datasets, 2008, are not coinciding.[126]

To obtain the most consistent time series possible spanning pre- and post-2008, the procedure put in place aims at considering both the discrepancies between the two datasets and the industry conversion issue simultaneously. Once pre-2008 data (available only in NACE Rev. 1.1) are converted to NACE Rev. 2, they are then used to compute pre-2008 growth rates for each country-industry. Subsequently, they are then applied backwards to the post-2008 time series to obtain a pre-2008 time series consistent in terms of absolute values with the post-2008 while simultaneously keeping into consideration the pre-2008 growth rates. See Box A.1 for further details on the methodology applied and Box A.2 for a practical example of the exercises.

Box A.1. Example of 3:2 Correspondence

This approach allows to overcome challenges related also to all the correspondence cases mentioned before. In the case of n-to-1, where many industries in NACE Rev. 1.1 are allocated to a single industry in NACE Rev. 2, the growth rate of the sum of the n industries is applied backwards to the single industry of NACE Rev. 2. In the case of 1-to-m, where a single industry in NACE Rev. 1.1 is allocated to many industries in NACE Rev. 2, the growth rate of the single industry in NACE Rev. 1.1 is applied backward to all industries in NACE Rev.2. Finally, in the most complicated cases of m-to-n correspondences, the growth rate of the sum of the many relevant pre-2008 industries is applied to each of the relevant post-2008 industries. Consider, for example, the case of a 3:2 conversion, as in the figure below: the three industries y1, y2, and y3 in NACE Rev. 1.1 are converted into two industries a1 and a2 in NACE Rev. 2. This approach uses the growth rate of the sum of y1 and y2 for a1, and the growth rate of the sum of y1, y2, and y3 for a2. Note, therefore, that the growth rate of a1 is not the same as the growth rate of a2.



[126] To provide an illustrative example, NACE Rev. 1.1 industry DA151 is mapped 1-to-1 into industry C101 but the value of production reported for Belgium in SBS NACE Rev. 1.1 is 5508.281 while in SBS NACE Rev. 2 is 5148.8.

Box A.2 Numerical example of filling backwards

As an example, consider industry SBS NACE Rev. 1.1 DA151 that maps 1-to-1 into NACE Rev. 2 industry C101. As an example, data of a country of the dataset for the years 2005-2008 are reported in Table A A.7.The series of industry DA151 (NACE Rev. 1.1, "SBS NACE 1" in the table) breaks after 2008, while the series C101 (NACE Rev. 2, "SBS NACE 2" in the table) is available only from 2008 onwards. The growth rate is calculated for the NACE Rev. 1.1 series as $g_t = {y_t^1}/{y_{t-1}^1}$ ("Growth SBS NACE 1" in the table) and applied to the NACE Rev. 2 series from 2008 backward: $y_{t-1}^2 = {y_t^2}/{g_t}$ ("Final SBS series" in the table).

Table A A.7. Filling Backward Example

	2005	2006	2007	2008
SBS NACE 1 (y_t^1)	4795.7	5147.5	4985.98	5508.28
Growth SBS NACE 1 (g_t)		1.073	0.968	1.104
SBS NACE 2 (y_t^2)	.	.	.	5148.8
Final SBS series	4482.72	4811.56	4660.59	5148.8

Note: industry SBS NACE Rev. 1.1 DA151 that mapped 1-to-1 into NACE Rev. 2 industry C101.
Source: OECD calculations.

The Apportioning Procedure

The final dataset obtained from SBS data contains a measure of gross output (in millions of euros) at the 3-digit NACE rev.2 level for 204 industries and 15 countries from 2000 to 2019. The final step of the procedure is to use this filled SBS dataset to obtain a disaggregated version of the NA data, otherwise available only at the A64 (i.e., slightly more aggregated than the 2-digit level) classification level. In order to get production data at the 3-digit level, the 3-digit SBS data are used to construct shares of the 3-digit industries within each 2-digit industry, which are then used as weights to distribute each 2-digit production data from the NA to 3-digit industries.[127] The 3-digit production data obtained are therefore consistent with NA – which are often based on the population of firms – and at the same time available at the desired level of granularity. The main reason for using the SBS 3-digit production data to apportion the 2-digit ones coming from NA instead of relying directly on them is the following: SBS captures the structure of the economy at a higher level of disaggregation than NA, and the data are representative of the economy within countries but not across countries (due to different methodologies adopted by national statistical agencies). Therefore, SBS is a good source for obtaining long time series of 3-digit weights but cannot be used directly as a source for measuring production in a cross-country context, making NA necessary to guarantee cross-country comparability.

A key point in the methodology is that SBS provides information on production both at the 2-digit and the 3-digit level. Each 2-digit sector is composed of one or more 3-digit industries. Therefore, it is possible to attribute the share of production that each of them represents in the corresponding 2-digit sector. Importantly, these weights are computed within SBS data, giving consistent information. The SBS surveys provide indeed a consistent picture of the within-country economic activity (although, as mentioned, a less

[127] According to NACE rev.2 classification 1-digit, 2-digit, and 3-digit are called, respectively, sections, divisions, and groups. These two nomenclatures will be used interchangeably.

reliable one than NA for cross-country comparisons). These 3-digit level shares are then used as weights to apportion 2-digit NA data into 3-digit industries.

Mathematically, let $GO_{Sct}^{2d\,NA}$ be the 2-digit value of gross output for industry *s* in country *c* and year *t* obtained from the NA data. Then let $GO_{sct}^{3d\,SBS}$ and $GO_{Sct}^{2d\,SBS}$ be respectively the 3-digit and 2-digit gross output obtained from SBS. The NA apportioned values at the 3-digit level are calculated as:

$$GO_{sct}^{3d\,NA} = \frac{GO_{sct}^{3d\,SBS}}{GO_{Sct}^{2d\,SBS}} \times GO_{Sct}^{2d\,NA} \qquad \text{Equation 18}$$

Box A.3 Example on the apportioning procedure

The 2-digit sector C17 contains two 3-digit industries: C171 and C172.[128] The share of sector of C17 accounted by industry C171 is defined according to the formula (suppressing country-year index for clarity):

$$\theta_{C171} = \frac{SBS_{C171}^{3}}{SBS_{C171}^{3} + SBS_{C172}^{3}} \qquad \text{Equation 19}$$

and therefore the 3-digit National Account output is given by: $NA_{C171}^{3} = \theta_{C171} * NA_{C17}^{2}$.

Table A A.8 reports the numerical example where the definition is applied to obtain 3-digit National Account output.

Table A A.8. Apportioning Example

Industry	C17	C171	C172
Production (SBS)	16756	6166.7	10589.3
Share (θ)	-	0.3681	0.6319
Production NA (NA)	15941	-	-
3-digit NA	**-**	**5867**	**10074**

Note: Apportioning of Manufacture of paper and paper product for France in 2014 (Gross Output in Millions of Euros).
Source: OECD calculations.

Summary of final sample for production

Given the number of initial missing values in some countries and industries, the final sample has been restricted to 15 countries: Belgium, Bulgaria, Germany, Denmark, Spain, Finland, France, Greece, Hungary, Italy, Norway, Poland, Portugal, Slovenia, Sweden, and the United Kingdom. It includes 204 industries over 20 years (2000-2019). There are 61,200 observations, out of which 3,885 (6.35%) are missing. The missing values are concentrated in country-industries combinations where either the whole series is missing or the first ten years are missing (those coming from SBS NACE Rev. 1.1). For a complete list of the 151 industries belonging to the final sample of production and their respective geographical buckets of belonging, please refer to Table A B.1.Table A B.1 Due to reasons of compatibility with trade data and lack of data in certain 3-digit industries in SBS some industries in the final production sample

[128] These industries are, respectively, Manufacture of paper and paper products (C17), Manufacture of pulp, paper and paperboard (C171), and Manufacture of articles of paper and paperboard (C172).

have different level of aggregations: out the 151 industries, 133 (88%) are 3-digit, 13 (9%) are 2-digit, and 5 (3%) are 1-digit or above.

International trade data

Inter-Country Input-Output (ICIO) data

The ICIO tables are produced by the OECD and provide information on the production and use of each industry in each country (OECD (2021[102])). They are available for the years 1995-2020, covering 45 industries and 66 countries (as well as the aggregated "rest of the world"). They provide data on balanced trade flows, which account for re-export and re-import; the data are reported at basic prices.

Given that the ICIO data is presented at the level of producing country-industry by using country-industry, it is necessary to compute exports and imports by aggregating across certain sets of countries and industries. Exports are computed from the ICIO matrices by taking the sum over supplier industry-countries across using industry-countries (to account for all the exports used as intermediates abroad) as well as final foreign demand (to account for all exports purchased by consumers), excluding cases where the supplier country is the same as the consuming country (to exclude the part of production that is not traded internationally). Imports are built by taking the sum across supplying countries and using-industries to construct imports of each industry, plus final demand.

Base pour l'Analyse du Commerce International (BACI) goods trade data

Data on trade in goods are obtained from BACI at the 6-digit Harmonised System (HS) 1996 Classification (Gaulier and Zignago (2010[103])). It is available for 200 countries and around 5,000 products. BACI is collected from United Nations Comtrade. It applies basic cleaning to ensure that trade flows are balanced and removes transport costs.[129]

A crosswalk, developed for the OECD Trade in Value Added (TiVA) project (OECD, 2021[102]), is used to map goods products into ISIC Rev. 4, 4-digit manufacturing industries. These ISIC industries are then converted into NACE Rev. 2, 3-digit industries. There are only six cases where one 4-digit ISIC code becomes many (two or three) 3-digit NACE codes. Weights are constructed using aggregated production data for the full country and year sample to distribute trade values from ISIC to NACE in these cases. Therefore, for these six industries, the value of trade is apportioned from the aggregated ISIC code to the disaggregated NACE code in proportion to the average shares of production in each of the disaggregated sectors for the relevant country.

The parts of products that contain residual waste as defined by the old classification of ISIC are excluded. For the small number of cases where products cannot be allocated to a single 4-digit ISIC sector, the 2– or 3-digit level trade are distributed to 4-digit sectors based on the share of trade going to each 4-digit sector within the higher aggregation (within a country-partner-year). For example, if 3-digit sector 111 has two subsectors, 1111 and 1112, and there is some trade for product 111X meaning it cannot be allocated uniquely to 1111 and 1112, its value is distributed to 1111 and 1112 based on their relative size in terms of its trade value (within the country-partner-year).

[129] For more details, see:

http://cepii.fr/cepii/en/bdd_modele/bdd_modele_item.asp?id=37#:~:text=Description%20BACI%20provides%20data%20on%20bilateral%20trade%20flows,to%20the%20%22Harmonized%20System%22%20nomenclature%20%286%20digit%20code%29

Trade in Services by Partner Country (TISP) services trade data

Services trade data are obtained from the OECD TISP dataset,[130] which provides bilateral trade data for disaggregated services categories as reported by countries for their Balance of Payments. It is reported in two separate datasets according to the product classification. These are EBOPS 2002, which has data covering 1998 to 2012 (though with variable coverage) and EBOPS 2010, which has data for 2010-2020. Each of these classification systems must be matched to NACE Rev. 2 industries.

Converting services products to industries

To link EBOPS 2010 with NACE Rev. 2 industries, two crosswalks from UNSTAT were used. The first crosswalk links EBOPS 2010 to Central Product Classification (CPC) 2.0, and the second links CPC 2.0 products to NACE Rev. 2 industries. Combining these two sources provides a crosswalk from EBOPS 2010 to NACE Rev. 2. Some manual adjustments to the resulting crosswalks are then made to obtain an m:1 concordance for all services products, except for "other business services not included elsewhere" which maps to many industries and is treated somewhat differently (see the next sub-section). The manual adjustments include removing potential matches for many-to-many cases where the description does not match, but there is an alternative match with a (close to) exact match. In addition, some NACE industries are aggregated to match the level of aggregation available in the trade data. Each of the manual adjustments is described in detail in Table A A.9. Note that there are three products that it is impossible to match to the NACE classification system ("Manufacturing services on physical inputs owned by others", "Maintenance and repair services n.i.e.", "Space transport"). In these cases, the values of trade are not included in the analysis.

For the EBOPS 2002 data, the necessary mappings are provided by the IMF to convert EBOPS 2002 to EBOPS 2010 and then relate each code directly to its NACE revision 2 analogue. There are three cases with 1:m matches. For these, the value of trade for EBOPS 2002 products is distributed to EBOPS 2010 products according to the country-partner specific trade shares observed in the EBOPS 2010 data. For example, the EBOPS 2002 code "computer services" goes to both "computer services" and "software publishing" in EBOPS 2010. For each country-partner, the value of trade is aggregated over all the years in the EBOPS 2010 data (2010-2020), and the share of each of computer services and software publishing is computed in their total. These shares are then used to distribute the two services in the EBOPS 2002 data.

Table A A.9. Manual adjustments to crosswalk for EBOPS to NACE rev 2

EBOPS 2010 service	Adjustments made
1 Manufacturing services on physical inputs owned by others	Cannot be matched to NACE
2 Maintenance and repair services n.i.e.	Cannot be matched to NACE
3.4 Postal and courier services	NACE codes 531 (Postal activities under universal service obligation) and 532 (Other postal and courier activities) are aggregated to 53
3.5 Space transport	Cannot be matched to NACE
3.6.1 Passenger rail transport	Matches to both NACE 491 (Passenger rail transport, interurban) and NACE 493 (Other passenger land transport). The match is imposed to be unique to 491.
3.8.1 Passenger inland waterway transport	Matches to both NACE 501 (Sea and coastal passenger water transport) and 503 (Inland passenger water transport). The match is imposed to be unique to 503.
3.11 Other supporting and auxiliary transport services	Imposed to match only to 2-digit NACE code 52, which includes 521 (Warehousing and storage) and 522 (Support activities for transportation)
5 Construction	Matches to aggregate NACE 41 to 43

[130] OECD Trade in Services by Partner Economy (TISP dataset)

EBOPS 2010 service	Adjustments made
8.3 Licenses to reproduce and/or distribute computer software	Matches to both NACE codes 581 (Publishing of books, periodicals and other publishing activities) and 582 (Software publishing). The match is imposed to be unique to 582.
8.4.1 Licenses to reproduce and/or distribute audio-visual products	Matches to NACE codes 581 (Publishing of books, periodicals and other publishing activities), 591 (Motion picture, video and television programme activities), 592 (Sound recording and music publishing activities), 900 (Creative, arts and entertainment activities). The match is imposed to be unique to 59, an aggregation of 591 and 592.
8.4.2 licenses to reproduce and/or distribute other products	Matches to NACE codes 581 (Publishing of books, periodicals and other publishing activities), 591 (Motion picture, video and television programme activities), 592 (Sound recording and music publishing activities), 774 (Leasing of intellectual property and similar products, except copyrighted works). 900 (Creative, arts and entertainment activities). The match is imposed to be unique to 774.
9.1 Telecommunications services	Imposed to match only to 2-digit NACE code 61 (Telecommunications)
9.2.2 Other computer services	Imposed to match only to an aggregation 2-digit NACE codes 62 (Computer programming) and 63 (Information services)
9.3 Information services	Imposed to match only to an aggregation 2-digit NACE codes 62 (Computer programming) and 63 (Information services)
10.1 Research and development services	Imposed to match only to 2-digit industry 72 (Scientific research and development)
10.2.1.2 Accounting, auditing, bookkeeping, and tax consulting services	Matches to NACE codes 692 (Accounting, bookkeeping and auditing activities; tax consultancy) and 702 (Management consultancy activities). Imposed to match only 692.
10.2.1.3 Business and management consulting and public relations services	Matches to both 701 (Activities of head offices) and 702 (Management consultancy activities). Aggregate 701 and 702 to 2-digit level (70).
10.2.2 Advertising, market research, and public opinion polling services	Matches to NACE codes 581 (Publishing of books, periodicals and other publishing activities),601 (Radio broadcasting),602 (Television programming and broadcasting activities),631 (Data processing, hosting and related activities; web portals),731 (Advertising), 732 (Market research and public opinion polling), and 742 (Photographic activities). Imposed to match to 2-digit code 73.
10.3.1.3 Scientific and other technical services	Matches to NACE codes 711 (Architectural and engineering activities and related technical consultancy), 712 (Technical testing and analysis), 743 (Translation and interpretation activities), 749 (Other professional, scientific and technical activities n.e.c.). Imposed to match to 2-digit code 71.
10.3.2.1 Waste treatment and de-pollution	Matches to NACE codes 370 (Sewerage), 381 (Waste collection), 382 (Waste treatment and disposal), 383 (Materials recovery), 390 (Remediation activities and other waste management services), 812 (Cleaning activities). Imposed to match uniquely to the aggregated classification of all sectors between 370 and 390.
10.3.2.2 Services incidental to agriculture, forestry and fishing	Matches to NACE codes 016 (Support activities to agriculture and post-harvest crop activities), 017 (Hunting, trapping and related service activities), 024 (Support services to forestry), 031 (Fishing), 032 (Aquaculture), 091 (Support activities for petroleum and natural gas extraction),099 (Support activities for other mining and quarrying),711 (Architectural and engineering activities and related technical consultancy),750 (Veterinary activities),931 (Sports activities),960 (Other personal service activities). Imposed to match only to the aggregated NACE industries 011 to 039.
10.3.3 Operating leasing services	681 (Buying and selling of own real estate), 682 (Rental and operating of own or leased real estate), 771 (Rental and leasing of motor vehicles), 772 (Rental and leasing of personal and household goods), 773 (Rental and leasing of other machinery, equipment and tangible goods), 774 (Leasing of intellectual property and similar products, except copyrighted works). Imposed to uniquely match to the 2-digit sector 77.
10.3.4 Trade-related services	Imposed to match to the wholesale and retail sectors (aggregated 2-digit NACE industries 45-47).
11.1.1 Audio-visual services	Matches to 591 (Motion picture, video and television programme activities), 592 (Sound recording and music publishing activities), 601 (Radio broadcasting), 602 (Television programming and broadcasting

EBOPS 2010 service	Adjustments made
	activities),772 (Rental and leasing of personal and household goods). Imposed to match to only the aggregated sectors 591 to 602.
10.3.5 Other business services n.i.e.	See main text for discussion of how this service is treated. Matches to NACE codes: 741; 742; 743; 749; 781; 782; 783; 791; 799; 801; 802; 803; 821; 822; 823; 829

Note: The table shows the manual adjustments made to the correspondence for each services trade product in the EBOPS 2010 classification to match to the NACE rev 2 classification system.

Allocating "other business services not included elsewhere"

To deal with the service category "other business services not included elsewhere", which maps to many industries, the following procedures are used.

For exports, "other business services not included elsewhere" is apportioned to each of its associated NACE industries based on the exporting country's production share in each NACE industry. For example, assume that the United Kingdom exports 10 million of "other business services not included elsewhere" to Italy in 2015 and it produces 30 million of specialised design services, 20 million of translation services and 0 for all other potential industries in "other business services not included elsewhere". Then, 6 million of its other business service exports are apportioned in specialised design, while the other 4 million in translation services.

For imports of "other business services not included elsewhere", the analogue of the exports procedure is used with one difference: the production of the source countries is weighted by their import share importance of the importing country (instead of simply using the production of the exporting country). That is, for importing country *c*, partner (exporting) country *p*, industry *s*, at time *t*, the weighted production of foreign partners is computed according to

$$WeightedProduction_{sct} = \sum_{p} \frac{Imports_{cpt}}{\sum_{c} Imports_{cpt}} \times Production_{spt} \qquad \text{Equation 20}$$

Then, this weighted production is used to distribute other business service imports across industries. The production variable of other countries is preferred as it is likely to be a better indicator of the import share than the industries that a country produces itself.[131]

Additional cleaning

Additional cleaning is carried out on all the services trade datasets. First, the data is reported in national currency, euros, and dollars (or one or two of these). The Euro value is taken where available and, if not, the converted dollar value is used; finally, if the value is still missing, the converted value of the national currency is used. Second, a similar sequential exercise is performed to obtain the value of trade with the EU and the world aggregate, first taking the reported values with the EU or world aggregate, respectively, and then using various other information to fill in any missing values such as the computed sum over all countries in the respective group. Third, services trade values with other tax havens are excluded, given the prevalence of profit shifting by multinationals using within-firm-group services trade.[132] Fourth, for the period 2010-2012, data is available from both EBOPS 2002 and EBOPS 2010. For this period, data for EBOPS 2010 are used as they have higher quality. Fifth, negative trade values are dropped. Sixth, if the

[131] This is because it is not clear whether imports should be positively correlated with domestic production, unlike for the analogue case of exports, where a positive correlation is expected.

[132] Tax havens are defined according to the Congressional Research Service (CRS report).

reported value of trade with the EU is greater than the value of trade with the world for any country-industry-year, the value of trade with the world is replaced with the value of trade with the EU.

The final piece of cleaning conducted on the services trade data deals with issues in the aggregation of reporting. Specifically, some countries (or country-partner-years) only report higher aggregations of services trade products, while detailed services categories are required for the mapping to NACE. This is particularly an issue for Spain and the United Kingdom. To obtain disaggregated data, the mirror flows observed in the data are used to redistribute aggregated reported trade to more disaggregated service categories according to the trade shares of the mirror flows. That is, in the data, it may be that the United Kingdom only reports exports of "Legal, accounting, management consulting, and public relations services" to Italy in 2015 but, for Italy, imports of the same services from the United Kingdom are reported (the "mirror flows"), as well as the more disaggregated sub-categories: "Legal services"; "Accounting, auditing, bookkeeping, and tax consulting services"; and "Business and management consulting and public relations services". In cases such as this, the mirror flows data reported by Italy are used to construct shares that distribute the United Kingdom's reported aggregate level trade among the more detailed sub-categories.

Firm-level financial data

This section summarises the cleaning procedures applied to the Orbis dataset used in the report. Orbis data have been used for two main purposes: i) identifying the top firms in a market in order to compute concentration, leadership ratio and entrenchment measures, and ii) for markup estimation. While the initial database is the same, some different cleaning procedures have been adopted for the two purposes. Both are described in this Annex.

As explained in Section 3, financial information within Orbis is available both at the business group-level (consolidated financial data aggregated across subsidiaries belonging to the same owner) and at the individual firm-level (unconsolidated information referring to an individual firm). In this report, unconsolidated accounts are used in the analysis.[133] Consolidated accounts are used only in two cases in which they can be considered equivalent to unconsolidated accounts: for independent firms (i.e., firms that are not part of a business group), and for subsidiaries at the bottom of the ownership hierarchy (subsidiaries not owning further subsidiaries) that do not have unconsolidated accounts, because for such firms consolidated and unconsolidated accounts coincide.

In the following two sub-sections, additional details on the data cleaning preparation for the two different samples are provided.

Sample for concentration and entrenchment

The methodology outlined in Section 4 shows how computing concentration and entrenchment require good coverage of business groups and individual subsidiaries' financial information. To ensure that all economic activity of each group's subsidiaries is captured, information for firms of all sizes and in all sectors is used.[134]

[133] As explained in Section 4, the measures of concentration and entrenchment built in this report look at business group activities rather than at single firms. The approach adopted in this study fundamentally relies upon unconsolidated data of the individual subsidiaries within a business group, to identify the precise industry and location of all the subsidiaries belonging to a group, and correctly apportion the group sales to the markets in which the business group is active.

[134] Note that this sample is used at an initial stage of the data construction in an attempt to consider the worldwide sales of business groups across all sectors in which they are active. This is important because it allows to have similar numbers when comparing the consolidated accounts of the headquarters and the sum of the unconsolidated sales of

Following Bajgar et al. (2023[1]), some steps are taken to improve the coverage of the data (see Bajgar et al. (2019[7]) for a discussion on the impact of these steps on the sample). First, the coverage of Orbis has been expanded by using available consolidated information to infer missing years in the unconsolidated information of the same firm and vice-versa. Second, to increase the coverage of consolidated accounts of listed firms, the Worldscope database has been used. Worldscope is merged with Orbis through firms' International Securities Identification Number (ISIN) numbers, which uniquely identify listed firms. For some countries, such as the United States, Worldscope can improve substantially Orbis coverage. The same cleaning rules used for Orbis data have been applied to Worldscope data. Worldscope reports consolidated financial data and contains very similar values to Orbis consolidated data for observations present in both datasets.[135]

As discussed in Section 4, the methodology developed to aggregate sales across all subsidiaries operating in a given market only uses unconsolidated sales of each firm. Consolidated accounts are used only to correct the unconsolidated information in cases where the total subsidiary sales exceed group sales (presumably due to inter-company transactions) or where unconsolidated data are missing. In the latter case, if a headquarter company always reports consolidated accounts but unconsolidated accounts only in some years, the missing years in the unconsolidated accounts are interpolated using growth rates of the consolidated accounts and assuming a constant share of unconsolidated accounts relative to consolidated accounts.

Sample for markups

The computation of markup requires high-quality firm-level data on several variables. Specifically, information on revenues and input costs, which include the cost of employees, materials, and capital, is required for the estimation of the firm production function from which firm markups are derived (see Section4). Therefore, following the literature on markup estimation (Calligaris et al. (2024[2]), De Loecker et al. (2018[15]), De Ridder et al. (2021[82]), some additional data cleaning on Orbis data is necessary.

The relevant variables are deflated by their corresponding purchasing power parity-adjusted country-industry sector-year specific deflator, which is obtained from OECD STAN and OECD SNA, and are available at 2-digit level. When no information is available at such disaggregated level, more aggregated level information is used to fill in the missing data.[136] More specifically, gross output is deflated by the gross output deflator, cost of materials by the intermediate input deflator, and investment and capital by the gross fixed capital formation deflator, all expressed in 2005 Euro prices. Given the high share of missing values in the variable reporting the number of employees (approximately 43%), the wage bill has been preferred as labour input when estimating the production function, and it has been deflated by the Average Compensation per Employee.

In the same spirit of maximising the coverage of the dataset, the variable used for material inputs is not material costs as reported directly in the Orbis dataset, but it has been calculated on the well-known accounting identity (materials =Operating revenue turnover – ebitda – cost of employees), which relies on variables with higher coverage (see Gal (2013[67]) for further details). Following Gal (2013[67]), missing observations on the main selected variables, such as value-added and cost of materials, have been imputed, whenever possible, exploiting information on analogue versions of these variables available in

all their subsidiaries. Subsequently, as explained in Section 3, due mainly to data coverage and comparability across countries, the sample of countries and industries is restricted to those specified in the report.

[135] See Bajgar et al. (2019[7]) for a discussion on the comparability between the two sources for firms present in both databases.

[136] For more information, see OECD STAN and OECD National Account Statistics.

the dataset. Missing values for the variables of interest are replaced by their lagged value multiplied the yearly growth of alternative versions of the same variable.

While big firms are relatively well covered in Orbis, for smaller firms it is less the case (see Bajgar et al., (2020[81])). Since many countries only report information for firms with more than 20 employees (Bajgar et al. (2020[81])), in line with Calligaris et al. (2024[2]), firms with an average number of employees in the period considered lower than 20 are excluded from the sample to maximise comparability across countries. By excluding these firms, Bulgaria, Romania, Sweden, and Latvia lose around 90% of observations, while a smaller share of firms is dropped in other countries.

Subsequently, only countries with at least 500 usable observations in total are kept in the sample. The countries included in the markup analysis are: Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Poland, Portugal, Romania, Slovenia, Slovak Republic, Spain, Sweden and the United Kingdom. In terms of sectoral coverage, the analysis focuses on mining, manufacturing, non-financial market services (excluding real estate) and utilities industries at the 3-digit level of aggregation (following the NACE Rev. 2 classification) for a total of 204 industries. The final sample has 5 002 739 observations in total.

The estimation of the production function in each of the 204 3-digit industries was done over the pooled 2000-2019 period and across the 23 countries. In addition to theoretical considerations (see Annex B), pooling observations over time allows to maximise the coverage of sectors. Finally, as is standard in the literature (Calligaris et al. (2024[2]), De Loecker et al. (2020[3]), De Ridder et al. (2021[82]), before estimating the production function, the 1% tails in the share of materials in sales each year are trimmed, and post-estimation, markups estimates are trimmed at the 3rd and 97th percentiles of their distribution to remove outliers. Table A A.10 provides some summary statistics on the distribution of estimated markups and key balance sheet variables used in the estimation. In different robustness checks discussed in Section 5 and reported in 0, the sensitivity of the results to trimming and alternative specifications of the production function are assessed.

Table A A.10. Markup and Balance Sheet Variables

	Mean	Min	10th Pct.	Median	90th Pct	Max	N
Markup	1.22	0.72	0.86	1.07	1.78	3.37	5,002,739
Materials Share	0.66	0.14	0.37	0.69	0.90	1.24	5,002,739
Materials	44.8	0.0002	0.73	6.05	56.8	205,000	5,002,739
Gross Output	57.7	0.0004	1.53	9.22	75.8	201,000	5,002,739
Capital	13.7	0.00	0.06	0.98	12.8	115,000	4,959,350
Cost of Employees	249.83	0.00	7.73	59.73	369.0	515,603.1	4,971,251

Note: Observations with non-missing markup, trimmed at the 3rd and 97th percentile. Values for Materials, Gross Output and Capital are expressed in millions of 2005 Euros in PPP adjusted terms. Firms with more than 20 employees on average. Data from AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE. and the United Kingdom; 2000-2019.
Source: Oecd calculations.

Sample for Concentration and Entrenchment

The final sample used for studying concentration measures and entrenchment spans 20 years (2000-2019) and is composed of 127 distinct industries allocated to the three different geographical buckets (27 are domestic, 80 are European, and 20 are global). Out of these, 112 (88%) are 3-digit, 10 (8%) are 2-digit, and 5 (4%) are aggregation of two or more 2-digit. The difference in the number of industries included in the production sample is due essentially to combined data limitation either in Orbis at the firm-level, or in

gross output at the industry-level or in the trade data.[137] In particular, a number of sectors that might be relevant from a competition perspective – either because structurally oriented towards high concentration levels or because historically under the lens of competition authorities – had to be excluded due to severe data limitations both at the numerator and at the denominator of the concentration measure.

Ownership data

As explained in Section 4, the business group structure is used to apportion the overall sales of the group across all the relevant market where it is active. To do so requires detailed ownership information on parent-subsidiary linkages. The primary source of firm ownership information is Orbis, which is supplemented with data from the Zephyr database of Mergers and Acquisitions (M&As). Importantly, both datasets are provided by Moody's and share a common firm identifier, which allows the merging of the two datasets.

Orbis contains comprehensive information on ownership linkages among firms, extensively used in the existing literature (Cravino and Levchenko (2017[104]), Fons-Rosen (2021[105])), which allows to detail ownership linkages between shareholders and their subsidiaries, as well as the identity of the global ultimate owner of subsidiaries (calculated at each calendar year from 2007 until 2020). The global ultimate owner is defined as the firm owning at least 50.01% of the total shares of a subsidiary. This is a commonly used threshold for the definition of control of another firm and, thus, to understand whether the subsidiary's financial information is consolidated into the parent accounts.

To calculate ultimate owners, Orbis uses the tree of ownership linkages for each firm and year. They identify each for each firm its shareholder (the immediate owner), then the shareholder's shareholders and so on. So, for each firm, they start at the bottom and work up the tree of ownership linkages until they find a shareholder that is independent (not controlled by anyone) or controlled by an individual. That shareholder is classified as the ultimate owner of the subsidiary firm at the bottom of the tree.

However, in Orbis, the data primarily start in 2007 and later for some firms. Thus, the main data source is complemented with the Zephyr M&A database to measure earlier changes in ownership, enabling the construction of a series starting as early as 2000 whenever data allow, as discussed in the following sub-sections.[138] The Zephyr database contains deal-level information on M&As from 1997 onwards for European firms, from 2000 onwards for North American firms, and for other geographic areas from 2003. Overall, Zephyr contains about 2 million M&A deals from 2000 to 2020.

In the following sub-sections, a summary of the methodology is provided. For further details and a more complete discussion, please refer to Bajgar et al. (2019[7]), (2023[1]).

[137] The industries excluded from the concentration sample with respect to those listed in Table A B.1 are 051, 052, 06, 07, 120, 253, 268, 304, 351, 495, 691, 692, 70, 741, 742, 743, 749, 750, 811, 813, 821, 822, 823, 829 (see Table A B.1 of Annex B: Additional details on the methodology for the sectors descriptions). It is worth noting that including some of these industries, such as, 051 "Mining of hard coal", 052 "Mining of lignite", 06 "Extraction of petroleum and gas", 07 "Mining of metal ores", 120 "Manufacture of tobacco products", and 351 "Electricity power generation", might have increased the *average level of concentration*, since they usually are rather concentrated industries, while the effect on *the trend over time* would have been ambiguous.

[138] Whilst ultimate ownership data starts in 2007, for some firms it is not available until later years. Common approaches to correcting for this in the literature are either to assume that firms without an Orbis ultimate owner are independent or to take data from a recent year – assuming ownership has not changed over time. Both approaches are problematic. With increasing coverage of ownership over time in Orbis, the former approach will falsely equate missing data with independence and lead to an overstatement of ownership changes over time. The latter approach will lead to an understatement of ownership changes over time and will typically overstate the number of markets and countries in which a firm operates.

Identifying business groups

The procedure to clean and harmonise Orbis and Zephyr relies on the work of (Bajgar et al. (2023[1]). Following their approach, several steps are undertaken to expand the coverage of the ultimate owner from Orbis. The first step is to use Zephyr to identify changes in immediate (rather than global ultimate) owners not available from Orbis. For each deal, Zephyr contains information on the target, acquirer and vendor firms. About 700,000 deals represent either changes in majority ownership – such as a firm increasing from 10% to 51% equity ownership – or a majority owner further increasing its stake – such as a firm increasing from 51% to 60% ownership. Both types of deal allow to identify the immediate owner of each target firm at the time of the deal. Furthermore, for changes in majority ownership – when the target firm switches hands – the vendor firm represents the previous immediate owner.

A second step is to use the information available from the table "current" Orbis linkages, which provides direct and indirect ownership linkages. These are used to retrieve the identity of the ultimate owner in cases where the latter is missing but it is possible to identify a shareholder with indirect share higher that 50.01%.

The third step is to translate the changes in immediate owners (from the first two steps above) to changes in the ultimate owner. The immediate owner who acquired the target firm may not be the ultimate owner. To find the ultimate owner, the same procedure used by Orbis is followed. Zephyr's immediate owner and available information on ownership linkages are combined to find the shareholders of the immediate owners, the shareholders of their shareholders, and so on. The 50.01% criterium is used until the procedure arrives at a shareholder that is either independent or controlled by an individual. This final shareholder is deemed the ultimate owner.

The fourth step is to impute missing years of ownership information and information and roll the owner backwards and forwards until there is an M&A or change in ownership (from the steps above). The additional information on ownership changes allows to roll the ownership information forwards and/or backwards until there is a change in owner, rather than simply assuming that a missing ultimate owner implies independence between firms. For example, if firm C is the ultimate owner of firm A in 2010, and from Zephyr M&A data it is know that firm A was acquired in 2008, then the ultimate ownership information is rolled backwards until 2008. Moreover, in about half of the acquisition cases in the M&A sample, it is also known that firm A was acquired from vendor firm B in 2008, so it is possible to infer that firm B was the (immediate) owner of firm A, and roll back further until an earlier M&A transaction.

Data cleaning

Numerous steps are undertaken to identify and correct potential issues in the ownership data, especially to identify missing linkages among the largest firms. Spot-checking revealed that some large firm groups have been missing ownership linkages between the parent firm and their subsidiaries for some years. This can be problematic because it can lead to double counting of group activity, with both the parent's consolidated financials and their subsidiary information included as separate groups.

Accordingly, the following checks are undertaken to mitigate this risk. First, ultimate owners that are themselves majority-owned by another firm cannot be true ultimate owners and are therefore adjusted in the data. Second, temporary (one or two years) deviations in ultimate owner relationships, whereby a firm's ultimate owner changes for just one or two years and then reverts to its previous owner, are removed, as this is an unusual phenomenon in ownership and is most likely to be measurement error. These two steps affect approximately 10,000 firms per year.

Third, to detect missing linkages, large firms that change from having no subsidiaries to a large number of subsidiaries from one year to the next are examined and manually updated, if necessary. Spot-checking revealed cases of intermediate holding companies (that often have no financial information) being temporarily incorrectly identified as the ultimate owner. To address this issue, large groups of subsidiaries

(in terms of sales) that have a parent with no financials but switch to a new parent in the following period that does have financials are examined manually. Cases of M&As identified by Zephyr have been excluded, and only cases where more than 90% of subsidiaries transfer to the new parent have been considered. The 1500 largest groups identified, corresponding to groups with sales larger than 10 million Euro, have been corrected in the following way. For the 150 largest groups, each group has been manually inspected against their financial statements, while for other groups a name-matching algorithm has been used to semi-automate the identification of whether the prior owner was in fact a holding company of the new parent. Those with very similar names have been considered as part of the same group, correcting 147 groups.

Fourth, large firms that never have any subsidiary and, vice-versa, large groups of subsidiaries that never have a parent with financials are examined to identify missing links. This builds on the previous step, identifying large groups of subsidiaries that never have a parent with financials and large parents that never have subsidiaries. In total, 1,031 parents with sales of more than 1 billion Euros that never have subsidiaries have been found, and 251 groups of subsidiaries with more than 1 billion Euros of sales that never have a parent with financials. Again, a name-matching algorithm has been used to semi-automate the identification of whether the prior owner was, in fact, a holding company of the new parent. This process applies to cases of groups (large groups of subsidiaries or large parents) with sales larger than 40 million and treats those with very similar names as part of the same group. In total, based on visual inspection of the name-matching string-matching similarity, 287 groups per year have been corrected.

Fifth, missing links where there are ownership changes among firms with very similar names – and are so very likely part of the same group (e.g., ABC Motors acquired by ABC Motors Thailand) – are identified and corrected. This considers any ownership change where the owners have a similar root to their name (e.g., “XYZ Inc” and “XYZ Plc”). These remaining firms are not large or do not have completely missing subsidiaries; if they had, they would have been encompassed in the earlier cleaning steps. These firms are, therefore, somewhat less problematic for the resulting concentration metrics. Given this reduced risk and the fact that all firms in the data are considered as part of this step, an automated check using name-matching is carried out, which requires an identical match of the cleaned name. Common company type abbreviations (e.g., Plc, Ltd, SA, Gmbh, etc.), country names (e.g., ABC (Viet Nam) Ltd) and punctuation are removed, and the resulting root of the name is required to be identical. The global ultimate owner is modified only when the ownership change involves two companies with almost exact name and the ownership change happens between one ultimate owner that has financials and the other one that has no financials. In total, approximately 5,000 cases are corrected.

Finally, a further check for groups with total gross output (considered as the sum of the unconsolidated accounts of all its subsidiaries) in a given country, industry, and year larger than 150 million Euro is conducted. Within this subset of business groups, firms with similar names in the same country and industry are checked using a string-matching algorithm to select relevant cases. As this algorithm captures situations where the ownership tree is partially missing some links, the spotted cases might be particularly relevant for concentration measures. For example, the company ACCO brands Europe was reported as a GUO, while it is part of the group ACCO Brands Corporation. Both were active in the same country-industry and year, leading therefore to a downward biased measure of concentration. In this situation, there are two groups (or simple firms), both with large revenues but that do not have a complete ownership structure. The subsample of GUOs with similar names and active in the same year has been manually inspected in order to understand when the GUO was indeed the same, correcting approximately 300 cases.

Euromonitor data

Table A A.11 Product markets in Euromonitor data

Product	Industry	Taxonomy	Product market value	Product's share of industry
Processed Meat	101: Meat processing	Domestic	368907.6	1
Processed Seafood	102: Fish processing	European	139627.1	1
Asian Speciality Drinks	103: Fruit processing	European	245.0884	0
Concentrates	103: Fruit processing	European	17556.09	0.05
Frozen Processed Fruit and Vegetables	103: Fruit processing	European	53810.61	0.15
Fruit Snacks	103: Fruit processing	European	11241.46	0.03
Jams and Preserves	103: Fruit processing	European	17752.21	0.05
Juice	103: Fruit processing	European	110466.5	0.31
Nut and Seed Based Spreads	103: Fruit processing	European	2127.442	0.01
Nuts, Seeds and Trail Mixes	103: Fruit processing	European	37248.7	0.1
Popcorn	103: Fruit processing	European	2729.349	0.01
Potato Chips	103: Fruit processing	European	48579.42	0.13
Shelf Stable Fruit and Vegetables	103: Fruit processing	European	57959.69	0.16
Tofu and Derivatives	103: Fruit processing	European	634.1403	0
Cooking Fats	104: Oils	European	2108.217	0.03
Margarine and Spreads	104: Oils	European	29444.57	0.42
Olive Oil	104: Oils	European	38059.57	0.55
Butter	105: Dairy	Domestic	43824.2	0.06
Coffee Whiteners	105: Dairy	Domestic	603.5888	0
Cream	105: Dairy	Domestic	34608.25	0.05
Flavoured Milk Drinks	105: Dairy	Domestic	11580.58	0.02
Fresh Milk	105: Dairy	Domestic	64620.1	0.09
Fromage Frais and Quark	105: Dairy	Domestic	29166.08	0.04
Hard Cheese	105: Dairy	Domestic	165535.1	0.22
Ice Cream	105: Dairy	Domestic	105618.1	0.14
Powder Milk	105: Dairy	Domestic	1110.592	0
Processed Cheese excl Spreadable	105: Dairy	Domestic	11923.4	0.02
Shelf Stable Milk	105: Dairy	Domestic	69599.22	0.09
Soft Cheese	105: Dairy	Domestic	76996.07	0.1
Sour Milk Products	105: Dairy	Domestic	6052.973	0.01
Spreadable Cheese	105: Dairy	Domestic	26422.81	0.03
Yoghurt	105: Dairy	Domestic	111622.5	0.15
Children's Breakfast Cereals	106: Grains	European	12899.77	0.2
Family Breakfast Cereals	106: Grains	European	26325.43	0.41
Hot Cereals	106: Grains	European	4403.065	0.07
Rice	106: Grains	European	20578.03	0.32
Bread	107: Bakery	Domestic	357603.2	0.47
Cakes	107: Bakery	Domestic	131818.1	0.17
Frozen Desserts	107: Bakery	Domestic	10169.8	0.01
Noodles	107: Bakery	Domestic	7434.592	0.01
Pasta	107: Bakery	Domestic	56185.53	0.07
Pastries	107: Bakery	Domestic	76454.9	0.1
Savoury Biscuits	107: Bakery	Domestic	31888.23	0.04
Sweet Biscuits	107: Bakery	Domestic	90138.66	0.12
Black Tea	108: Other food	European	14303.75	0.02
Bouillon	108: Other food	European	10752.99	0.01

Chocolate Confectionery	108: Other food	European	216750.6	0.24
Chocolate Spreads	108: Other food	European	15209.52	0.02
Cooking Sauces	108: Other food	European	7510.855	0.01
Dietary Supplements	108: Other food	European	48896.45	0.06
Dried Baby Food	108: Other food	European	3791.085	0
Energy Drinks	108: Other food	European	31287.04	0.04
Flavoured Powder Drinks	108: Other food	European	10806.3	0.01
Fresh Coffee	108: Other food	European	105895.2	0.12
Frozen Pizza	108: Other food	European	29606.29	0.03
Fruit/Herbal Tea	108: Other food	European	14841.14	0.02
Green Tea	108: Other food	European	3714.285	0
Gum	108: Other food	European	24165.38	0.03
Herbs and Spices	108: Other food	European	18625.7	0.02
Honey	108: Other food	European	14032.5	0.02
Instant Coffee	108: Other food	European	29150.35	0.03
Instant Tea	108: Other food	European	438.3631	0
Ketchup	108: Other food	European	8211.749	0.01
Mayonnaise	108: Other food	European	10355	0.01
Meal Replacement	108: Other food	European	6109.874	0.01
Meat and Seafood Substitutes	108: Other food	European	6923.63	0.01
Milk Formula	108: Other food	European	21400.99	0.02
Mustard	108: Other food	European	4374.744	0
Other Baby Food	108: Other food	European	4519.502	0.01
Other Plant-based Hot Drinks	108: Other food	European	2085.693	0
Other Tea	108: Other food	European	2115.148	0
Pasta Sauces	108: Other food	European	18034.92	0.02
Prepared Baby Food	108: Other food	European	16338.2	0.02
RTD Coffee	108: Other food	European	4002.345	0
RTD Tea	108: Other food	European	16196.45	0.02
Shelf Stable Soup	108: Other food	European	10516.75	0.01
Snack Bars	108: Other food	European	14731.6	0.02
Soy Drinks	108: Other food	European	6814.017	0.01
Soy Sauces	108: Other food	European	1486.907	0
Sports Drinks	108: Other food	European	9687.531	0.01
Sports Non-Protein Products	108: Other food	European	3757.878	0
Sports Protein Products	108: Other food	European	10214.92	0.01
Sugar Confectionery	108: Other food	European	81781.39	0.09
Tomato Pastes and PurÃ©es	108: Other food	European	13722.03	0.02
Vitamins	108: Other food	European	15137.24	0.02
Bird Food	109: Animal feeds	Domestic	2190.157	0.02
Economy Dry Cat Food	109: Animal feeds	Domestic	2343.212	0.02
Economy Dry Dog Food	109: Animal feeds	Domestic	5926.326	0.05
Economy Wet Cat Food	109: Animal feeds	Domestic	5062.308	0.04
Economy Wet Dog Food	109: Animal feeds	Domestic	4419.482	0.03
Fish Food	109: Animal feeds	Domestic	1960.87	0.02
Mid-Priced Dry Cat Food	109: Animal feeds	Domestic	7801.303	0.06
Mid-Priced Dry Dog Food	109: Animal feeds	Domestic	12801.51	0.1
Mid-Priced Wet Cat Food	109: Animal feeds	Domestic	16857.5	0.13
Mid-Priced Wet Dog Food	109: Animal feeds	Domestic	6633.34	0.05
Pet Healthcare	109: Animal feeds	Domestic	11031.72	0.08
Premium Dry Cat Food	109: Animal feeds	Domestic	9678.49	0.07
Premium Dry Dog Food	109: Animal feeds	Domestic	15473.86	0.12
Premium Wet Cat Food	109: Animal feeds	Domestic	15561.98	0.12

Premium Wet Dog Food	109: Animal feeds	Domestic	5930.193	0.05
Small Mammal/Reptile Food	109: Animal feeds	Domestic	6540.983	0.05
Blended Scotch Whisky	110: Beverages	Domestic	33984.62	0.03
Brandy and Cognac	110: Beverages	Domestic	12885.49	0.01
Carbonated Bottled Water	110: Beverages	Domestic	42080.28	0.04
Champagne	110: Beverages	Domestic	21989.39	0.02
Cider/Perry	110: Beverages	Domestic	16584.96	0.02
Dark Beer	110: Beverages	Domestic	40893.59	0.04
Dutch Gin	110: Beverages	Domestic	327.7458	0
Economy Lager	110: Beverages	Domestic	14163.03	0.01
Flavoured Bottled Water	110: Beverages	Domestic	14269.97	0.01
Flavoured/Mixed Lager	110: Beverages	Domestic	17917.71	0.02
Fortified Wine and Vermouth	110: Beverages	Domestic	14692.19	0.01
Functional Bottled Water	110: Beverages	Domestic	2523.442	0
Irish Whiskey	110: Beverages	Domestic	2884.681	0
Liqueurs	110: Beverages	Domestic	34128.39	0.03
Low Calorie Cola Carbonates	110: Beverages	Domestic	37287.19	0.04
Mid-Priced Lager	110: Beverages	Domestic	80994.69	0.08
Non Alcoholic Spirits	110: Beverages	Domestic	485.3157	0
Non-Cola Carbonates	110: Beverages	Domestic	57353.86	0.05
Non-Grape Wine	110: Beverages	Domestic	2807.78	0
Non/Low Alcohol Beer	110: Beverages	Domestic	15098.17	0.01
Other Spirits	110: Beverages	Domestic	30746.06	0.03
Premium Lager	110: Beverages	Domestic	98585.16	0.09
RTDs	110: Beverages	Domestic	14634.96	0.01
Regular Cola Carbonates	110: Beverages	Domestic	58076.12	0.05
Rum	110: Beverages	Domestic	15210.51	0.01
Single Malt Scotch Whisky	110: Beverages	Domestic	6891.915	0.01
Still Bottled Water	110: Beverages	Domestic	71163.44	0.07
Still Light Grape Wine	110: Beverages	Domestic	256053.7	0.24
Stout	110: Beverages	Domestic	3330.36	0
Tequila (and Mezcal)	110: Beverages	Domestic	748.099	0
Vodka	110: Beverages	Domestic	39033.01	0.04
Cigarettes	120: Tobacco	Domestic	825442.4	0.85
Cigarillos	120: Tobacco	Domestic	16299.55	0.02
Cigars	120: Tobacco	Domestic	13041.36	0.01
Moist Snuff	120: Tobacco	Domestic	7971.428	0.01
Nicotine Pouches	120: Tobacco	Domestic	131.6788	0
Smoking Tobacco	120: Tobacco	Domestic	109167.9	0.11
Baby Wipes	139: Other textiles	European	8172.466	0.04
Home Care Wipes and Floor Cleaning Systems	139: Other textiles	European	4777.318	0.02
Home Textiles	139: Other textiles	European	106874.8	0.46
Moist Toilet Wipes	139: Other textiles	European	2184.221	0.01
Nappies/Diapers	139: Other textiles	European	28706.53	0.12
Retail Adult Incontinence	139: Other textiles	European	10611.5	0.05
Sanitary Protection	139: Other textiles	European	24368.05	0.11
Window Covering	139: Other textiles	European	44639.08	0.19
Apparel Accessories	141: Wearing apparel	Global	64981.82	0.08
Childrenswear	141: Wearing apparel	Global	200363.9	0.26
Men's Jeans	141: Wearing apparel	Global	57428.93	0.07
Men's Nightwear	141: Wearing apparel	Global	8215.545	0.01
Men's Swimwear	141: Wearing apparel	Global	10057.06	0.01
Men's Underwear	141: Wearing apparel	Global	39206.05	0.05

Sports Apparel	141: Wearing apparel	Global	219035.6	0.28
Women's Jeans	141: Wearing apparel	Global	49005.22	0.06
Women's Nightwear	141: Wearing apparel	Global	21741.66	0.03
Women's Swimwear	141: Wearing apparel	Global	22804.73	0.03
Women's Underwear	141: Wearing apparel	Global	89944.5	0.11
Hosiery	143: Knitted apparel	Global	61961.89	1
Backpacks	151: Tanning leather	Global	8342.856	0.06
Business Bags	151: Tanning leather	Global	6871.975	0.05
Handbags	151: Tanning leather	Global	76454.01	0.59
Luggage	151: Tanning leather	Global	25291.11	0.19
Wallet and Coin Pouches	151: Tanning leather	Global	12935.27	0.1
Footwear	152: Footwear	European	421895.7	0.77
Sports Footwear	152: Footwear	European	128530.4	0.23
Wall Covering	162: Wood products	European	21379.56	1
Facial Tissues	172: Paper articles	European	12980.83	0.15
General Purpose Wipes	172: Paper articles	European	791.5141	0.01
Paper Towels	172: Paper articles	European	21732.02	0.26
Toilet Paper	172: Paper articles	European	49709.14	0.58
Herbicides	202: Pesticides	European	3377.033	0.47
Pest Control	202: Pesticides	European	3830.077	0.53
Home Paint	203: Paints	European	34530.92	1
2-in-1 Products	204: Detergents	European	3155.103	0
Automatic Dishwashing	204: Detergents	European	17077.14	0.03
Baby and Child-specific Sun Care	204: Detergents	European	1996.457	0
Bar Soap	204: Detergents	European	5211.061	0.01
Bathroom Cleaners	204: Detergents	European	2565.713	0
Bleach	204: Detergents	European	4695.895	0.01
Body Care	204: Detergents	European	26528.14	0.04
Body Wash/Shower Gel	204: Detergents	European	25712.08	0.04
Carpet Cleaners	204: Detergents	European	743.1434	0
Colour Cosmetics Sets/Kits	204: Detergents	European	3472.191	0.01
Colourants	204: Detergents	European	16763.84	0.02
Conditioners and Treatments	204: Detergents	European	14897.19	0.02
Deodorants	204: Detergents	European	30598.69	0.04
Descalers	204: Detergents	European	1562.762	0
Detergent Tablets	204: Detergents	European	9540.087	0.01
Drain Openers	204: Detergents	European	1577.876	0
Eye Make-Up	204: Detergents	European	25785.52	0.04
Fabric Softeners	204: Detergents	European	16761.69	0.02
Facial Cleansers	204: Detergents	European	18369.41	0.03
Facial Make-Up	204: Detergents	European	27491.39	0.04
Floor Cleaners	204: Detergents	European	2669.566	0
Hair Removers/Bleaches	204: Detergents	European	3226.203	0
Hand Care	204: Detergents	European	4097.315	0.01
Hand Dishwashing	204: Detergents	European	12409.11	0.02
Home Care Disinfectants	204: Detergents	European	1410.255	0
Home Insecticides	204: Detergents	European	5814.924	0.01
Kitchen Cleaners	204: Detergents	European	1768.515	0
Laundry Aids	204: Detergents	European	12947.9	0.02
Lip Care	204: Detergents	European	2859.306	0
Lip Products	204: Detergents	European	13820.46	0.02
Liquid Detergents	204: Detergents	European	30619.86	0.04
Liquid Soap	204: Detergents	European	7057.252	0.01

Mass Women's Fragrances	204: Detergents	European	9904.504	0.01
Men's Fragrances	204: Detergents	European	30630.06	0.04
Men's Post-Shave	204: Detergents	European	2410.848	0
Men's Pre-Shave	204: Detergents	European	4036.802	0.01
Men's Razors and Blades	204: Detergents	European	17908.11	0.03
Men's Skin Care	204: Detergents	European	4454.523	0.01
Moisturisers And Treatments	204: Detergents	European	70043.06	0.1
Mouth Fresheners	204: Detergents	European	284.8919	0
Mouthwashes/Dental Rinses	204: Detergents	European	8073.002	0.01
Multi-Purpose Cleaners	204: Detergents	European	9804.581	0.01
Nail Products	204: Detergents	European	10087.98	0.01
Other Detergents	204: Detergents	European	5328.2	0.01
Oven Cleaners	204: Detergents	European	1057.135	0
Powder Detergents	204: Detergents	European	16251.03	0.02
Premium Women's Fragrances	204: Detergents	European	37862.65	0.06
Salon Professional Hair Care	204: Detergents	European	6937.56	0.01
Scouring Agents	204: Detergents	European	1176.297	0
Self-Tanning	204: Detergents	European	1568.056	0
Shampoos	204: Detergents	European	29842.73	0.04
Shoe Polish	204: Detergents	European	1572.167	0
Skin Care Sets/Kits	204: Detergents	European	6560.968	0.01
Sun Care	204: Detergents	European	18602.71	0.03
Sun Protection	204: Detergents	European	13125.6	0.02
Toilet Care	204: Detergents	European	11903.68	0.02
Toners	204: Detergents	European	2903.77	0
Tooth Whiteners	204: Detergents	European	653.2653	0
Window/Glass Cleaners	204: Detergents	European	1842.059	0
Women's Pre-Shave	204: Detergents	European	349.7	0
Women's Razors and Blades	204: Detergents	European	3832.975	0.01
Acne Treatments	212: Pharmaceutical	Global	3951.055	0.03
Adult Aspirin	212: Pharmaceutical	Global	3720.962	0.03
Adult Ibuprofen	212: Pharmaceutical	Global	5230.396	0.04
Adult Mouth Care	212: Pharmaceutical	Global	2507.711	0.02
Decongestants	212: Pharmaceutical	Global	8410.273	0.06
Dental Floss	212: Pharmaceutical	Global	2038.062	0.01
Denture Care	212: Pharmaceutical	Global	4953.734	0.04
Digestive Remedies	212: Pharmaceutical	Global	23965.03	0.17
Emergency Contraception	212: Pharmaceutical	Global	750.4522	0.01
Hair Loss Treatments	212: Pharmaceutical	Global	1112.185	0.01
Herbal/Traditional Products	212: Pharmaceutical	Global	43542.91	0.31
NRT Smoking Cessation Aids	212: Pharmaceutical	Global	5140.469	0.04
Paediatric Allergy Remedies	212: Pharmaceutical	Global	122.3063	0
Paediatric Aspirin	212: Pharmaceutical	Global	20.4968	0
Paediatric Dermatologicals	212: Pharmaceutical	Global	187.8196	0
Paediatric Ibuprofen	212: Pharmaceutical	Global	580.6235	0
Paediatric Vitamins and Dietary Supplements	212: Pharmaceutical	Global	1998.157	0.01
Toothpaste	212: Pharmaceutical	Global	26819.74	0.19
Wound Care	212: Pharmaceutical	Global	5457.913	0.04
Beverageware	231: Glass	European	20910.59	1
Bathroom and Sanitaryware	234: Other porcelain	European	41384.18	0.55
Dinnerware	234: Other porcelain	European	33660.51	0.45
Cutlery	257: Tools	European	12817.97	0.71
Gardening Hand Tools	257: Tools	European	5273.323	0.29

Mobile Phones	263: Communication equip.	Global	231754.6	1
Portable Players	264: Consumer electronics	European	23343.19	0.11
Televisions	264: Consumer electronics	European	152352.3	0.71
Video Games Hardware	264: Consumer electronics	European	30413.2	0.14
Video Players	264: Consumer electronics	European	5991.324	0.03
Wireless Headbands	264: Consumer electronics	European	1252.735	0.01
In-Car Navigation	265: Measurement instruments	Global	6925.42	0.06
Mechanical Watches	265: Measurement instruments	Global	64188.93	0.54
Quartz Analogue Watches	265: Measurement instruments	Global	43598.18	0.37
Quartz Digital Watches	265: Measurement instruments	Global	4496.498	0.04
Imaging Devices	267: Optical equip.	Global	32199.29	1
Compact Fluorescent Lamps (CFL)	274: Lighting	European	5672.326	0.11
Halogen Lamps	274: Lighting	European	5869.692	0.11
Incandescent Lamps	274: Lighting	European	576.0507	0.01
Light-Emitting Diode Lamps (LED)	274: Lighting	European	8183.225	0.15
Lighting Fixtures	274: Lighting	European	32146.48	0.6
Linear Fluorescent Lamps (LFL)	274: Lighting	European	1518.636	0.03
Air Treatment Products	275: Domestic appliances	European	22762.36	0.06
Automatic Washing Machines	275: Domestic appliances	European	50993.75	0.13
Battery Toothbrush Replacement Heads	275: Domestic appliances	European	389.6495	0
Battery Toothbrush Units	275: Domestic appliances	European	601.5485	0
Blenders	275: Domestic appliances	European	4653.386	0.01
Charcoal Barbecues	275: Domestic appliances	European	7378.833	0.02
Dishwashers	275: Domestic appliances	European	34974.51	0.09
Electric Barbecues	275: Domestic appliances	European	1066.269	0
Electric Grills	275: Domestic appliances	European	2310.753	0.01
Electric Toothbrush Replacement Heads	275: Domestic appliances	European	2612.12	0.01
Electric Toothbrush Units	275: Domestic appliances	European	4321.594	0.01
Espresso Coffee Machines	275: Domestic appliances	European	5073.357	0.01
Fridge Freezers	275: Domestic appliances	European	44717.89	0.11
Fridges	275: Domestic appliances	European	13985.92	0.04
Fryers	275: Domestic appliances	European	2058	0.01
Gas Barbecues	275: Domestic appliances	European	7188.426	0.02
Hair Care Appliances	275: Domestic appliances	European	9465.72	0.02
Heating Appliances	275: Domestic appliances	European	5158.043	0.01
Irons	275: Domestic appliances	European	8897.726	0.02
Kettles	275: Domestic appliances	European	5276.834	0.01
Large Cooking Appliances	275: Domestic appliances	European	74386.18	0.19
Manual Toothbrushes	275: Domestic appliances	European	9233.118	0.02
Microwaves	275: Domestic appliances	European	12445.87	0.03
Mixers	275: Domestic appliances	European	3301.463	0.01
Pod Coffee Machines	275: Domestic appliances	European	7780.828	0.02
Rice Cookers	275: Domestic appliances	European	296.0901	0
Standard Coffee Machines	275: Domestic appliances	European	11916.07	0.03
Vacuum Cleaners	275: Domestic appliances	European	37890.24	0.1
Drills	282: Other GP machinery	European	8462.859	0.39
Other Power Tools	282: Other GP machinery	European	13389.55	0.61
Gardening Power Tools	283: Agriculture machinery	European	15338.24	0.54
Lawn Mowers	283: Agriculture machinery	European	12859.76	0.46
Indoor Furniture	310: Furniture	European	589264.2	0.96
Outdoor Furniture	310: Furniture	European	27230.68	0.04
Costume Jewellery	321: Jewellery	Global	33481.8	0.2
Fine Jewellery	321: Jewellery	Global	135634.6	0.8

Traditional Toys and Games	324: Toys	European	122473	1
Contact Lens Solutions	325: Medical instruments	Global	5318.593	0.02
Conventional Lenses	325: Medical instruments	Global	1044.373	0
Daily Disposable Lenses (DD)	325: Medical instruments	Global	10334.83	0.05
Frequent Replacement Lenses (FRP)	325: Medical instruments	Global	12222.49	0.06
Readymade Reading Glasses	325: Medical instruments	Global	6846.347	0.03
Spectacle Frames	325: Medical instruments	Global	46866.84	0.22
Spectacle Lenses	325: Medical instruments	Global	103163.7	0.48
Sunglasses	325: Medical instruments	Global	28932.72	0.13
Air Care	329: Other manufacturing	European	15919.7	0.27
Ball Point Pens	329: Other manufacturing	European	4286.465	0.07
Cat Litter	329: Other manufacturing	European	8167.217	0.14
Closed Vaping Systems	329: Other manufacturing	European	3852.178	0.07
Fountain Pens	329: Other manufacturing	European	1712.688	0.03
Graphite Pencils	329: Other manufacturing	European	1169.718	0.02
Mechanical Pencils	329: Other manufacturing	European	429.4275	0.01
Open Vaping Systems	329: Other manufacturing	European	18569.18	0.32
Pen Inkwells and Refills	329: Other manufacturing	European	513.2916	0.01
Pencil Lead Refills	329: Other manufacturing	European	283.9199	0
Roller Ball Pens	329: Other manufacturing	European	3370.098	0.06
Convenience Stores	471: Retail - non-specialised	European		
Discounters	471: Retail - non-specialised	European		
Forecourt Retailers	471: Retail - non-specialised	European		
Hypermarkets	471: Retail - non-specialised	European		
Luxury Retailing	471: Retail - non-specialised	European		
Mixed Retailers	471: Retail - non-specialised	European		
Off-Price Retailing	471: Retail - non-specialised	European		
Other Non-Grocery Specialists	471: Retail - non-specialised	European		
Supermarkets	471: Retail - non-specialised	European		
Traditional Grocery Retailers	471: Retail - non-specialised	European		
Electronics and Appliance Specialist Retailers	474: Retail - ICT	European		
Home and Garden Specialist Retailers	475: Retail - household	European		
Leisure and Personal Goods Specialist Retailers	476: Retail - recreational	European		
Apparel and Footwear Specialist Retailers	477: retail - other specialised	European		
Health and Beauty Specialist Retailers	477: retail - other specialised	European		
Rail	491: Passenger rail	Domestic	245142.2	1
Bus	493: Other passenger land	Domestic	92749.07	1
Cruise	501: Passenger sea	Domestic	99781.8	0.7
Ferry	501: Passenger sea	Domestic	41876.09	0.3
Charter	511: Passenger air	Global	46569.19	0.06
Low Cost Carriers	511: Passenger air	Global	161008.1	0.21
Scheduled Airlines	511: Passenger air	Global	554181	0.73
Budget Hotels	551: Hotels	Domestic	134031.9	0.18
Luxury and Upscale Hotels	551: Hotels	Domestic	301734.5	0.4
Mid-Market Hotels	551: Hotels	Domestic	315200.2	0.42
Asian Limited-Service Restaurants	561: Restaurants	Domestic		
Bakery Products Limited-Service Restaurants	561: Restaurants	Domestic		
Burger Limited-Service Restaurants	561: Restaurants	Domestic		
Cafes/Bars	561: Restaurants	Domestic		
Chicken Limited-Service Restaurants	561: Restaurants	Domestic		
Ice Cream Limited-Service Restaurants	561: Restaurants	Domestic		
Pizza Full-Service Restaurants	561: Restaurants	Domestic		
Pizza Limited-Service Restaurants	561: Restaurants	Domestic		

Self-Service Cafeterias	561: Restaurants	Domestic		
Street Stalls/Kiosks	561: Restaurants	Domestic		
Video Games Software	582: Software publishing	Global	91260.67	1
Business Car Rental	771: Rental - motor	European	42021.56	0.46
Leisure Car Rental	771: Rental - motor	European	49149.76	0.54
Domestic Trips	791: Travel agency	European		0
Travel Intermediaries	791: Travel agency	European	1334034	1

Note: The table shows product markets in the Euromonitor CG&S data, as well as their corresponding industry, taxonomy category, and market value. Products with missing market value only have market shares in terms of quantity (not value).
Source: Euromonitor.

Additional variables

Table A A.12. Summary statistics on additional variables

	Obs.	Mean	S.D.	Min	Median	Max
Intangible Investments	16671	0.15	0.11	0.00	0.12	0.94
Software and Database Investment	18297	0.02	0.02	0.00	0.01	0.21
Innovative Property Investment	16657	0.06	0.07	0.00	0.03	0.46
Economic Competencies Investment	23051	0.05	0.05	0.00	0.04	0.44
OTT	33124	0.46	3.46	0.00	0.28	373.57
Regimpact	26125	0.06	0.09	0.00	0.03	0.68

Note: The table presents industry-country level summary statistics on Intangible Intensity (Intangible investments divided by value added), Software and Database Intensity (Software and Database investments divided by value added), Innovative Property Intensity (R&D, entertainment and artistic originals, new financial products, and design investments divided by value added), Economic Competencies Intensity (organisational capital, brand, and employer-provided training investments divided by value added), and OTT (the sum of import and exports divided by production). The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, ITA, PRT, SVN, SWE, and USA. Note that information on Intangibles and Innovative Property is not available for BEL, while regulation impact data is absent for the United States.
Source: OECD calculations.

Annex B. Additional details on the methodology

Taxonomy

Consumption-based approach

An alternative approach to defining the geographic dimension of competition is to take the perspective of final consumption. From this perspective, the level of competition is determined by the availability of the good or service to consumers. The total value of consumption in a country-industry is given by the total value of domestically produced output consumed at home, defined here as domestic sales, and the value of imports from abroad. Put differently, from the perspective of consumers, exports of domestic firms are not relevant to determining the size of their market. In this setting, industries are considered tradeable if the value of imports is high relative to the value of domestically produced consumption. Therefore, import penetration (IP) is used to define the taxonomy for the consumption-based approach. The following metrics are defined:

Domestic share: $$\frac{DomesticSales}{DomesticSales + Imports_{EU} + Imports_{non-EU}}$$

EU share: $$\frac{Imports_{EU}}{DomesticSales + Imports_{EU} + Imports_{non-EU}}$$

Non-EU share : $$\frac{Imports_{non-EU}}{DomesticSales + Imports_{EU} + Imports_{non-EU}}$$

Taxonomy: list of industries

Table A B.1. Taxonomy list of industries and geographical dimension

Industry Code	Industry Description	Taxonomy Geography	Included in baseline sample
051	Mining of hard coal	Global	No
052	Mining of lignite	Domestic	No
06	Extraction of crude petroleum and natural gas	Global	No
07	Mining of metal ores	Global	No
081	Quarrying of stone, sand and clay	European	Yes
089	Mining and quarrying n.e.c.	Global	Yes
091	Support activities for petroleum and natural gas extraction	Domestic	Yes
099	Support activities for other mining and quarrying	Domestic	Yes
101	Processing and preserving of meat and production of meat products	Domestic	Yes
102	Processing and preserving of fish, crustaceans and molluscs	European	Yes
103	Processing and preserving of fruit and vegetables	European	Yes
104	Manufacture of vegetable and animal oils and fats	European	Yes

Industry Code	Industry Description	Taxonomy Geography	Included in baseline sample
105	Manufacture of dairy products	Domestic	Yes
106	Manufacture of grain mill products, starches and starch products	European	Yes
107	Manufacture of bakery and farinaceous products	Domestic	Yes
108	Manufacture of other food products	European	Yes
109	Manufacture of prepared animal feeds	Domestic	Yes
110	Manufacture of beverages	Domestic	Yes
120	Manufacture of tobacco products	Domestic	No
131	Preparation and spinning of textile fibres	European	Yes
132	Weaving of textiles	European	Yes
133	Finishing of textiles	Domestic	Yes
139	Manufacture of other textiles	European	Yes
14	Manufacture of apparel	Global	Yes
151	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur	Global	Yes
152	Manufacture of footwear	European	Yes
161	Sawmilling and planning of wood	European	Yes
162	Manufacture of products of wood, cork, straw and plaiting materials	European	Yes
171	Manufacture of pulp, paper and paperboard	European	Yes
172	Manufacture of articles of paper and paperboard	European	Yes
181	Printing and service activities related to printing	Domestic	Yes
182	Reproduction of recorded media	European	Yes
19	Manufacture of coke / petroleum	European	Yes
201	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms	European	Yes
202	Manufacture of pesticides and other agrochemical products	European	Yes
203	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	European	Yes
204	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	European	Yes
205	Manufacture of other chemical products	European	Yes
206	Manufacture of man-made fibres	European	Yes
211	Manufacture of basic pharmaceutical products	Global	Yes
212	Manufacture of pharmaceutical preparations	Global	Yes
221	Manufacture of rubber products	European	Yes
222	Manufacture of plastic products	European	Yes
231	Manufacture of glass and glass products	European	Yes
232	Manufacture of refractory products	European	Yes
233	Manufacture of clay building materials	European	Yes
234	Manufacture of other porcelain and ceramic products	European	Yes
235	Manufacture of cement, lime and plaster	European	Yes
236	Manufacture of articles of concrete, cement and plaster	Domestic	Yes
237	Cutting, shaping and finishing of stone	Global	Yes
239	Manufacture of abrasive products and non-metallic mineral products n.e.c.	European	Yes
241	Manufacture of basic iron and steel and of ferro-alloys	European	Yes
242	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel	European	Yes
243	Manufacture of other products of first processing of steel	European	Yes
244	Manufacture of basic precious and other non-ferrous metals	European	Yes
245	Casting of metals	European	Yes
251	Manufacture of structural metal products	European	Yes
252	Manufacture of tanks, reservoirs and containers of metal	European	Yes
253	Manufacture of steam generators, except central heating hot water	Global	No

Industry Code	Industry Description	Taxonomy Geography	Included in baseline sample
	boilers		
254	Manufacture of weapons and ammunition	Global	Yes
255	Forging, pressing, stamping and roll-forming of metal; powder metallurgy	Domestic	Yes
256	Treatment and coating of metals; machining	Domestic	Yes
257	Manufacture of cutlery, tools and general hardware	European	Yes
259	Manufacture of other fabricated metal products	European	Yes
261	Manufacture of electronic components and boards	Global	Yes
262	Manufacture of computers and peripheral equipment	European	Yes
263	Manufacture of communication equipment	Global	Yes
264	Manufacture of consumer electronics	European	Yes
265	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	Global	Yes
266	Manufacture of irradiation, electromedical and electrotherapeutic equipment	Global	Yes
267	Manufacture of optical instruments and photographic equipment	Global	Yes
268	Manufacture of magnetic and optical media	European	No
271	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus	European	Yes
272	Manufacture of batteries and accumulators	European	Yes
273	Manufacture of wiring and wiring devices	European	Yes
274	Manufacture of electric lighting equipment	European	Yes
275	Manufacture of domestic appliances	European	Yes
279	Manufacture of other electrical equipment	European	Yes
281	Manufacture of general-purpose machinery	European	Yes
282	Manufacture of other general-purpose machinery	European	Yes
283	Manufacture of agricultural and forestry machinery	European	Yes
284	Manufacture of metal forming machinery and machine tools	European	Yes
289	Manufacture of other special-purpose machinery	European	Yes
291	Manufacture of motor vehicles	European	Yes
292	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers	European	Yes
293	Manufacture of parts and accessories for motor vehicles	European	Yes
301	Building of ships and boats	Global	Yes
302	Manufacture of railway locomotives and rolling stock	European	Yes
303	Manufacture of air and spacecraft and related machinery	Global	Yes
304	Manufacture of military fighting vehicles	Domestic	No
309	Manufacture of transport equipment n.e.c.	European	Yes
310	Manufacture of furniture	European	Yes
321	Manufacture of jewellery, bijouterie and related articles	Global	Yes
322	Manufacture of musical instruments	Global	Yes
323	Manufacture of sports goods	European	Yes
324	Manufacture of games and toys	European	Yes
325	Manufacture of medical and dental instruments and supplies	Global	Yes
329	Manufacturing n.e.c.	European	Yes
331	Repair of fabricated metal products, machinery and equipment	Domestic	Yes
332	Installation of industrial machinery and equipment	Domestic	Yes
351	Electric power generation, transmission and distribution	Domestic	No
352	Manufacture of gas; distribution of gaseous fuels through mains	Domestic	Yes
353	Steam and air conditioning supply	Domestic	Yes
360	Water collection, treatment and supply	Domestic	Yes
37T39	Sewerage; Waste; Other waste	Domestic	Yes

Industry Code	Industry Description	Taxonomy Geography	Included in baseline sample
45T47	Motor vehicles; Wholesale; Retail	European	Yes
491	Passenger rail transport, interurban	Domestic	Yes
492	Freight rail transport	European	Yes
493	Other passenger land transport	Domestic	Yes
494	Freight transport by road and removal services	European	Yes
495	Transport via pipeline	Global	No
501	Sea and coastal passenger water transport	Domestic	Yes
502	Sea and coastal freight water transport	Global	Yes
503	Inland passenger water transport	Domestic	Yes
504	Inland freight water transport	European	Yes
51	Air transport	Global	Yes
52	Warehousing	European	Yes
53	Postal and courier activities	European	Yes
55T56	Accommodation & food services	Domestic	Yes
581	Publishing of books, periodicals and other publishing activities	Domestic	Yes
582	Software publishing	Global	Yes
59T60	Motion picture & broadcasting	Domestic	Yes
61	Telecommunications	Domestic	Yes
62T63	Computer programming & information	European	Yes
691	Legal activities	Domestic	No
692	Accounting, bookkeeping and auditing activities; tax consultancy	Domestic	No
70	Activities of head offices	European	No
71	Architectural and engineering	European	Yes
72	Scientific R&D	European	Yes
73	Advertising and market research	European	Yes
741	Specialised design activities	Domestic	No
742	Photographic activities	European	No
743	Translation and interpretation activities	Domestic	No
749	Other professional, scientific and technical activities n.e.c.	Global	No
750	Veterinary activities	Domestic	No
77	Rental and leasing	European	Yes
781	Activities of employment placement agencies	European	Yes
782	Temporary employment agency activities	European	Yes
783	Other human resources provision	European	Yes
791	Travel agency and tour operator activities	European	Yes
799	Other reservation service and related activities	European	Yes
801	Private security activities	European	Yes
802	Security systems service activities	European	Yes
803	Investigation activities	European	Yes
811	Combined facilities support activities	Domestic	No
812	Cleaning activities	Domestic	Yes
813	Landscape service activities	Domestic	No
821	Office administrative and support activities	European	No
822	Activities of call centres	Domestic	No
823	Organisation of conventions and trade shows	Domestic	No
829	Business support service activities n.e.c.	European	No

Note: The table presents the list of industries used in the analysis and their associated geographic market.
Source: OECD compilation.

Robustness of the taxonomy

Table A B.2. Robustness of the taxonomy

	Same as baseline	Domestic to EU	Domestic to Global	EU to Domestic	EU to Global	Global to Domestic	Global to EU
Import Penetration	87.1%	1.2%	0.0%	0.6%	6.7%	0.0%	4.3%
Late years sample	90.8%	1.2%	0.0%	3.1%	4.9%	0.0%	0.0%
Production weighted	96.9%	0.0%	0.0%	1.2%	0.6%	0.0%	1.2%
Unweighted	82.8%	2.5%	0.6%	4.3%	0.0%	0.0%	9.8%

Note: The table shows the percentage of industries that have the same taxonomy classification under alternative specifications. It also shows how alternative specifications change the taxonomy.
Source: OECD calculations.

Markups

Defining markups from firms' cost minimisation

Following De Loecker and Warzynski (2012[13]), which build on Hall (1988[50]), the expression for markups is derived from the first-order condition of the cost minimisation problem faced by firms with respect to an input of production free of adjustment costs (i.e., firms choose this input statically period by period, without intertemporal considerations) and for which firms are price takers.

Assume each firm f at time t follows a production function that converts inputs of labour L_{ft}, materials M_{ft}, and capital K_{ft} into output Y_{ft}, with a firm-specific productivity given by Ω_{ft}. Materials is the variable input purchased at price $P^{M_{ft}}$. Capital K_{ft} is a stock variable that firms choose dynamically (i.e., they do not choose it by period but before the present period). The production function can be written in its general form as:

$$Y_{ft} = Y\left(M_{ft}, L_{ft}, K_{ft}, \Omega_{ft}\right)$$

Equation 21

Optimising firms choose their variable input, materials and labour, to minimise costs subject to achieving a given level of output. The first order condition with respect to the variables input, for instance, materials, emerging from the minimisation cost problem leads to the condition:

$$P^{M_{ft}} = \lambda_{ft} \frac{\partial Y_{ft}(.)}{\partial M_{ft}},$$

Equation 22

Where λ_{ft} is the Lagrange multiplier, measuring marginal costs (it is indeed is the value of the objective function as we relax the output constraint). By rearranging λ_{ft} and multiplying both sides of the above expression by the firms' price P_{ft}, the right-hand side can be rewritten in terms of the output elasticity of materials multiplied by its inverse revenue share. In addition, markup μ_{ft} is given by price over marginal cost, $\mu_{ft} = \frac{P_{ft}}{\lambda_{ft}}$. Thus, the previous expression can be written as:

$$\mu_{ft} = \left(\frac{\partial Y_{ft}(.)}{\partial M_{ft}} \frac{M_{ft}}{Y_{ft}}\right) \frac{P_{ft} Y_{ft}}{P^{M_{ft}} M_{ft}} = \frac{\alpha^M}{S_{ft}}.$$

Equation 23

The markup is equivalent to the elasticity α^M of the flexible input M over the share of that flexible input's cost on revenues, S_{ft}. Stated differently, markups are given by the ratio between the output elasticity of

the variable input chosen and its revenue share. Note that the output elasticity will depend on the specific production function adopted.

Estimation of markups

Markups can be estimated using balance sheet data on revenues and input spending. The methodology relies on estimating in each 3-digit industry the output elasticity of the variable input α_M. The advantage of the method is that it does not require assumptions on the demand side or on how firms compete. Instead, it requires two key assumptions to hold. First, at least one input of production can be adjusted without frictions. Second, firms are price takers for that input and produce by minimising their costs.

Building on standard assumptions in the literature (De Ridder, Grassi and Morzenti (2021[82])), the following Cobb-Douglas production function is assumed in each 3-digit industry:[139]

$$Y_{ft} = \Omega_{ft} {M_{ft}}^{\alpha_M} {L_{ft}}^{\alpha_L} {K_{ft}}^{\alpha_K}$$

Equation 24

Taking logs of both sides (and using lowercase variables to represent the log of the original variable), the previous relationship can be rewritten as follows:

$$y_{ft} = \alpha_M m_{ft} + \alpha_L l_{ft} + \alpha_K k_{ft} + \omega_{ft}.$$

Equation 25

Following De Loecker and Warzynski (2012[13]), a control function approach – and, in particular, the Ackerberg et al. (2015[79]) methodology– is used to estimate econometrically the parameters of the production function. Following the literature, materials are assumed to be the flexible input, given that labour is likely to face higher frictions like hiring and firing costs and capital is usually set dynamically and lasts for multiple periods.

This procedure therefore provides an estimate of the elasticity of all inputs, including elasticity of materials, $\hat{\alpha}^M$, in each industry. Since cost of materials as a share of the firm's revenue (S_{ft}^m) is directly available in the data, the estimated markups are given by:

$$\hat{\mu}_{ft}^m = \frac{\hat{\alpha}^M}{S_{ft}^m}.$$

Equation 26

In the baseline specification, the industry-specific production functions are estimated separately for each 3-digit industry but are constant over time. The specification with constant elasticities over time is the preferred one for various reasons. First, from a theoretical point of view, the equilibrium does not vary with time but is static. Note that, despite the 20-year period analysed, longer periods have been used in other papers in the literature. More importantly, the time span covers the great financial crisis (GFC), and the elasticities computed using the years of the GFC would not only capture technological changes in the production function but would also be affected by the economic cycle. While the varying material inputs share in the denominator of the markup calculation accounts for seasonal variations in markups, output elasticity in the numerator should purely represent the technology of the industry. From a more practical point of view, the Orbis dataset has relevant differences in the sample composition over the years, with the sample covered by the database increasing significantly in more recent years. Finally, and importantly, to estimate the production function, a minimum number of observations in each industry is needed. Thus,

[139] De Ridder et al. (2021[82]) show in a simulation exercise that a Cobb-Douglas production function matches the markup dispersion closer than a translog production function when revenue data is used.

a trade-off between going very detailed in terms of industries and splitting the sample in multiple periods arises. For the purposes of this exercise and for comparability with concentration measures, the highest granularity possible in terms of industries has been preferred. However, pooling all years within an industry implies that technology is assumed to be constant over time in each 3-digit industry. As the sample covers two decades, it is possible that technology instead varied. Therefore, in a robustness check, time varying production functions are estimated, allowing for output elasticities to change over time. To overcome the lack of sufficient observations, recent work has implemented the strategy of considering rolling windows between 3 and 10 years (see Traina (2018[106]) and Baqaee and Fahri (2020[107]). Thus, in a robustness exercise at the end of this Annex, the following alternative production function estimations have been carried out: i) estimations for each 5-year rolling window at the NACE 2-digit level (no year fixed effect) (cf. Baqaee and Farhi (2020[107]) and De Loecker et al. (2020[3])); ii) pooled estimations at the NACE 2-digit level (no year fixed effect); iii) 6-year rolling windows at the NACE 3-digit level (no year fixed effects). The different combinations of time window and industry-level of disaggregation (6 years at 3-digit level versus 5 years at 2-digit level) have been adopted to meet the criteria on the minimum coverage in the sample to implement the estimation procedure.[140] Note that the elasticities with rolling windows are computed in each year on a different sample of firms and are affected by the sample composition besides technological change. Finally, pooled estimation at the NACE 2-digit level has been reported since it has been used as a methodology by several references in the literature (De Loecker, Eeckhout and Unger (2020[3]).

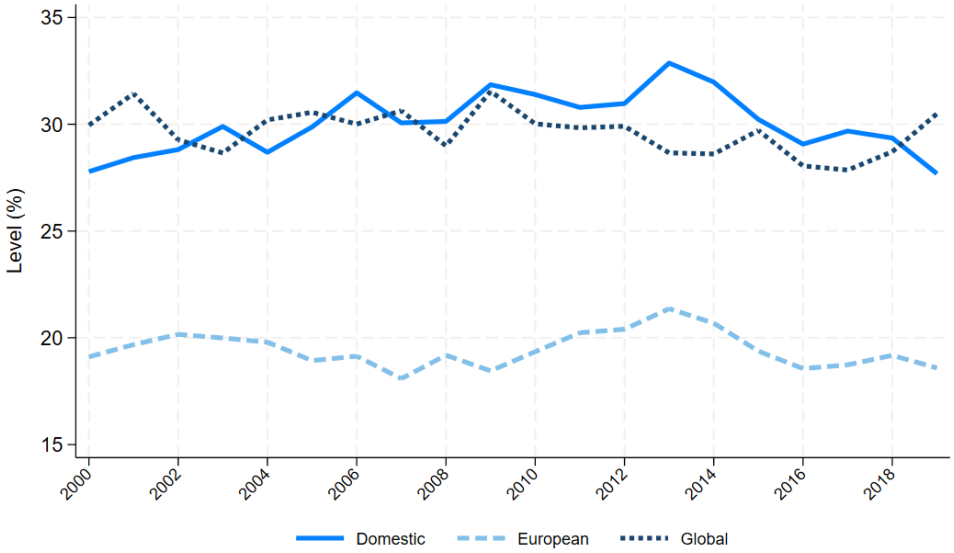
The methodology used in this study has been criticized for not being able to purge the measurement error resulting from the use of revenue instead of output quantities in the first stage of the production function estimation. As discussed in Klette (1996[108]), De Loecker and Warzynski (2012[13]) and Bond et al. (2021[109]), the estimation of markup levels according to this methodology is biased downwards when deflated revenues are used, as in this case, instead of output quantities (not available in the data). However, De Ridder et al. (2021[82]) point out that the dispersion and trends over time of markups are unbiased, and their correlations with other variables are still informative. They benchmark markups estimated with revenue data against markups estimated with quantity data. They argue that although the estimated markups under this methodology may be not accurately informative about the level of the true markups because of the biases in the elasticities, they can still provide informative results about their dispersion and time series trends. Therefore, the focus in this report is on time series trends of markups and their correlations with other economic information rather than on the levels themselves.

[140] Under this methodology only the sectors oil drilling (061) and iron ore mining (071) had to be dropped due to lack of sufficient data.

Annex C. Trends and further robustness

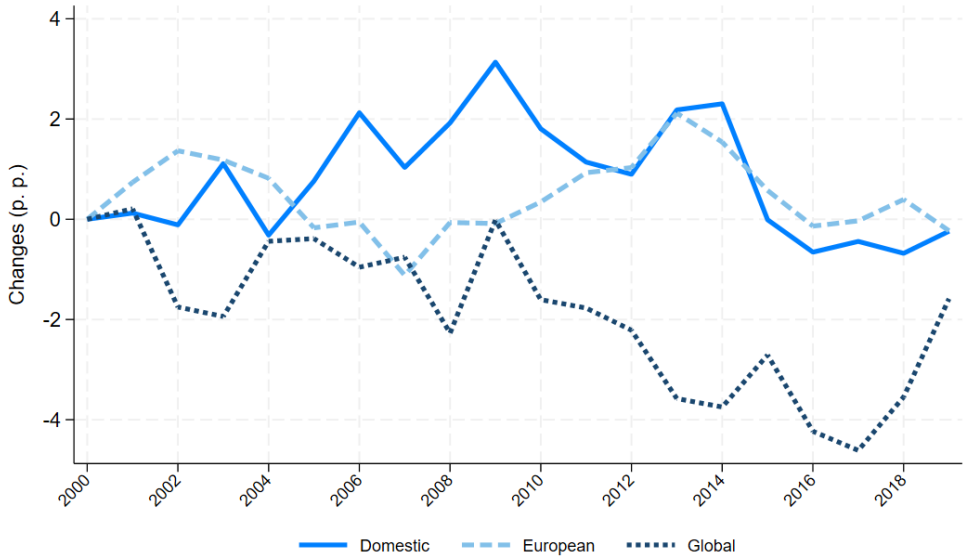
Concentration

Figure A C.1. Concentration levels across geographical buckets (weighted)



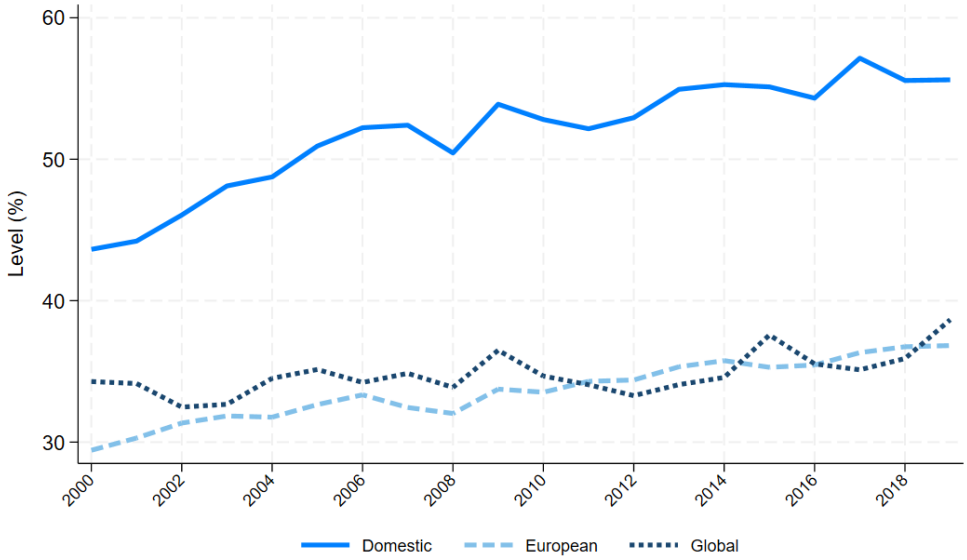
Note: The chart shows the weighted average across industries (and countries, for the domestic bucket) of CR4 levels. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Figure A C.2 Concentration cumulative changes across geographical buckets (weighted)



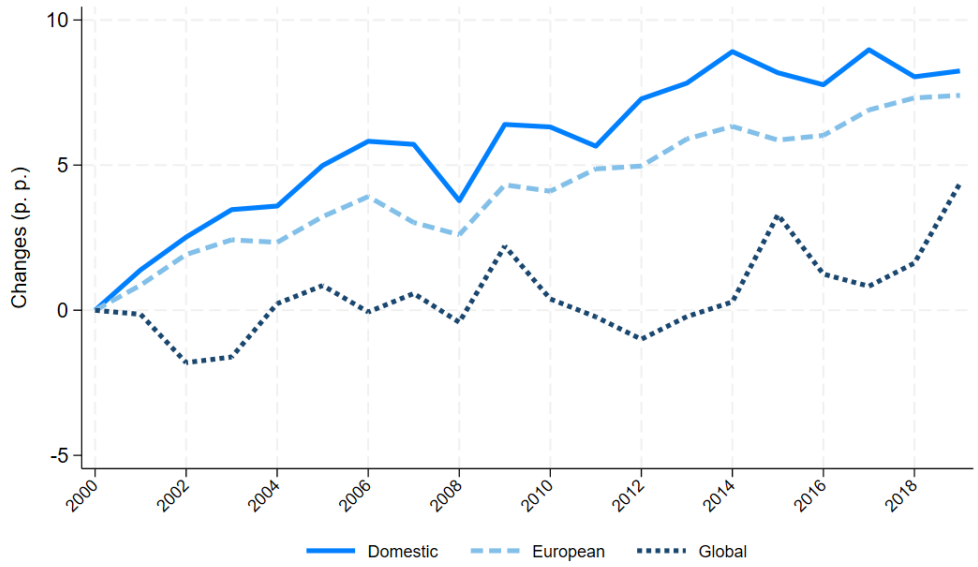
Note The chart shows the weighted average across industries (and countries, for the domestic bucket) of CR4 cumulative changes. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Figure A C.3 Concentration levels across geographical buckets (CR8)



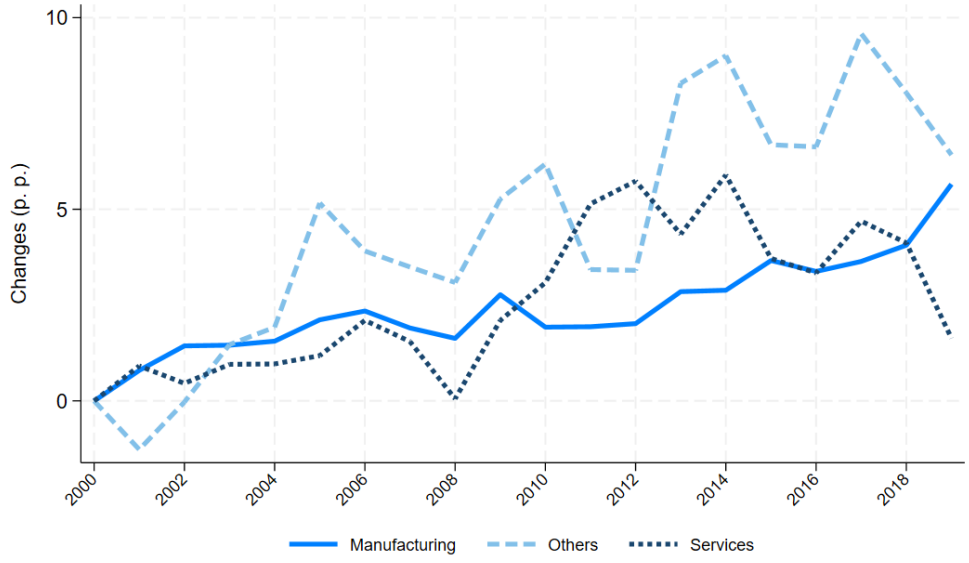
Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of CR8 levels. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Figure A C.4. Concentration cumulative changes across geographical buckets (CR8)



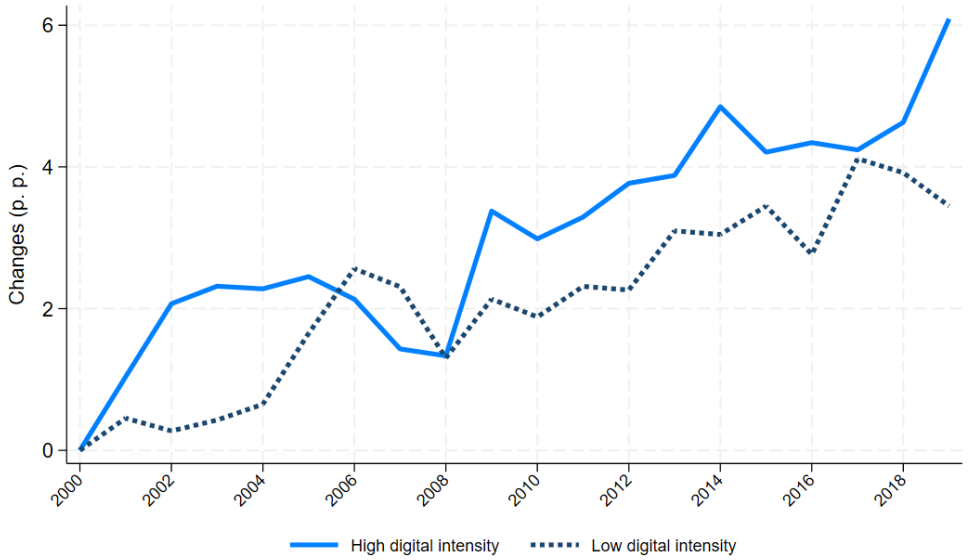
Note: The chart shows the unweighted average across industries (and countries, for the domestic bucket) of CR8 cumulative changes. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Figure A C.5. Concentration cumulative changes across 1-digit sectors



Note: The chart shows the weighted average across industry-geography combinations of CR4 cumulative changes across 1-digit sectors (manufacturing, services, and mining and utilities). A weight of 1 is attributed to country-industries couples for domestic industries, while a weight of 15 is attributed to industries belonging to the European and the global buckets. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

Figure A C.6. Concentration cumulative changes accros digital versus non-digital intensive sectors



Note: The chart shows the weighted average across industry-geography combinations of CR4 cumulative changes across sectors identified as high or low digital intensive. A weight of 1 is attributed to country-industries couples for domestic industries, while a weight of 15 is attributed to industries belonging to the European and the global buckets. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

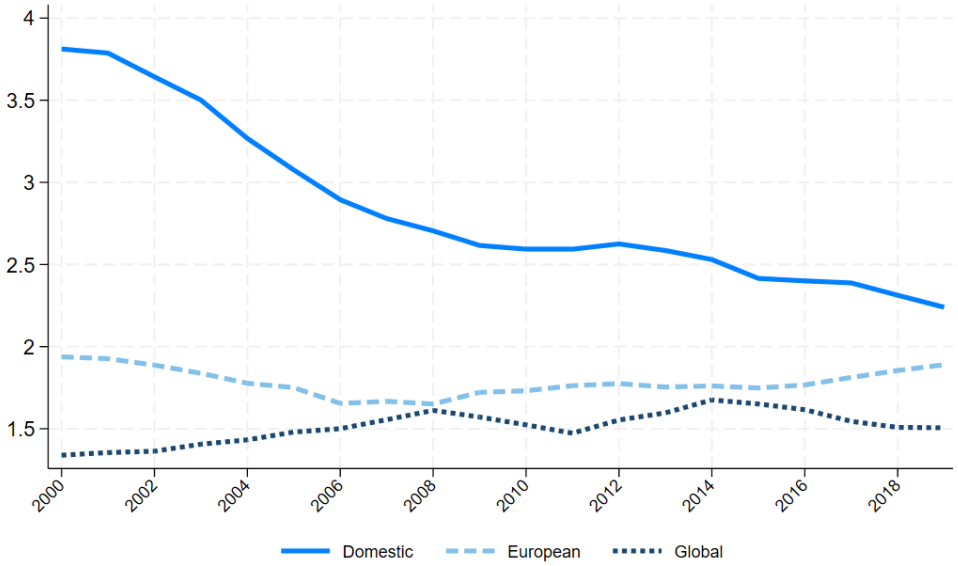
Table A C.1. Industries included in the 4-digit analysis

NACE Rev.2 code and description		
2-digit	**3-digit**	**4-digit**
10 Manufacture of food products		
	10.1 Processing and preserving of meat and production of meat products	
		10.11 Processing and preserving of meat
		10.12 Processing and preserving of poultry meat
		10.13 Production of meat and poultry meat products
	10.2 Processing and preserving of fish, crustaceans and molluscs	
		10.20 Processing and preserving of fish, crustaceans and molluscs
	10.3 Processing and preserving of fruit and vegetables	
		10.31 Processing and preserving of potatoes
		10.32 Manufacture of fruit and vegetable juice
		10.39 Other processing and preserving of fruit and vegetables
	10.4 Manufacture of vegetable and animal oils and fats	
		10.41 Manufacture of oils and fats
	10.5 Manufacture of dairy products	
		10.51 Operation of dairies and cheese making
		10.52 Manufacture of ice cream
	10.6 Manufacture of grain mill products, starches and starch products	
		10.61 Manufacture of grain mill products
		10.62 Manufacture of starches and starch products
	10.7 Manufacture of bakery and farinaceous products	
		10.71 Manufacture of bread; manufacture of fresh pastry goods and cakes
		10.72 Manufacture of rusks and biscuits; manufacture of preserved pastry goods and

		Cakes
		10.73 Manufacture of macaroni, noodles, couscous and similar farinaceous products
	10.8 Manufacture of other food products	
		10.81 Manufacture of sugar 1072
		10.82 Manufacture of cocoa, chocolate and sugar confectionery 1073
		10.83 Processing of tea and coffee
		10.84 Manufacture of condiments and seasonings
		10.85 Manufacture of prepared meals and dishes
		10.86 Manufacture of homogenised food preparations and dietetic food
	10.9 Manufacture of prepared animal feeds	
		10.91 Manufacture of prepared feeds for farm animals
		10.92 Manufacture of prepared pet foods
11 Manufacture of beverages		
	11.0 Manufacture of beverages	
		11.01 Distilling, rectifying and blending of spirits
		11.02 Manufacture of wine from grape
		11.03 Manufacture of cider and other fruit wines
		11.04 Manufacture of other non-distilled fermented beverages
		11.05 Manufacture of beer
		11.06 Manufacture of malt
		11.07 Manufacture of soft drinks;production of mineral waters and other bottled waters

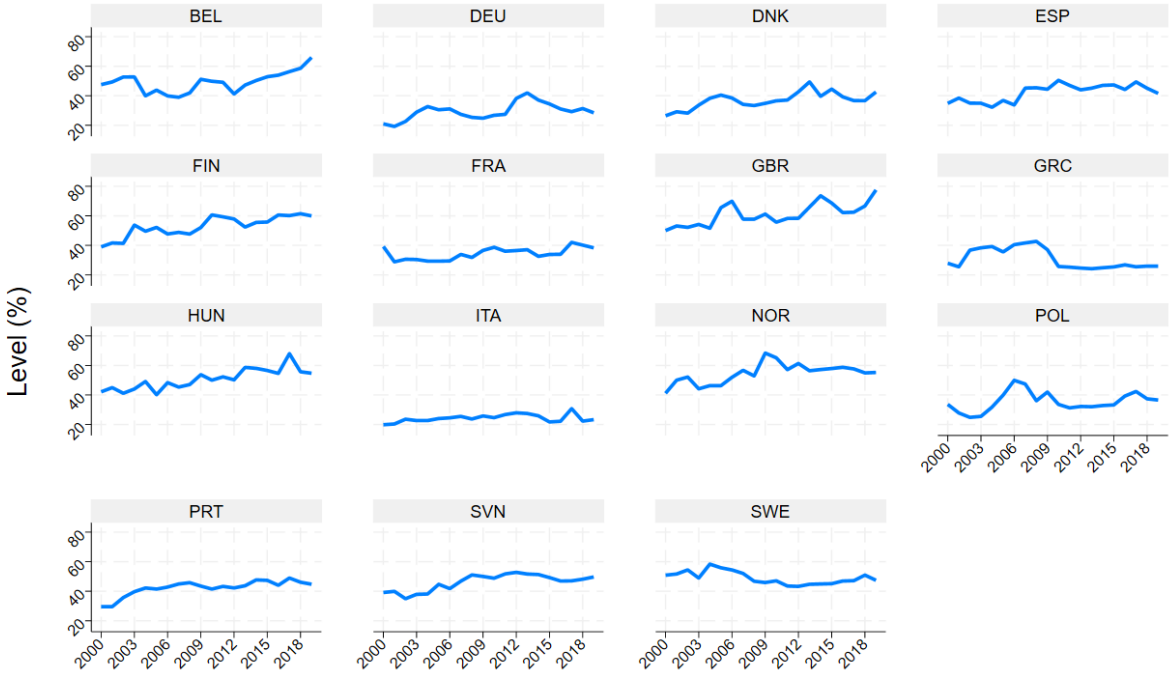
Note: This table reports the NACE Rev. 2 code and description of the industries included in the 4-digit level of analysis of concentration
Source: NACE Rev.2 manual.

Figure A C.7. Leadership ratio across geographical buckets (1st versus 2nd), weighted



Note: The chart shows the weighted average across industries (and countries, for the domestic bucket) of the leadership ratio. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services and are classified as either domestic, European, or global, depending on the taxonomy. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE for the domestic and European bucket, while in the global one also JPN, KOR, and USA are included.
Source: OECD calculations.

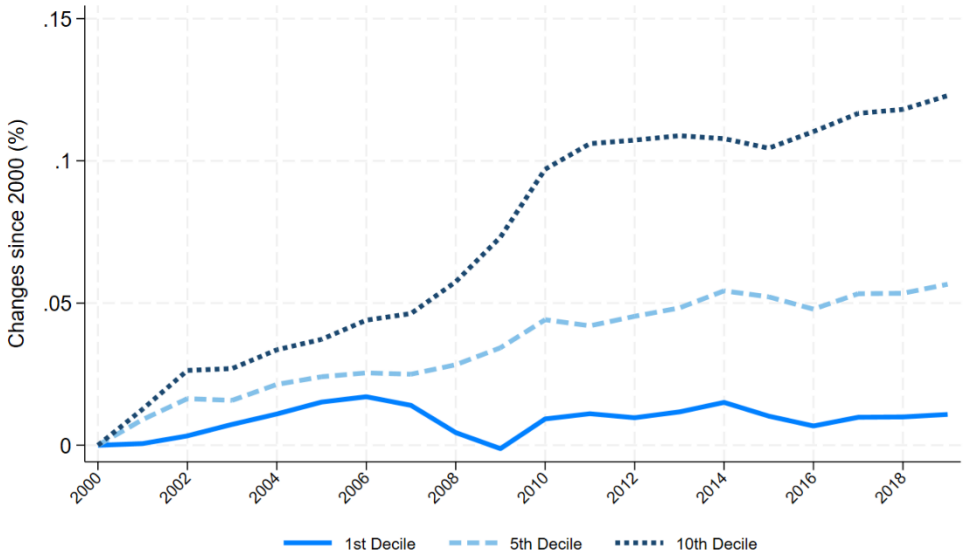
Figure A C.8. Average CR4 in industries competing at the domestic level across countries.



Note: The chart shows average CR4 levels across the countries of the concentration sample in domestic industries. The 40 domestic industries included are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services.
Source: OECD calculations.

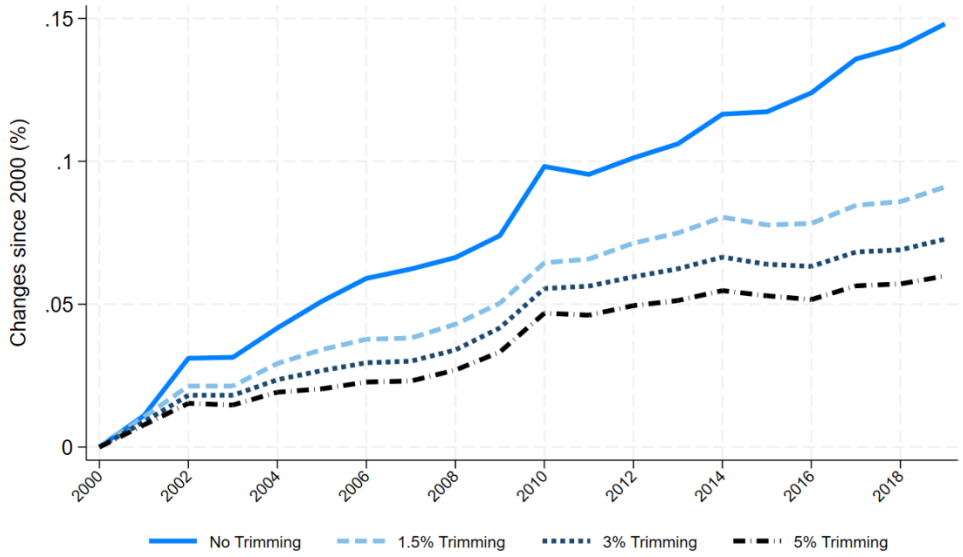
Markups

Figure A C.9. Log markups growth over time (2000-2019) by industry-year deciles



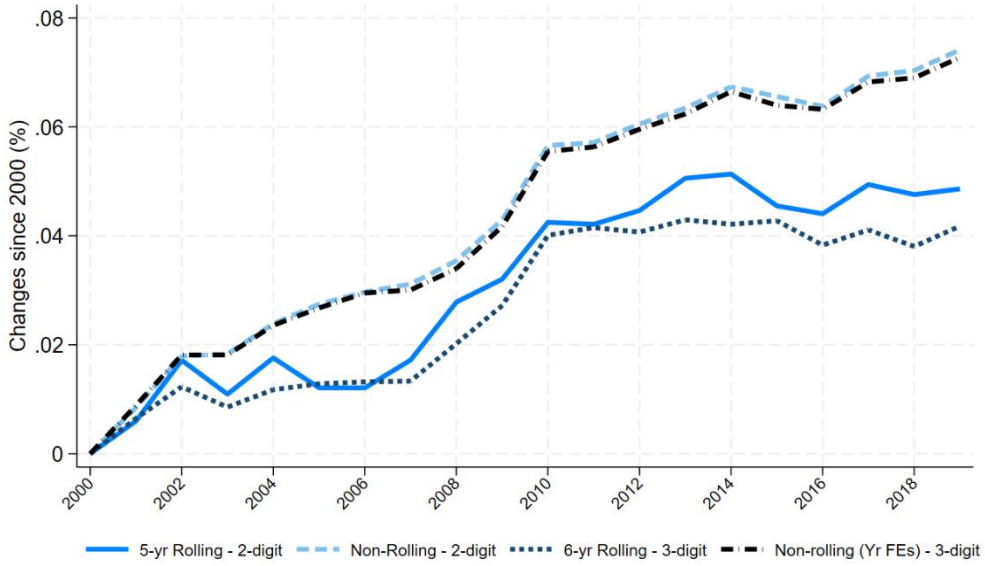
Note: The chart shows log changes of unweighted average markup in the chosen part of the distribution of markups and indexes the 2000 level to 0. Hence, the vertical axes represent log-differences from the starting year and approximate percentage growth rates. Deciles of markups are computed separately by for each industry-year. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculation based on Orbis data.

Figure A C.10. Log markups growth over time (2000-2019), different trimming thresholds



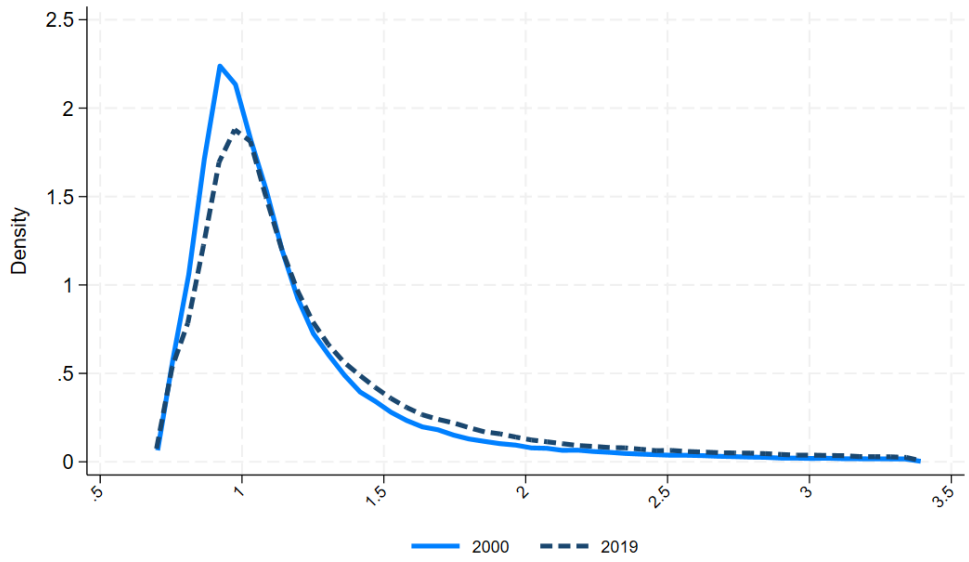
Note: Unweighted markup levels, trimmed at the 3rd and 97th percentile (1.5th and 98.5th percentile as in De Ridder et al. (2021[82]) and 5th and 95th percentile) of the distribution of firm-year level markups pooled across all years and untrimmed. Log changes of unweighted average markup across firms in sample. Log changes are computed as the difference of the log of average markups in a given year with the log of the average markup in the initial year (2000) and approximate percentage growth rates. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculation based on Orbis data.

Figure A C.11. Log markups growth over time (2000-2019), different production function specifications



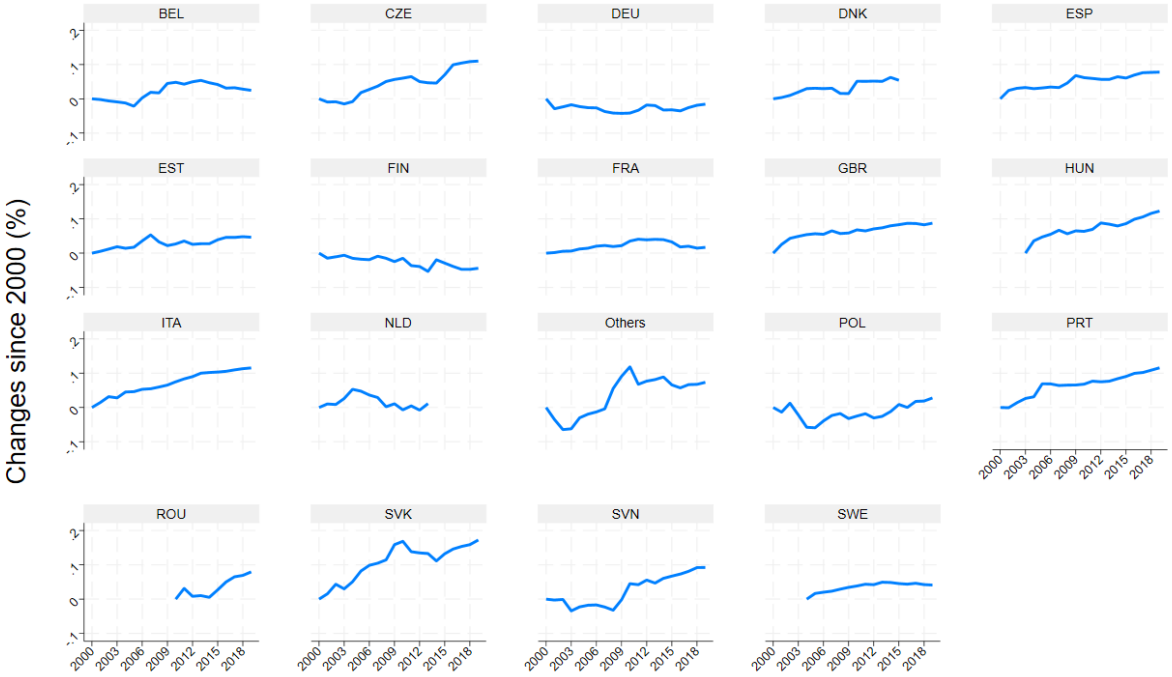
Note: the chart shows markup levels computed using alternative production function specifications. See section 5 and Annex B for a description of the alternative estimation routines. Log changes of unweighted average markup across firms in sample. Log changes are computed as the difference of the log of average markups in a given year with the log of the average markup in the initial year (2000) and approximate percentage growth rates. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. Countries included AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculation based on Orbis data.

Figure A C.12. Distribution of firm-level markups in 2000 and 2019



Note: the chart shows the kernel density estimation of the markup distribution in 2000 and 2019. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. The countries included are AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, SWE.
Source: OECD calculation based on Orbis data.

Figure A C.13. Average markups changes across countries



Note: The chart shows average log changes of markup across the countries belonging to the markups sample. It plots log markups and indexes the 2000 level to 0. Hence the vertical axes represent log-differences from the starting year and approximate percentage growth rates. Industries included cover all 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services sectors. The trend of "Others" aggregates together AUT, BGR, IRL, LUX and LVA.
Source: OECD calculations.

Annex D. Product and industry concentration

Table A D.1. Summary statistics of product markets

	mean	sd	min	p10	p25	p50	p75	p90	max	count
Value (mns eur 2021 prices)	426.27	1629.04	0.01	3.47	14.45	60.48	255.39	842.57	40581.80	31405
GUO Count	9.82	9.20	1.00	3.00	4.00	7.00	12.00	20.00	84.00	34198
Top 1 GUO Share	0.33	0.19	0.00	0.11	0.19	0.30	0.44	0.59	1.00	33662
Top 2 GUOs Share	0.48	0.23	0.00	0.17	0.32	0.47	0.64	0.79	1.00	33662
Top 3 GUOs Share	0.55	0.23	0.00	0.22	0.40	0.57	0.73	0.86	1.00	33662
Top 4 GUOs Share	0.60	0.24	0.00	0.25	0.45	0.63	0.77	0.88	1.00	33662
PP Change in Top 4 GUO Share	0.73	8.64	-79.77	-7.95	-3.10	0.45	4.38	9.55	74.49	4173
Market Share Instability	0.01	0.03	0.00	0.00	0.00	0.01	0.01	0.03	0.98	27068
Entrenchment	3.44	0.84	0.00	2.00	3.00	4.00	4.00	4.00	4.00	29479

Note: The table presents summary statistics on the product-country-year level data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE. The data cover 2012-2021.
Source: OECD calculations.

Table A D.2. Summary statistics of industries

	mean	sd	min	p10	p25	p50	p75	p90	max	count
Value (mns eur 2021 prices)	3768.88	6071.15	0.96	111.26	323.79	1357.28	3703.92	11884.24	40581.80	3552
GUO Count	47.53	50.97	2.00	9.00	13.00	29.00	60.00	109.00	295.00	3664
Top 1 GUO Share	0.18	0.12	0.00	0.05	0.09	0.15	0.25	0.36	0.71	3664
Top 2 GUOs Share	0.29	0.17	0.01	0.09	0.16	0.25	0.41	0.53	0.99	3664
Top 3 GUOs Share	0.36	0.20	0.01	0.12	0.20	0.32	0.50	0.63	0.99	3664
Top 4 GUOs Share	0.40	0.22	0.01	0.14	0.24	0.38	0.55	0.70	0.99	3664
PP Change in Top 4 GUO Share	1.03	7.17	-26.55	-6.05	-2.59	0.52	4.18	8.67	74.49	458
Market Share Instability	0.01	0.02	0.00	0.00	0.00	0.01	0.01	0.02	0.66	2896
Entrenchment	3.71	0.53	0.00	3.00	3.00	4.00	4.00	4.00	4.00	3206
Product Count	10.17	13.03	1.00	1.00	2.00	5.00	13.00	27.00	61.00	3664
Top 1 Product Share	0.61	0.29	0.07	0.22	0.35	0.60	0.94	1.00	1.00	3552
Top 2 Products Share	0.78	0.26	0.13	0.37	0.55	0.91	1.00	1.00	1.00	3552
Top 3 Products Share	0.85	0.22	0.18	0.48	0.70	0.99	1.00	1.00	1.00	3552
Top 4 Products Share	0.88	0.19	0.23	0.56	0.80	1.00	1.00	1.00	1.00	3552

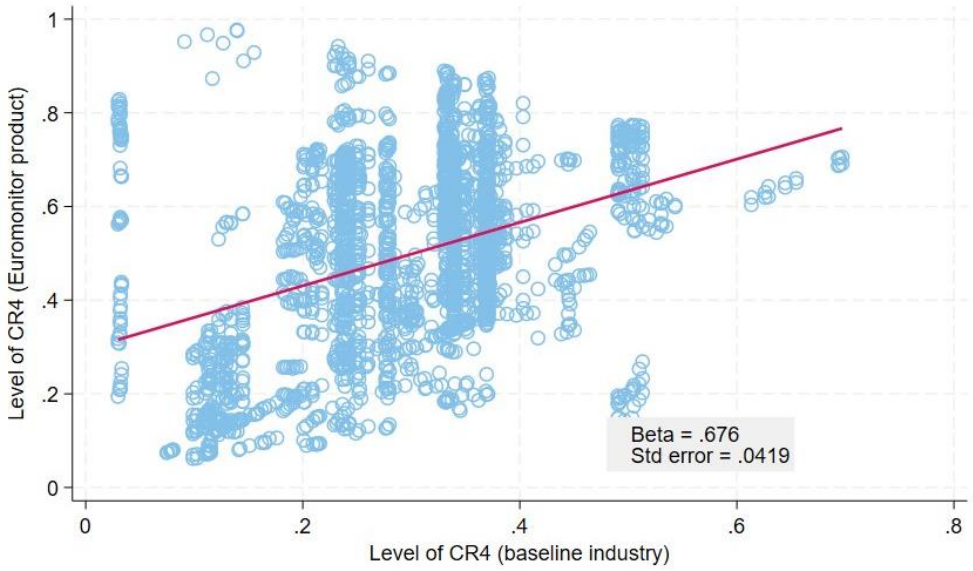
Note: The table presents summary statistics on the industry-country-year level data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE. The data cover 2012-2021.
Source: OECD calculations.

Table A D.3. Summary statistics of global ultimate owners

	mean	sd	min	p10	p25	p50	p75	p90	max	count
Value	128.32	805.12	0.00	0.34	1.50	7.38	34.44	157.81	32908.19	50627
Product count	2.38	4.13	1.00	1.00	1.00	1.00	2.00	5.00	116.00	81484
Industry count	1.29	0.82	1.00	1.00	1.00	1.00	1.00	2.00	15.00	81484
Country count	1.87	2.31	1.00	1.00	1.00	1.00	1.00	4.00	14.00	81484
Top product share	0.86	0.22	0.10	0.50	0.73	1.00	1.00	1.00	1.00	50627
Top industry share	0.96	0.12	0.26	0.82	1.00	1.00	1.00	1.00	1.00	50627
Top country share	0.93	0.17	0.18	0.67	1.00	1.00	1.00	1.00	1.00	50627

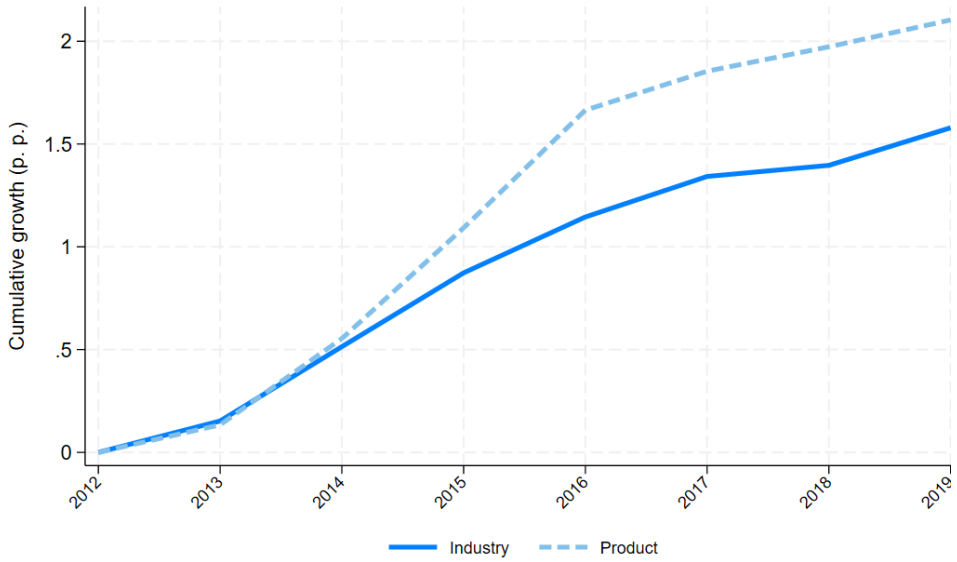
Note: The table presents summary statistics on the industry-country-year level data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE. The data cover 2012-2021.
Source: OECD calculations.

Figure A D.1. Product and industry concentration correlation with Euromonitor data only



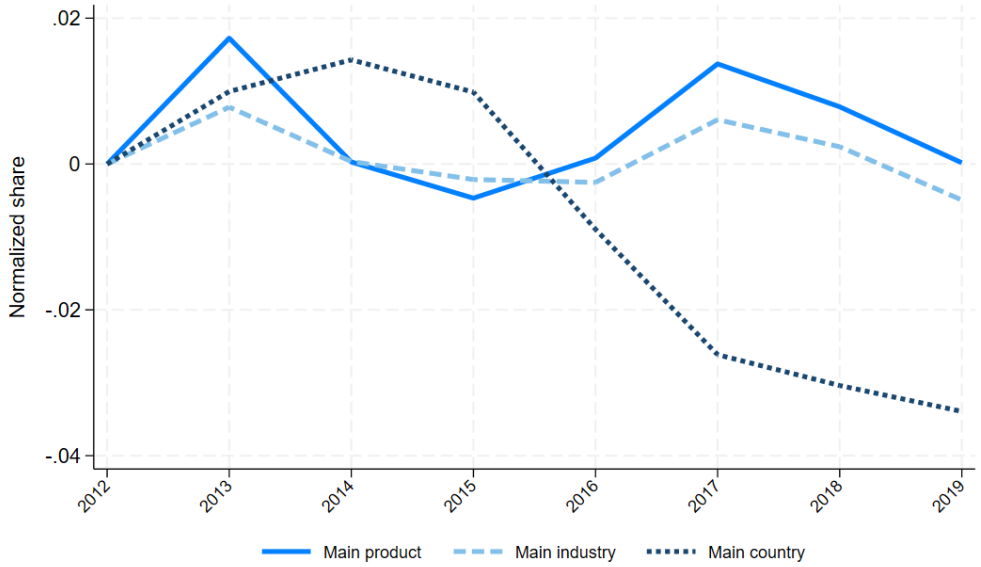
Note: The chart shows CR4 computed at the product-year level and the industry-year level. Both concentration measures are computed incorporating the taxonomy and using Euromonitor data.
Source: OECD calculations.

Figure A D.2. Concentration trends in industries and product markets: weighted by size



Note: The chart shows the weighted (by market size, measured by total gross output) average across industry- or product- country combinations of CR4 cumulative change. Products included are those in the Euromonitor data, while the industries are those that correspond to these products. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Figure A D.3. Shares of GUOs' value in their top country, product, and industry for top firms in the initial period



Note: The chart shows the average share of GUOs' value in their main country, product, and industry, defined as that with the highest share of their value. The chart is restricted to include ranked in the top four of their main industry in the initial period of the sample. Products included are those in the Euromonitor data, while the industries are those that correspond to these products. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Table A D.4. Regression results for merger control interventions on product and industry concentration, including industry-years with no decisions

	(1)	(2)	(3)	(4)
	Intervention rate	Intervention rate	Intervention count	Intervention count
CR4 Baseline		0.0389***		0.298***
		(0.0140)		(0.0594)
CR4 Product (EM)	0.185***		0.437***	
	(0.0537)		(0.109)	
Log Market Value			0.0495**	
			(0.0224)	
Log Production				0.132***
				(0.0121)
Observations	336	2520	328	2520
Year FE	No	No	No	No
Sample	Euromonitor	Full	Euromonitor	Full

Note: The table shows OLS regression results and associated standard errors. Columns (1) and (2) use the intervention rate as the dependent variable, while columns (3) and (4) use the count of interventions and additionally control for the economic size of the market. Columns (1) and (3) relate product market concentration from Euromonitor to interventions. Columns (2) and (4) relate industry-level concentration from the baseline measures, covering all industry-years. Industry-years in which no decisions were made are included, with the dependent variable imposed to be 0 for these observations. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE. Standard errors are robust to heteroskedasticity and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

Annex E. Regression analysis

Correlations between proxies of competition

Table A E.1. Regressions of markups on concentration using the taxonomy

	(1)	(2)	(3)	(4)	(5)
	log avg markup	log average 1st decile	log average 5th decile	log average 10th decile	log 90/10 decile ratio
C4 domestic	-0.0002	0.0000	-0.0000	-0.0001*	-0.0001*
	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
C4 European	0.0001	0.0000	-0.0000	0.0004*	0.0003*
	(0.0003)	(0.0001)	(0.0003)	(0.0002)	(0.0002)
C4 Global	0.0009	0.0001	0.0006	0.0015*	0.0014*
	(0.0007)	(0.0004)	(0.0010)	(0.0006)	(0.0007)
Observations	35904	36945	36945	36945	36945
Adj. R-Square	.8424425	.8391858	.9407751	.939728	.9511325
Controls	Yes	Yes	Yes	Yes	Yes
Market-year and industry FE	Yes	Yes	Yes	Yes	Yes

Note: OLS regressions of different measures of average markups (defined in Table 7.1) on CR4 domestic and CR4 European, and CR4 global, defined in an analogue way to CR4 domestic and CR4 tradeable, in footnote 92. Regressions are weighted: a weight of 1 is attributed to each country-industry pair if the industry is domestic, while a weight of 15 is attributed to each tradeable industry. The sample used in the regression is made by a mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market. The coverage in terms of countries is the intersection between those contained in the concentration sample and in the markup sample (see Data Appendix). Standard errors are clustered at the market-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

Correlations with economic fundamentals

Table A E.2. Markups, further heterogeneity

	(1)	(2)	(3)
	Log markup	Log markup	Log markup
Intangible Intensity (t-1)	0.0150	-0.0336	-0.0588
	(0.0567)	(0.1304)	(0.1841)
Frontier MU	0.5673***		
	(0.0233)		
Frontier MU='1' # Intangible Intensity (t-1)	0.2206**		
	(0.1104)		
Quantiles TFP=1		0.1085***	
		(0.0198)	
Quantiles TFP=2		0.1760***	
		(0.0386)	
Quantiles TFP='1' # Intangible Intensity (t-1)		0.2139***	
		(0.0823)	
Quantiles TFP='2' # Intangible Intensity (t-1)		0.4616***	
		(0.1317)	
Tradeable (t-1)			-0.1304***
			(0.0257)
Tradeable (t-1) # Intangible Intensity (t-1)			0.3961***
			(0.1494)
Observations	3.1e+06	3.1e+06	3.1e+06
Adj. R-Square	0.5049	0.2108	0.1607
Controls	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes

Note: OLS regressions of log markups, measured at the firm level, Intangible Intensity (Intangible investments divided by value added), Frontier MU (a dummy variable that equals to one for firms in the top decile of the markups distribution within each industry-year), Quantiles (a categorical variable for the different quantiles of the TFP distribution: the reference group includes firms belonging to the 1st-50th quantile, TFP=1 includes firms belonging to the 51st-90th quantile, while TFP=2 includes firms belonging to the 91st-100th quantile), and Tradeable (a dummy that equals to one when industries are classified as European, or global). The control variables used in the regressions are capital intensity at the firm-level, age class, and size class (defined by number of employees). All the independent variables are one year lagged. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, HUN, ITA, POL, PRT, SVN, and SWE. Note that information on Intangibles is not available for BEL and POL, while regulation impact data is absent for the USA. Standard errors are clustered at the country–A38 industry-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

Correlation of concentration with other macroeconomic trends

Table A E.3. Relationship of CR4 with labour productivity, labour share, and investments

	(1)	(2)	(3)	(4)	(5)	(6)
	Labour productivity	Labour productivity	Labour share	Labour share	Investment proxy	Investment proxy
CR4 (t-1)	-0.1338	-0.1716**	-0.0359**	-0.0199	0.0039	0.0052
	0.1072	0.0765	(0.0172)	0.0247	0.0076	-0.0079
Firm's LP frontier dummy		1.1175***	-0.0359**	-0.3235***		0.0036
		0.0344		(0.0081)		-0.0031
Firm's LP frontier dummy # CR4 (t-1)		0.4047***		-0.0590***		-0.0089
		0.095		(0.0226)		-0.0097
Observations	2801079	2801079	2949946	2949946	2968113	2968113
Adj. R-Square	0.3079491	0.5359828	0.088806	.0831496	0.0232699	0.0232715
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: OLS regressions of log labour productivity (LP, Columns (1)-(2)), Labour Share (Columns (3)-(4)), and a proxy for investments (investment-capital ratio, Columns (5)-(6)), all measured at the firm level, on CR4 (measured at the market-year level), Frontier LP (a dummy variable that equals to one for firms in the top decile of the LP distribution), and their interaction. The control variables used in the regressions are capital intensity at the firm-level, age class, and size class (defined by number of employees). CR4 is one year lagged. Industries included in the analysis are mix of 2 and 3-digit industries belonging to mining, manufacturing, utilities, and non-financial market services. The countries included in the sample are AUT, BEL, BGR, CZE, DEU, DNK, ESP, EST, FIN, FRA, GBR, HUN, IRL, ITA, LUX, LVA, NLD, POL, PRT, ROU, SVK, SVN, and SWE. Standard errors are clustered at the country–A38 industry-level and reported in parentheses. ***, **, * represent significance at the 1%, 5% and 10% level.
Source: OECD calculations.

Annex F. Margins of growth for leading firms

There are numerous channels through which market-leading firms can grow their sales and, therefore, potentially increase their market concentration. This section examines the margins of growth – products, countries, and brands – of Europe's largest business groups. Throughout the section, brands refer to the global brand name, and products refer to consumer product markets. For example, the business group "Ferrero" has multiple brands – such as "Kinder", "Ferrero Rocher", and "Crunch" – all sold within the "chocolate confectionery" product market, but the brand "Kinder" is also sold in the "cakes" and "sweet biscuits" product markets. Some brands may exist in many countries, while others may only be sold in one country.

Three potential margins of growth are examined: products, countries, and brands. First, the costs of expanding into adjacent product markets may have declined (Aghion et al. (2023[43]), Benkard et al. (2021[10])), for example, due to the increasing importance of intangibles (De Ridder, 2024[17]), leading to firms increasing sales in new product markets. Second, the world has become more globalised in the 21st century, meaning that it is cheaper to supply products to new countries – either by establishing a commercial presence abroad or through international trade. Firms may, therefore, have increased their sales by expanding into new country markets. Third, branding is an important component of intangible capital, which also appears to be on the rise (Bronnenberg, Dubé and Syverson, 2022[110]), and can be an important dimension used by firms to increase their market positions.

There are also likely to be important interactions between these margins. For example, when firms expand to new countries, they may do so by extending their existing product lines from another country, or by developing an entirely new product. To expand to a new product market, firms may leverage the value of their existing brands, such as when Apple developed the iPhone to enter the mobile phone market. Or, to get a foothold in a new country market, firms may acquire an existing brand, as documented by Alviarez et al (2020[111]).

To analyse the importance of these channels, three types of decomposition of the total value of leading firms' sales are conducted. First, the total value of sales growth of all firms is decomposed into: entry and exit of firms, addition or subtraction of markets (where a market is defined as a product-country or a brand-product-country), or within market growth or decline. This analysis follows the methodology of Bernard et al. (2009[112]), who decompose the margins of US trade, providing insights on the relative importance of entry and exit, adding and dropping markets, and intensive margin market growth. Second, focusing only on leading firms and removing the entry/exit margin, the value of firm sales is decomposed into existing versus new products/countries/brands to examine the extent to which firms expand into new markets and how different margins of these new expansions interact. Finally, sales of leading surviving firms are decomposed into the main product/country/brand versus non-main product/country/brands to test the extent to which business groups are specialised in their primary markets. These decompositions provide differing insights on the growth margins of business groups; each is designed to identify different channels through which firms are expanding, and together, they provide a richer picture of the growth of business groups.

This analysis is conducted using data from Euromonitor, described in Section 3. It is a unique dataset with the advantage of providing information on market shares by brand, narrowly defined consumer product market, and country. Brands can be linked to the ultimate owner company, allowing the identification of changes in ownership. As discussed in Alviarez et al. (2020[111]), the data capture sales through either

establishment of a physical presence or cross-border trade. A drawback of the data is that they only cover firms with important market shares – above 0.1% in a product-country market. Therefore, micro firms are not included in the data as separate entities although are considered to build the total market size, which does capture the entire market. Most of the analysis in this section focuses on the activities of leading business groups, so this limitation of the data does not affect the main conclusions of the section. An additional issue is that there are a few cases where the brand name is missing. These are left in the data as missing for the baseline analysis, but the results are very similar when dropping missing brands.

Decomposition 1: entry and exit, adding and dropping, and intensive margin growth (Bernard et al., 2009)

The first decomposition exactly follows the methodology of Bernard et al. (2009[112]), who decompose the margins of growth for US goods trade.[141] It takes the total value of sales growth across all firms in each period and decomposes it into three main channels: 1) entry and exit of firms; 2) adding and dropping of product-country markets; and 3) within product-country growth of sales. To begin with, firms' activity is considered at the product-country markets, as in Bernard et al (2009[112]). Then, the brand dimension is added, so the growth decomposition examines growth within or between brand-product-country triplets. It is important to reiterate the caveat of the data sample for this decomposition: the data only cover firms with significant market shares (approximately 0.1% of a product-country market). Therefore, entry and exit correspond to entry and exit *from the sample.*

Table A F.1. presents the results of the decomposition. The row titled "Total change in sales" shows the total growth of sales, in billions of euros at 2021 prices, for all firms in the sample over the relevant period (shown in the column heading). The first two rows show the contribution of firm entry and exit (the third row is net entry). The fourth row shows the contribution of new product-country pairs, which may be a new product, a new country, or both a new product and a new country, while the fifth row shows the loss of sales from firms exiting a product-country market (the sixth row is net product-country entry). The next two rows show growth and decline, respectively, within existing product-country markets (with the ninth row showing the net intensive margin growth). The percentage contributions of the net of each margin are shown in the final three rows.

The columns show different time periods over which the growths are calculated. The first seven columns show year-on-year changes, the penultimate column is the sum of the annual changes, while the last column reports the long change in sales from 2012-2019. An important difference between the last column and the rest is the set of product-countries used to determine the extensive or intensive margin growth. In the first eight columns, the set of product-countries used to determine extensive or intensive margin growth is determined in each year, whereas for the last column, the set of product-countries is determined in 2012. Therefore, the key difference with this last column compared with the others is that any product-country added during the period 2013-2019 is considered to be extensive margin growth, whereas in the preceding columns it would only be considered as extensive margin for one period, since in the following year it would then be considered as an existing product-country and so it would count as intensive margin growth.

The first key takeaway is that year-on-year growth is dominated by the intensive margin, while the extensive margin plays a minimal role. This is intuitive: in the first year that firms add a new product-country, or in product-countries that get retired, the value of sales is likely to be small. Then, conditional on survival in the market, sales growth grows as the firm consolidates its market position. Also, the gross flows – increases and decreases – are substantial relative to the net flows, suggesting that there is a lot of heterogeneity across firms (for example, while some firms expand, others decline; while some firms entry, other exit). These findings are in line with the findings of Bernard et al. (2009[112]) for US trade.

[141] The same decomposition has been used to analyse UK services trade in De Lyon (2022[119]).

Despite this, there are some periods where the addition or subtraction of product-country markets constitutes more than 10% of the total growth or decline in firm sales. Furthermore, looking at the last column, growth in product-country markets that did not exist within the firm in 2012 constituted growth of 31.2 billion euros, equivalent to 19% of the growth caused by increases in sales within existing product-country markets (168.5 billion euros). This suggests that firms entering and exiting different product-country markets could be an important contributor to market dynamics and may be playing a role in competition trends documented throughout this report (this is explored in more detail throughout the remainder of this Annex).

Finally, firm entry and exit plays a substantial role in growth over the full seven-year sample, constituting 21.5% of the total change in sales. However, this should be interpreted with the caveats of the data sampling procedure in mind.

Table A F.1. Decomposition of growth by entry and exit, and product-country pairs

	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2012-2019 (sum of annual changes)	2012-2019 (long change)
Firm births	11	47.2	22.4	9.2	6.7	49.7	13.2	159.4	153.9
Firm deaths	-12.7	-45.3	-28	-12	-6.6	-44.5	-11.1	-160.2	-116.2
Net firm entry	-1.7	2	-5.5	-2.8	0.2	5.2	2.1	-0.5	37.7
New product-country	4.8	4.1	9.1	7.1	2.8	2.7	1.6	32.2	31.2
Retired product-country	-3.3	-2.8	-5	-4.8	-2	-5	-5.5	-28.4	-23.7
Net product-country	1.6	1.4	4.1	2.3	0.9	-2.2	-3.9	4.2	7.5
product-country growth	34.8	32.3	41	41.8	43.3	38.1	38.5	269.8	168.5
product-country decline	-18.2	-13.5	-12.9	-15.8	-12.9	-11.3	-13.4	-98.0	-38.3
Net intensive margin	16.6	18.8	28.2	26	30.4	26.8	25.1	171.9	130.2
Total change in sales	16.5	22.1	26.7	25.5	31.5	29.7	23.3	175.3	175.4
Net entry and exit (p.p. contribution)	-10.1%	8.9%	-20.7%	-10.8%	0.6%	17.5%	9.0%	-0.3%	21.5%
Net add and drop (p.p. contribution)	9.5%	6.2%	15.3%	8.9%	2.8%	-7.5%	-16.5%	2.4%	4.3%
Net intensive margin (p.p. contribution)	100.6%	84.9%	105.5%	101.9%	96.7%	90.0%	107.5%	98.1%	74.3%

Note: The table shows the value of growth of firms, in billions of Euros deflated to 2021, decomposed by different margins of growth: entry and exit of firms; new product-countries and retired product-countries; and within product-country growth and decline. The bottom three rows show the aggregate percentage contribution of each net channel. Each column shows a different time period, with the far-right column showing the long difference in sales between 2012 and 2019. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

An important margin through which firms may expand their sales is through new brands. These may be within product-country markets in which firms already operate or in new product-country markets. To examine the importance of brands, an equivalent decomposition is carried out using brand-product-country triplets as the relevant margin. Therefore, a new brand-product-country could be either a new brand, new product, or new country, as well as any combination of these. The results are presented in Table A F.2.[142]

[142] Note that the entry and exit of firms is the same in Table A F.1. as it is in Table A F.2.

When incorporating brands as an additional margin or adjustment, the importance of the add and drop margin of new brand-product-countries increases substantially. This is seen by comparing the results of Table A F.2 with Table A F.1. . Focusing on the final column, new brand-product-countries account for 64.2 billion euros in 2019 relative to 2012, while new product-countries only accounted for growth of 31.2 billion. Overall, net adding and dropping of brand-product-countries constituted 11.6% of the increase in sales in 2019 relative to 2012 (whereas it represented only 4.3% of the total increase in Table A F.1.).[143] The magnitude of the increasing importance of this margin is sizeable, suggesting that developing or acquiring new brands plays an important role in firms' growth.

Table A F.2. Decomposition of growth by entry and exit, and brand-product-country triplets

	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2012-2019 (sum of annual changes)	2012-2019 (long change)
Firm births	11	47.2	22.4	9.2	6.7	49.7	13.2	159.4	153.9
Firm deaths	-12.7	-45.3	-28	-12	-6.6	-44.5	-11.1	-160.2	-116.2
Net firm entry	-1.7	2	-5.5	-2.8	0.2	5.2	2.1	-0.5	37.7
New brand-product-country	13.8	7.9	14.5	16.2	5.2	10.3	3.9	71.8	64.2
Retired brand-product-country	-12.3	-5.1	-7.7	-10.5	-4.2	-12.9	-6.8	-59.5	-43.9
Net brand-product-country	1.5	2.9	6.9	5.7	0.9	-2.6	-3	12.3	20.3
brand-product-country growth	34.1	32.5	39.3	38.2	43.9	38.3	38.6	264.9	156.7
brand-product-country decline	-17.4	-15.1	-14	-15.6	-13.5	-11.2	-14.4	-101.2	-39.4
Net intensive margin	16.7	17.3	25.4	22.6	30.4	27.1	24.2	163.7	117.3
Total change in sales	16.5	22.1	26.7	25.5	31.5	29.7	23.3	175.3	175.4
Net entry and exit (p.p. contribution)	-10.1%	8.9%	-20.7%	-10.8%	0.6%	17.5%	9.0%	-0.3%	21.5%
Net add and drop (p.p. contribution)	9.1%	12.9%	25.8%	22.2%	2.9%	-8.6%	-12.7%	7.0%	11.6%
Net intensive margin (p.p. contribution)	101.0%	78.2%	94.9%	88.6%	96.5%	91.1%	103.6%	93.4%	66.9%

Note: The table shows the value of growth of firms, in billions of Euros deflated to 2021, decomposed by different margins of growth: entry and exit of firms; new brand-product-countries and retired brand-product-countries; and within brand-product-country growth and decline. The bottom three rows show the aggregate percentage contribution of each net channel. Each column shows a different time period, with the far-right column showing the long difference in sales between 2012 and 2019. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Decomposition 2: growth by existing versus new products, countries, and brands

The previous analysis hints that an important margin for a firm's growth is the development or acquisition of new brands and that firms are entering and exiting product-country markets, even over the short seven-year time period. However, it does not provide information on whether firms develop new brands in existing

[143] Note that because the analysis shown in Table A F.2 adds a new criteria (brands) relative to Table A F.1. , the add and drop margin is mechanically more important. Indeed, a new product-country is also necessarily a new brand-product-country, but the reverse is not true (i.e., it is possible to have a new brand-product-country without having a new product-country).

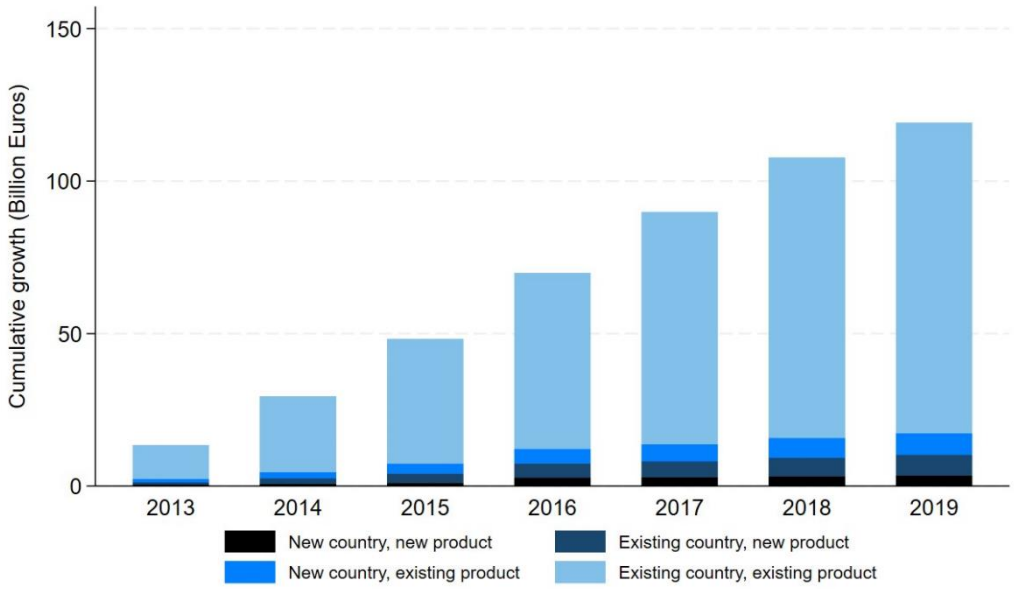
products or countries, or whether they are in new products or countries. To examine the interactions between the growth of sales in new versus existing brands, products, and countries, an alternative decomposition is developed and presented in this sub-section. A brand, product, or country is considered to be “new” if it did not exist within the business group in 2012 and “existing” if it did exist in 2012.

For the purposes of the present study on market concentration, the activities of the largest firms – those which are market leaders – is most relevant. These firms are also likely to remain in the sample over the full seven-year period. For these reasons, the sample is now restricted to include only firms that are in the top four of any product-country in the initial year, 2012. The extensive margin is also shut down, with only surviving firms examined (this also removes the issue of sampling in the Euromonitor data which makes the interpretation of entry and exit difficult).

To summarise the methodology for the analysis in this section, the sales of business groups which are in the top four of any product-country market in 2012 and who have not exited the market are decomposed into multiple channels. These channels depend on whether a brand, product, or country existed (a firm is observed in a brand-product-country triplet if it has at least a market share of 0.1) within the firm in 2012. The charts plot cumulative growth, i.e., the sum of annual growth in sales up to the relevant year.

Most of the growth in firm sales was within products and countries in which firms already operated in 2012, as shown in Figure A F.1. . Total cumulative growth in sales of firms in the sample from 2012-2019 was around 119 billion euros, of which 102 billion euros was in existing products and countries.

Figure A F.1. Growth by existing or new countries and products

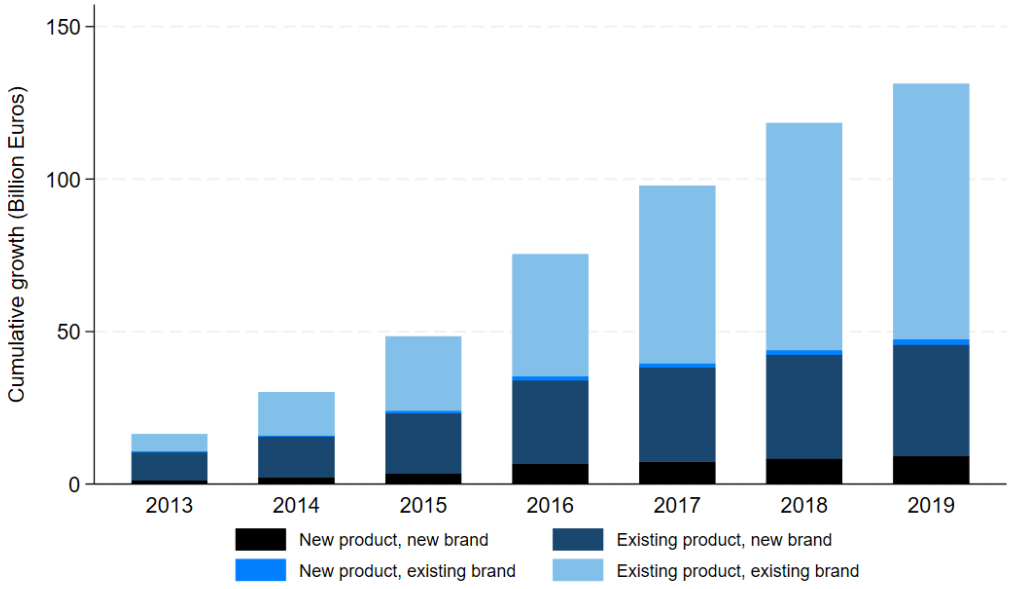


Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any product-country market in 2012. The growth is decomposed into existing and new products and countries, where existing means that the firm had some sales in that product or country in 2012. Values are in billions of euros deflated to 2021 terms. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Next, Figure A F.2. shows that an important part of growth is through the development of new brands and that, when firms add new brands, it is typically within the same product market. Further, when firms do make sales to new product markets, it is typically through a new brand.

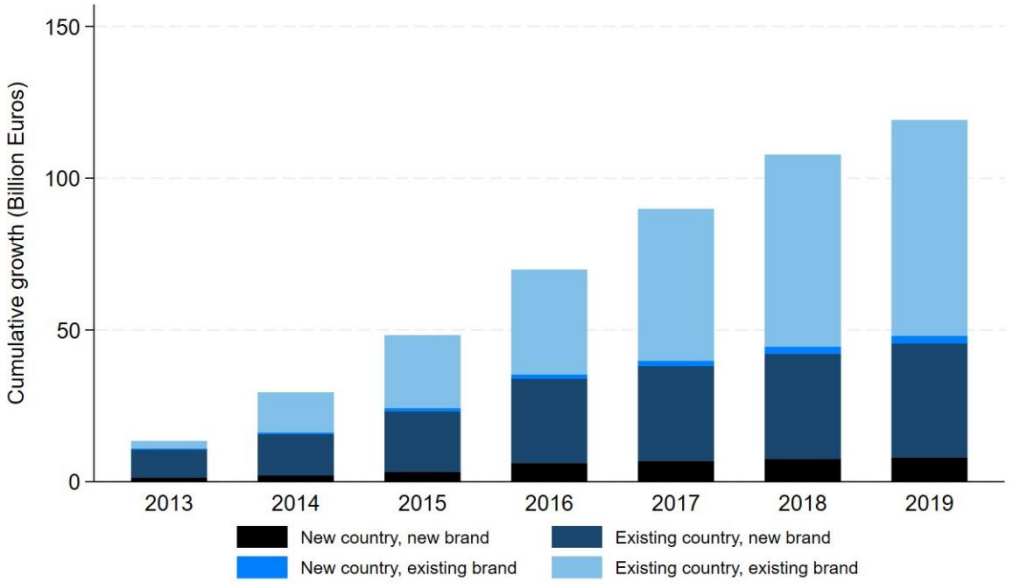
Finally, Figure A F.3. shows that growth through new brands is typically in an existing country. When firms expand to new countries, it is typically through new brands, which may be either acquired or newly developed. This finding is consistent with Alvariez (2020[111]), who shows that firms acquire foreign brands to enter a new market, and with Coşar et al. (2018[113]), who show that there is a strong home market advantage driven by a preference for local brands. Therefore, the M&A market for brands presents a potentially important margin for growth of the world's leading business groups across countries. Finally, comparing Figure A F.3. and Figure A F.2., there is more expansion of existing brands into new countries than there is into new product markets, although the values are small.

Figure A F.2.Growth by existing or new brands and products



Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any product-brand market in 2012. The growth is decomposed into existing and new products and brands, where existing means that the firm had some sales in that product or brand in 2012. Values are in billions of euros deflated to 2021 terms. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Figure A F.3. Growth by existing or new brands and countries



Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any brand-country market in 2012. The growth is decomposed into existing and new brands and countries, where existing means that the firm had some sales in that brand or country in 2012. Values are in billions of euros deflated to 2021 terms. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Taking the analysis of this section together with the previous section suggests that an important portion of firm growth is driven by the development or acquisition of new brands. These new brands tend to be in existing products and countries, suggesting that firms may be using brands to increase growth even within existing markets.

Decomposition 3: growth by main product, country, or brand, versus others

The existing analysis suggests that, over the seven-year period 2012-2019, firms grow relatively little into new product and country markets. They may, however, have increased the relative importance of products, countries, or brands outside of their primary activities. Such an expansion could be driving increasing market concentration and, potentially, market power as world-leading firms establish positions as leaders in more markets while also increasing their total size.

To examine this, total growth of firms in the top four of a market in 2012 is decomposed into their main product – which is defined as that with the largest share of sales in the initial period -, other existing products, and new products. The same analysis is conducted for brands, and countries, as well as product-country, product-brand, and country-brand pairs. Again, cumulative growth from 2012 to 2019 is plotted.

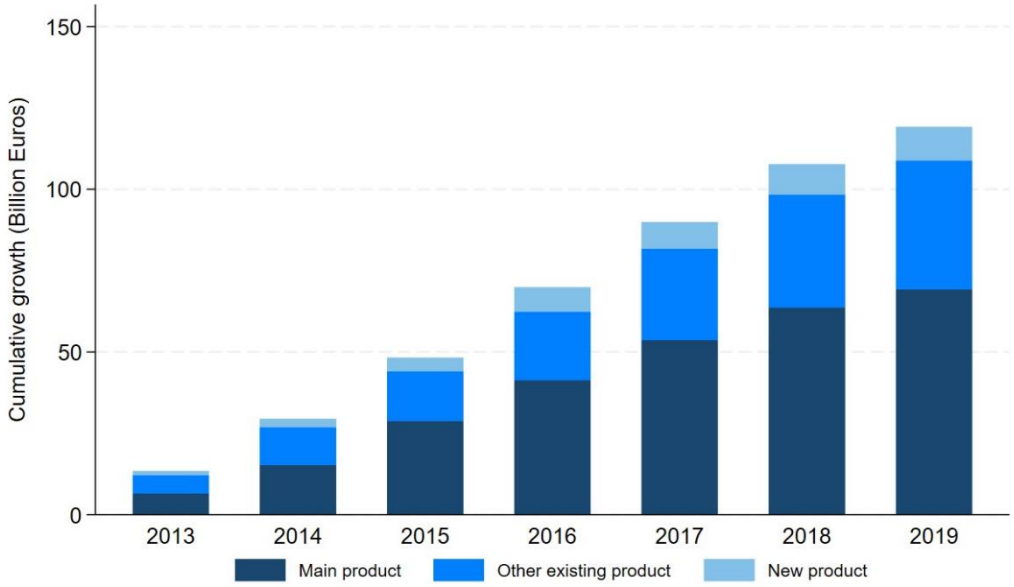
Figure A F.4 plots the cumulative growth of leading firms' sales by their main product market, other existing products, and new products. Most of their growth was driven by their main product, but the amount of growth given by other non-main products is significant, constituting around a third of the total. As before, there is a small but non-negligible role for growth in new products.

In Figure A F.5. , growth is decomposed by country. There is an important role of growth in countries other than firms' primary country of operation, in line with the analysis of Figure 6.5. This suggests that there has been an important role of globalisation in the expansion of leading firms, where they have been able to

increase their presence across borders. Comparing Figure A F.5. with Figure A F.4 shows that growth in secondary country markets was more important than growth in secondary product markets.

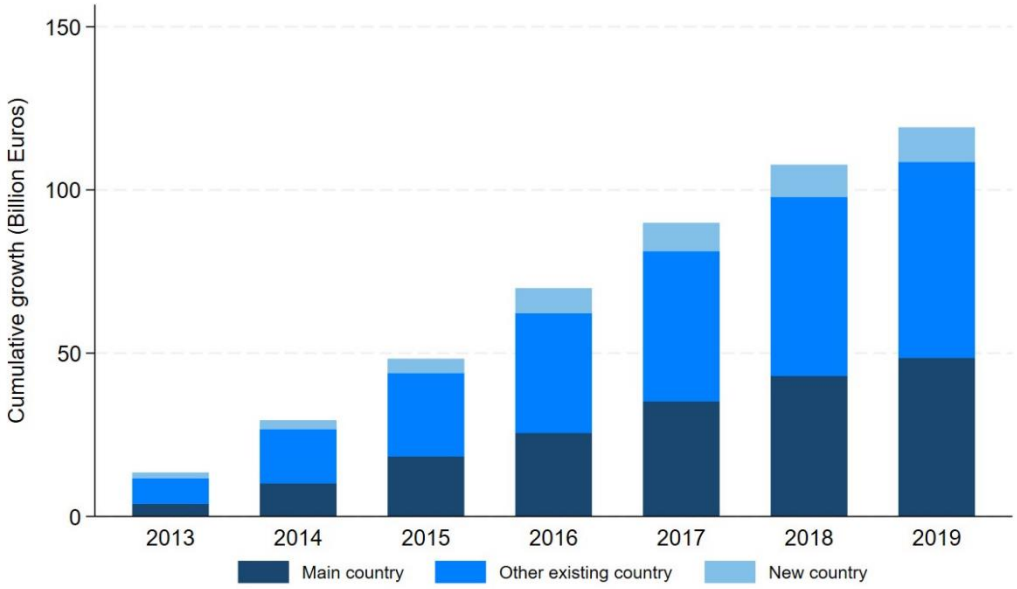
For the decomposition across brands, shown in Figure A F.6. , a different pattern emerges. There is an important role for growth through new brands – either acquired or developed in-house – and almost no role for growth through non-main existing brands. This suggests that firms rely heavily on their primary brand for growth, as well as the development or acquisition of new brands, rather than developing secondary brands.

Figure A F.4 Growth by main product, other existing products, and new products



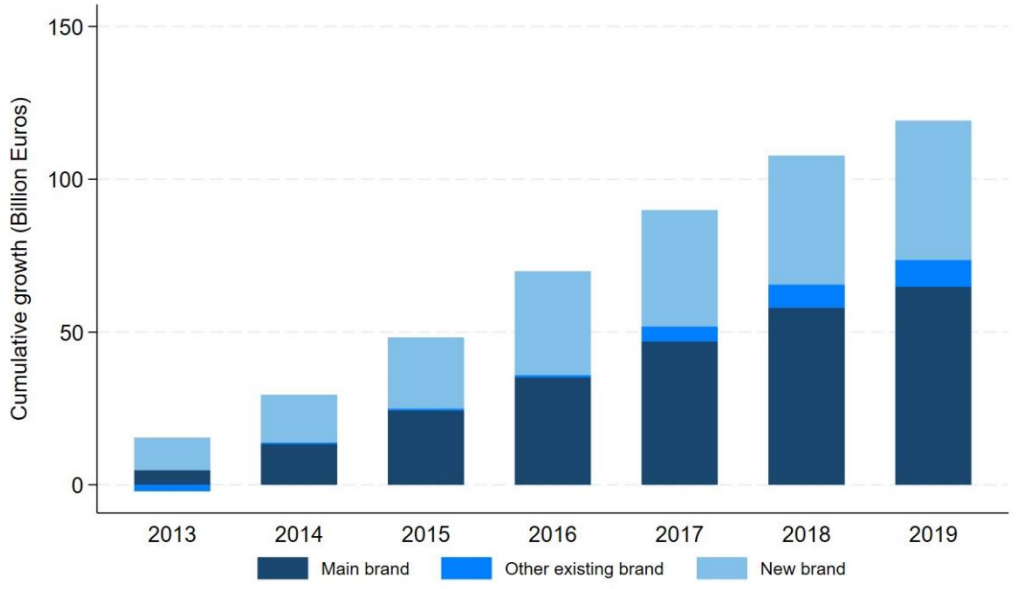
Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any product-country market in 2012. The growth is decomposed into firms' main product (defined as that with the highest share of sales in the initial period, 2012), other existing products (defined as those with positive sales in the initial period, 2012), and new products. Values are in billions of euros deflated to 2021 terms. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Figure A F.5. Growth by main country, other existing countries, and new countries



Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any product-country market in 2012. The growth is decomposed into firms' main country (defined as that with the highest share of sales in the initial period, 2012), other existing countries (defined as those with positive sales in the initial period, 2012), and new countries. Values are in billions of euros deflated to 2021 terms. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Figure A F.6. Growth by main brand, other existing brands, and new brands

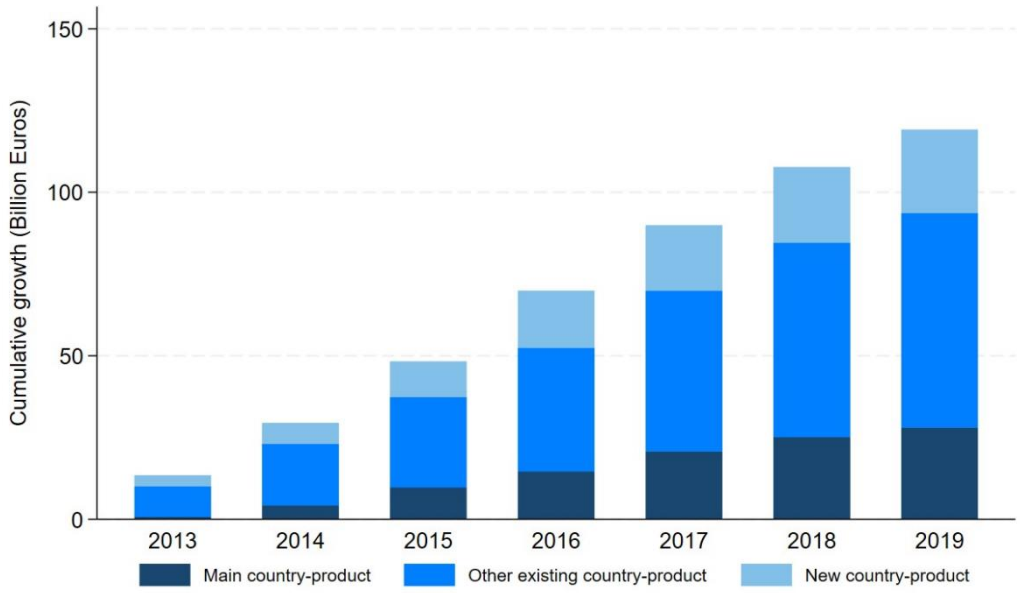


Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any product-country market in 2012. The growth is decomposed into firms' main brand (defined as that with the highest share of sales in the initial period, 2012), other existing brands (defined as those with positive sales in the initial period, 2012), and new brands. Values are in billions of euros deflated to 2021 terms.
Source: OECD calculations.

Next, these margins of growth are analysed in pairs (country-product, brand-product, and brand-country). The results are shown in Figure A F.7. , Figure A F.8. , Figure A F.9. and present a richer picture of the margins of growth. In these cases, the main pair is the one with the highest share of sales in the initial period.

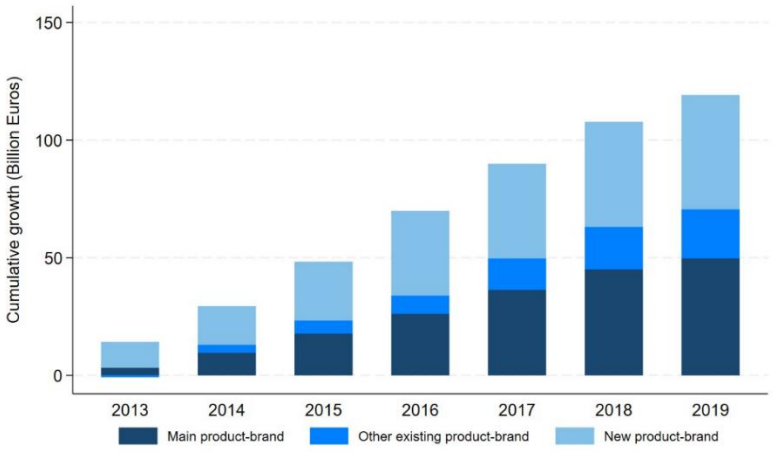
First, Figure A F.7. decomposes growth by main product-country, other existing product-countries, and new product-countries. The results show that the primary product-country accounts for a relatively small share of total growth, so firms mainly grow through expanding non-main products, countries, or both. Second, Figure A F.8. shows that the main product-brand pair is relatively important for growth. It also shows that new product-brand pairs are important for growth, and this must mainly be due to new brands in existing product markets because Figure A F.4 shows that the amount of growth in new product markets is relatively small. Finally. Figure A F.9. shows that the importance of the main brand-country for growth is relatively small, with most of the growth coming through existing non-main brand-countries and entirely new brand-countries.

Figure A F.7. Growth by main country-product, other existing country-products, and new country-products



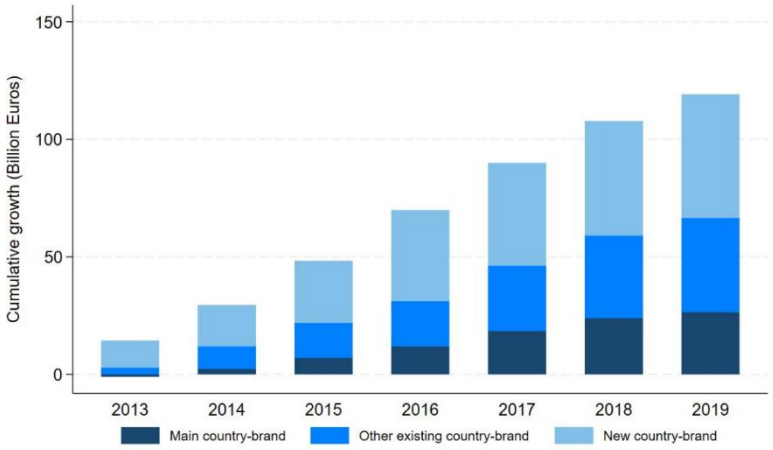
Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any product-country market in 2012. The growth is decomposed into firms' main product-country (defined as that with the highest share of sales in the initial period, 2012), other existing product-countries (defined as those with positive sales in the initial period, 2012), and new product-countries. Values are in billions of euros deflated to 2021 terms. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Figure A F.8. Growth by main product-brand, other existing product-brands, and new product-brands



Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any product-country market in 2012. The growth is decomposed into firms' main product-brands (defined as that with the highest share of sales in the initial period, 2012), other existing product-brands (defined as those with positive sales in the initial period, 2012), and new product-brands. Values are in billions of euros deflated to 2021 terms. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations

Figure A F.9. Growth by main country-brand, other existing country-brands, and new country-brands



Note: The chart shows cumulative growth of surviving firms initially in the top four leading firms in any product-country market in 2012. The growth is decomposed into firms' main country-brand (defined as that with the highest share of sales in the initial period, 2012), other existing country-brands (defined as those with positive sales in the initial period, 2012), and new country-brands. Values are in billions of euros deflated to 2021 terms. Products included are those in the Euromonitor data. The countries included in the sample are BEL, DEU, DNK, ESP, FIN, FRA, GBR, GRC, HUN, ITA, NOR, POL, PRT, SVN, and SWE.
Source: OECD calculations.

Discussion

This analysis shows the dimensions through which leading firms grow and expand their market share, which has implications for the evolution of competition. Benkard et al. (2021[10]) argue that the rise in industry concentration is caused by leading firms expanding into additional product or country markets. While most growth is within existing products and countries, there is a role for expansion into products and countries that are not the primary markets of firms. The expansion of firms into countries outside their primary market is an important margin of growth, accounting for more growth than expansion into secondary product markets. Globalisation – particularly the increasing integration of the EU and declining communication costs – as well as the increasing importance of intangible capital (De Ridder, 2024[17]) or overhead costs (Aghion et al., 2023[43]) are likely to be important factors in facilitating this growth of leading firms into new markets.

This growth may have important implications for competition. Helpman and Niswonger (2022[114])develop a model in which product innovation in a setting with multi-product firms generates increasing concentration and markups. Expansion into new countries by leading firms can amplify their global market shares and the benefits from the scalability of their intangible capital, possibly leading to increased market power.

This analysis also shows that leading firms grow substantially through new brands, which may be acquired from other firms or newly developed. New brands constitute a significantly larger contribution to growth than new product markets or new countries. Indeed, most of the sales growth from new brands is within existing product or country markets. When firms enter new product or country markets, most of the value generated in new sales is through brands that are also new to the firm. This is in line with Alvariez et al. (2020[111]), who show that firms in the beer industry typically expand to new country markets by acquiring brands. Importantly, with respect to its implications for competition, the increase in market power from these acquisitions results in higher prices and profits (Alvariez et al. (2020[111])).