CONCENTRATION AND COMPETITION: EVIDENCE FROM EUROPE AND IMPLICATIONS FOR POLICY[1]

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ABSTRACT

The paper provides new evidence on proxy indicators of market power for major European countries. The data show moderately increasing average industry concentration over the last two decades, a considerably increasing proportion of high-concentration industries, and an overall tendency toward oligopolistic structure. Estimates of aggregate profitability also show a sustained increase over the recent decades for European economies. Although the academic and policy debate is not settled as to whether the causes of these trends are policy driven or reflect technological improvement, our findings suggest that competition policy is likely to face more challenges as large companies are becoming more common in more and more industries.

I. INTRODUCTION

Recent empirical evidence suggests that market economies are changing in fundamental ways. There is an increase in firm markups, higher aggregate industry concentration, a decline in the labor share of output, larger firm and income inequality, and a reduction in business dynamism.[2] These trends affect both the United States and Europe, though they tend to be more pronounced in the United States. The causes of these changes and the policy conclusions drawn from them are subject to a lively debate.[3] Some authors (e.g., Eeckhout, 2021; Grullon et al., 2020;

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[2] Industry concentration: Bajgar et al. (2019), Gutiérrez and Philippon (2020), Akcigit et al. (2021), Aggregate profitability and labor share: Barkai (2020), Gutiérrez and Philippon (2020), Markups: De Loecker and Eeckhout (2018), Cavalleri et al. (2019), Díez et al. (2019), Weche and Wambach (2018), De Loecker et al. (2020), Akcigit et al. (2021).

[3] Akcigit et al. (2021), Autor et al. (2020), Berry et al. (2019), Gutiérrez and Philippon (2020), Shapiro (2018, 2019), Werden and Froeb (2018).

Philippon, 2019; Shapiro, 2019) argue that lax merger control is at least partially responsible for these trends, particularly in the United States, whereas others emphasize the role of technological change (e.g., digitization and automation) and globalization (e.g., Autor et al., 2020; Bessen, 2020). These alternative explanations are not necessarily contradicting each other as several forces can be at play simultaneously.

This paper takes a fresh look at new evidence on industrial concentration and aggregate profits to understand how to interpret them from a competition policy perspective. Our main question is simple: what does it mean that industry concentration increased, as we find, by 7 percentage points *on average* in the last two decades? Average concentration changes are not straightforward to translate to the usual logic of competition policy. Competition policy usually intervenes in highly concentrated markets: these are the markets where authorities may find an abuse of market power or the risk that further consolidation would harm competition. If there is a negative effect of increasing concentration in market economies, it is likely to materialize in these high-concentration markets.

Whether one can adapt this logic to industry concentration as well, depends on whether industry concentration is a useful proxy for market power. We address this issue directly and clarify the relationship between industry concentration and market power by linking merger interventions to industry concentration. The intensity of merger interventions, captured for instance by the intervention rate in an industry, is an indicator for market power, since merger intervention happens typically in antitrust markets where competition agencies find market power. We show that higher industry concentration is associated with more market power only for the higher end of the industry concentration distribution. In our sample, industry concentration is a useful proxy for market power only in high-concentration industries, where the share of the four largest firms is above 50 percent. However, the level of industry concentration depends on the construction of the concentration indicator and carries a degree of arbitrariness. Therefore, our analysis focuses on the change in the share of high-concentration industries. In other words, our focus is mostly on the dynamics of concentration rather than its level.

We add to the literature in four ways. First, we look at European concentration trends employing a new data set, commissioned by the Directorate-General for Competition (DG COMP) from Euromonitor International.[4] The data contain the share of the four largest firms per industry in the five largest European economies—France, Germany, Italy, Spain, and the United Kingdom, or the "EU4 + UK"—and cover 22 years, from 1998 to 2019.[5] As such, the paper adds to the emerging literature that presents European concentration figures at industry level.[6]

Second, we clarify the relationship between industry concentration and market power and focus on high-concentration industries when studying concentration trends: we look at how their share within the total economy changed. In other words, we document whether concentration increases are focused on high-concentration industries. This focus helps us to zero in on the part of the economy where changes in concentration are most likely to exert a negative effect. Most industries are not characterized by high concentration, however. Low-concentration industries are less likely to be affected negatively by increasing concentration; indeed, it might be a sign of growing efficiency. But where concentration is already high, it is unlikely that further economies of scale can be exploited since a minimum efficient scale would have already been reached, whereas market power can well be detrimental to consumers. Also, low-concentration

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4   Contracts COMP/2018/002 and COMP/2020/013.
5   The EU4 + UK roughly corresponds to 80 percent of the GDP of EU27 + UK.
6   Bajgar et al. (2019), Díez et al. (2019).

industries are not the typical focus of the analysis and intervention of competition authorities, which instead are more focused on high-concentration industries.

Third, and directly related to the previous point, we are able to compare concentration trends in high-concentration industries to merger enforcement in the EU. This helps to put the stance of competition policy in perspective.[7] For example, if one observed an increasing share of high-concentration industries and a constant rate of merger interventions, one could hardly conclude that merger enforcement is becoming tougher. Such intervention analysis is a useful check when it comes to industry concentration data.

Fourth, we also present aggregate level estimates of profitability in Europe and compare to those of the United States. Although such aggregate profit estimates are not direct measures of market power, they might reflect and be related to the competitive stance of the economy. As such, they should be read in conjunction with other profit/markup estimates from the literature.

In principle, concentration data relevant for the analysis of overall, long-term competition trends has to satisfy three conditions. It has to cover a long enough time span for each aggregate, it has to be on the right level of aggregation, and it has to cover the whole economy. Unfortunately, there is no data source and methodology complying with all three of these conditions. Hence, there is no "best" measure of competition trends, and different types of estimates should be used simultaneously when assessing the performance of the economy. But we do argue that the type of data we analyze carry forward important advantages.

First, collecting antitrust market data spanning several decades and covering a sufficiently large part of the economy is not feasible. Antitrust market definitions might change over time, and the relevant breakdown of company accounts is not publicly available. Antitrust market share data reported in merger decisions cover only a few consecutive years of a limited number of markets.[8] On the other hand, the industry level data used in this paper cover industries for two decades in a consistent way. Second, however, the industry level concentration data provide no direct evidence on market power at the antitrust market level. Industries are much broader aggregates than antitrust markets, and high concentration at the industry level does not necessarily translate into high concentration in the underlying antitrust markets. Third, the industry level data cover the whole industrial structure of the economies studied. Antitrust market level data from competition agencies cover the cases the agencies have to deal with, such as mergers notified, abuse of dominance found, and so forth. Hence, the list of antitrust markets identified by competition agencies might not be a representative look at the whole economy's industrial structure.

Notwithstanding the above criticisms of industry level data, high industry level concentration shows the role of large firms in industries and the economy as a whole. If an industry becomes more and more characterized by large companies, it is more likely that in some markets in that industry a competition investigation would find increased market power after a merger or detect an abuse of dominance. Thus, while we agree that market power has many determinants and arises endogenously along with market structure, so it cannot be established purely based on a simplified "structure-conduct-performance" framework (Berry et al., 2019), we also note that, for any practical purpose, data sets that look at several antitrust markets covering the whole economy in a representative way, for a few decades, and across different countries are simply not available.

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[7] It is important to note that the stance of European competition policy is determined by both the European Commission's enforcement activity, as well as that of the individual member states' competition authorities. The concentration figures and other measures of market power reflect both of these impacts.

[8] For an attempt to use statistical methods to uncover long-term trends from European antitrust market data, see Affeldt et al. (2021).

To avoid the pitfall of overinterpreting evidence on industry level concentration, several reports suggest that one should assess concentration in conjunction with other measures of market trends and market power.[9] These other measures might include data on profitability, markups, firm dynamics of entry and exit, various market and technology characteristics (fixed and sunk costs, network effects, monopsony power, international trade, etc.), as well as indicators of competition policy intervention. It is in this spirit that we also present information on the evolution of profit margins. Combining concentration and profit margin data should give us a reasonably clear picture of general trends in the EU.

As said above, we use the share of the four largest firms as the industry concentration indicator. A high value of the indicator reflects an oligopolistic market structure. The economic literature has shown that, all other things (like product differentiation) being equal, higher concentration tends to lead to more significant market power. Therefore, a high share of the four largest firms makes it more likely that a market is characterized by firms that can exercise market power and an increase in the share of the four largest firms is likely to lead to an increase in market power.

The emphasis on market shares, seen as a measure of concentration, is grounded in economic theory. Virtually all standard models of Industrial Organization suggest that, absent efficiencies, concentration by merger tends to be associated with increased prices and decreased consumer welfare. In some cases, the link between market shares and market power can be quite direct (e.g., Nocke and Schutz, 2018; Nocke and Whinston, 2020).

This is also in line with recent competition policy interventions. For example, many "phase two" merger intervention cases (i.e., mergers that are analyzed in depth by the European Commission) are justified by an assessment finding a creation or strengthening of dominance of the merging firms. In this context, one of the possible characteristics of dominance is often found to be a share of the merging firms above 50 percent.[10]

Hence, anticompetitive mergers triggering intense competition policy scrutiny can often be associated with a share of the four largest firms between 50 and 100 percent. In line with this, throughout the analysis, we define high-concentration industries as those where the four largest firms account for at least 50 percent of turnover. Focusing on the change in the share of high-concentration industries, rather than the change in industry averages as done in existing work, helps to give a clearer interpretation of concentration trends for policy purposes. An increasing share of high-concentration industries means that more industries are characterized by oligopoly structures.

Focusing on the four largest firms in an industry also allowed data collection to check and verify the reliability of data from several sources. The estimates in this paper focus on three main sources of data. First, industry share numerators mainly come from the ORBIS data set. It is important to note that in each industry/country we focus only on the four largest firms. Hence the changing coverage issue of the ORBIS data set (i.e., the increasingly improving data availability of small firms) does not impact our numerator estimates. Second, the industry data set's creator, Euromonitor International, also conducted extensive desk research that is needed in particular to assess cross-industry allocation of sales figures of each firm, and also to identify large firms not present in ORBIS, if any. Third, to estimate the denominators, that is, the industry sizes, consistent data are obtained from the respective national accounts (this comes from Euromonitor International's Passport Industrial database). As such, the increasing

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9   Bajgar et al. (2019), Berry et al. (2019), Díez et al. (2019).
10 For example, in some recent merger cases from the European Commission's practice with significant interventions, the ranges of market shares of the four largest firms on the respective markets of concern were as follows: INEOS/Solvay (M.6905): 55–100 percent; Ball/REXAM (M.7567): 95–100 percent; AB InBev/SABMiller (M.7881): 45–90 percent; Siemens/Alstom (M.8677): 75–100 percent; Wieland/Aurubis (M.8900): 70–100 percent. It should be noted, however, that dominance might also be found with market shares lower than 50 percent depending on the factors affecting competition on the given market.

coverage issue of the ORBIS data set does not bias the concentration estimates. In particular, an increasing coverage implies that an ORBIS-based industry wide sum of turnovers could increase more than the actual turnover sum of a given industry. Using the ORBIS totals could then imply a lower concentration increase or even a decrease as compared with the actual trends.[11] The methodology underlying our data hence avoids this problem. Finally, we note that using only the four largest firms' aggregate (C4) can be more robust to data construction and inconsistencies than broader measures, such as C8 or HHI. These latter measures have to cover more firms, which can lead to more measurement errors. The HHI, in particular, uses the full population of firms increasing the burden of construction and sensitivity of the variable. Although the square operator in the HHI reduces the importance of very small firms, midsized firms and the related measurement errors might still play a role. Section II and the Annex provide further details of data construction.

Still, there is probably no single "best" way of constructing firms' industry shares and hence each data set on industrial concentration will produce somewhat different results. These differences may also imply that external verification becomes important for these studies. Hence, to check for consistency, the results of this paper should be compared with those of the OECD (Bajgar et al., 2019) and the IMF (Díez et al., 2019). We find that the results are overall consistent, showing a moderately increasing concentration level over the last decades.

Our findings indicate that concentration increased moderately in a wide range of industries in the five largest European economies and over the past 20 years we consider. However, even this moderate average increase in industry concentration lead to a substantial increase in the share of high-concentration industries. High-concentration industries are the ones that are typically the focus of antitrust interventions. The share of high-concentration industries increased, because low-concentration industries became more concentrated, rather than already high-concentration industries further concentrating. We also find that the dynamics of concentration changes suggests a shift toward oligopolies rather than industries with entrenched monopolies. Furthermore, we provide evidence of increasing aggregate profit shares in European countries, which is in line with data from the United States. Finally, our results point to a divergence between concentration changes and merger enforcement in the EU4 + UK after the financial crisis.

The paper is structured as follows. Section II describes the data and relates our approach to the existing literature. Section III presents general concentration trends for the five observed European countries. Section IV delves into the experiences of each individual country. Section V follows with analyzing differences in concentration changes across industries. Section VI takes a look at the relationship between merger control and industrial concentration trends. Section VII provides some aggregate measures of profitability for Europe and the United States. Section VIII concludes.

II. DATA

This section gives an overview of the most important data issues, whereas the Appendix mentions further details. The yearly concentration data set covers the largest five European economies (France, Germany, Italy, Spain, and the United Kingdom; they made up ∼80 percent of the EU GDP before Brexit) for 156 ISIC industry categories,[12] from 1998 to 2019. However, for the purposes of the analysis, industries with heavy public sector involvement—public

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[11] Kalemli-Ozcan et al. (2020) show that in an ORBIS-based denominator calculation not properly taking into account the economy-wide distribution of small-and-medium-sized firms affect industry concentration figures.

[12] These are the most disaggregated industry categories in ISIC, referred to as "ISIC 4-digit industries" in the text. In some of the analysis, the more aggregated industry blocks (ISIC 1-digit categories) are used as well.

administration, education, health, and social work—as well as the catch all industry "Other" are excluded.

For each country-year-industry observation, the data contain the four largest firms' turnover value, as well as the total industry's turnover. Based on this information, the share of the four largest firms is calculated for each country-year-industry observation. Therefore, the data set consists of $22 \times 5 \times 156 \sim 17{,}115$ observations (some industries have less than four firms).

The data were collected by Euromonitor International. It combines firm-level turnover value figures of the ORBIS data set, industry level aggregate data from Euromonitor International's Passport Industrial database,[13] as well as supplementary information on the firms' activity from Euromonitor International's desk research work.

The data compilation has to solve three main issues. First, the ownership of firms has to be sorted out so as to create single entities comprising all subsidiaries of a given firm in a given country-year-industry triplet. Failing to do so would create artificially independent firms and hence biases in the concentration levels.

Second, for each firm, the turnover values have to be allocated properly to each industry where the firm is active. Allocating each firm to a single industry might result again in biases. The first two steps are interrelated, and involve an iterative process using both the consolidated and unconsolidated firm accounts, as well as external expert information.

Third, the total industry size has to be estimated using external sources from national accounts (e.g., from Eurostat). The coverage of the ORBIS data set changes over time as more and more small firms are covered in later years. Using the yearly sum of the firms' values covered in ORBIS would overestimate the increase in industry size and hence underestimate the increase in our measure of concentration. Hence, Euromonitor International's Passport Industrial database, based among others on national accounts, is used for the denominator calculations. Further details on each one of three steps are provided in the Appendix.

An important question arising from the geographic segmentation issue is that of imports. The description above implies that the resulting allocated turnover figures are interpreted as approximations of domestic sales values of firms active in a given country. These sales do include sales by subsidiaries of foreign production entities that, in an economic sense, would amount to imports. However, direct import activity not done through a European subsidiary is not captured in the data. To the best of our understanding, this is a shortcoming of all industry/firm-level data that is used in the literature to calculate concentration indices. The issue further highlights the methodological difficulties and the need for a cautious interpretation of the results of the analysis.[14,15]

We make a further comment on the weightings used for the industry concentration indices. As the unit of observation, in a given country and year, is an ISIC four-digit industry, the simplest way to calculate statistics (distributions and averages) is to use these units. However, one can also calculate distributions and averages counting either the total turnover of an industry or the value of the four largest firms. Counting the total industry values will provide statistics that reflect more closely an aggregate view of the economy. Counting the value of the four largest firms

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[13] Passport Industrial uses as data sources, among others, national accounts, and aggregators (e.g., Eurostat).

[14] Besley et al. (2021) draw a distinction between firms in tradable and nontradable sectors, arguing that antitrust policies are more likely to have an effect in the latter group.

[15] Amiti and Heise (2021) use confidential census data, including data on exports, for U.S. manufacturing firms. As such, the authors are able to implement an adjustment to domestic concentration taking into account import competition. They show that while concentration increased among domestic firms, this was counteracted by the growth of foreign firms. Unfortunately, in our case, we do not have access to such firm level export data, and cannot implement the methodology of the paper. As explained, to some limited extent, the activity of foreign production entities is taken into account in our data. Besides, the dynamics of imports and exports at the firm level might be different from the United States. Hence, while overall the results might be affected by trade issues, it is difficult to conclude on the direction of the impact.

reflects the competitive environment of large companies. Moreover, weighting also serves as a robustness check against the varying level of aggregation of the 156 industries we have data for.

Therefore, many of the graphs to follow also show results based on these different weights: counting the number of industries, using total industry value weights, and using the four largest firms' turnover weights. For all the weighted results, weights are kept constant over time.[16]

Finally, we note that the aggregate profitability trends presented in Section VI are based on an aggregate version of the methodology proposed by Barkai (2020). In our work, National Accounts data from the AMECO database are combined with other aggregate variables such as bond yields. Section VI and the Appendix give further details.

A. Relationship to Other Concentration Data Sets Used in the Literature

As mentioned above, an ideal concentration data has to satisfy three conditions: (i) the right level of aggregation, (ii) long enough time span, and (iii) coverage of the whole economy. Most papers in the literature use industry/firm-level data that solve the second and third problems, but not the first. Relevant antitrust markets are more disaggregated than industry categories of the NACE, ISIC, or similar nomenclatures. Moreover, antitrust market definitions might change over time, and are not observed consistently in long enough time series for the whole economy. Hence, antitrust market level data solve, by construction, the first, aggregation level problem. But at the same time, such data are lacking on the second and third problems.

Although there is a large and growing literature on U.S. concentration (see, e.g., Grullon et al., 2020; Philippon, 2019, and the references therein), the body of evidence on Europe is relatively smaller. In terms of methodology, the paper closest to ours is the work of Bajgar et al. (2019). Like our paper, the authors use ORBIS firm-level data to estimate company shares and combine it with publicly available aggregate industry data to estimate industry sizes. Also, in terms of the ownership and industry allocation issues they follow similar principles. The reported European industry concentration trends, covering the period 2000–2014, are similar to those in our paper. In addition, the authors also report North American (United States and Canada) industry concentration trends, which seem steeper than the European tendencies.

Díez et al. (2019) also report estimates of European concentration trends for the period 2000–2015. Their calculations are based on the ORBIS database. Instead of estimating industry size from outside sources, however, they calculate the ratio of sales of top 4–20 firms. As such, the concentration estimate avoids the changing coverage problem of ORBIS. However, the evolution of the top 20 firms' sales might still be different from the underlying industry size trends. Nevertheless, the reported results show increasing European industry concentration, albeit at a somewhat smaller rate those estimated by us or Bajgar et al. (2019).

Cavalleri et al. (2019) report industry concentration trends for the Euro area for the period 2006–2015. Unlike the above papers and our results, the reported estimates show flat industry concentration measures. The reasons for these divergent results stem from methodological differences. Although, similar to the other papers, the main source of information is ORBIS and other micro (company) level databases, the paper estimates industry sizes from the same data. Hence, the changing coverage problem of the micro level databases might affect the industry share and concentration estimates. In particular, the increasing coverage results in an underestimation of the concentration increase. Furthermore, the paper applies an "outlier correction," where the four percentiles containing the largest and smallest firms are dropped from the data. Given the definition of the concentration measures, dropping the largest firms might have a nontrivial impact on the estimates, likely resulting in smaller changes/increases in concentration than without the correction.

Gutiérrez and Philippon (2020) also report European industry concentration trends. Their calculations are primarily based on ORBIS, Compustat, and the ECB's CompNET database.

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[16]   In particular, the 2019 total industry turnover values and the four largest firms turnover values are used.

They find relatively stable European industry concentration evolution over the period 2000–2015. Again, the different results from those of our paper or Bajgar et al. (2019) arise from methodological differences. First, Gutiérrez and Philippon (2020) do not take into account that firms are often part of larger business groups and, hence, sales have to be both aggregated and allocated across several industries for a given firm. Second, the underlying micro level databases suffer from the changing coverage problem. Gutiérrez and Philippon (2020) thus make a correction based on industry level gross output. It should be noted, however, that gross output is a measure that includes a chain of double counting. Hence, its trend may not follow the industry size, and can even grow more quickly. This would lead to flatter estimated industry concentration than what would follow from using the industry size.

Turning to papers using more disaggregated data, Benkard et al. (2021) use product level concentration indices to reexamine U.S. concentration trends. Their data come from a survey asking consumers to report the brands they purchase. Their main finding is that 45 percent of the product markets are highly concentrated, and more than conventionally reported, but at the same time the average concentration decreased since 1994. It should be noted that these product markets are not necessarily antitrust markets either, actually the data might easily be more disaggregated than the relevant antitrust markets (for instance, as acknowledged by the authors, domestic and imported beer are different product markets in their data set). They also find increasing concentration when product markets are aggregated into wider sectors.

In Europe, Affeldt et al. (2021) build a data set based on the European Commission's published merger decisions, 1995–2014. These decisions contain information on the antitrust markets affected by the mergers. A major strength of this approach is that the level of aggregation is, by construction, the relevant one for competition policy. It is true, though, that very rarely exist mergers *in the same market* in several consecutive years (for instance, to conclude on concentration trends in mobile telephony, they need to compare, for example, a merger decision in the United Kingdom with one in Germany, which occurred in different periods but are distinct markets), neither merger cases may consistently cover the whole economy.[17] In addition, the observed market shares are before any remedy divestments are taken into account, hence they very often do not reflect the actual market situation. The data presented by our paper provide consistent times series for all industries of the economy, even though not at the antitrust market level. As such, the two types of data are complementary, both bringing useful information into the analysis.

Overall, the contribution of our paper is that it presents an analysis of a unique, consistent, industry level data set of European industrial concentration. The data cover the largest European economies without industry selection, and span over two decades. Although, as discussed above, such data set is not without limitations of its own, it has complementary strengths as compared with other approaches.

III. CONCENTRATION TRENDS IN EUROPE IN THE LAST 20 YEARS

Is concentration increasing? Although this might be too broad a question for practical policy purposes, nonetheless this is still the question that many studies and commentators are asking. So, to ensure comparability, we also start at the most general level of aggregation.

One simple way to look at general concentration trends is to study the distribution of concentration changes. Figure 1 shows the distribution of the change in the share of the four largest firms between 1998 and 2019 for the industries in the EU4 and the United Kingdom. In general,

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[17] A further selection issue is that not all merger decisions contain market share information, the information lacking especially in the case of smaller transactions. Another issue causing potential further consistency issues is the introduction of the so-called simplified merger cases in 2000. These cases are less likely to contain market share information.
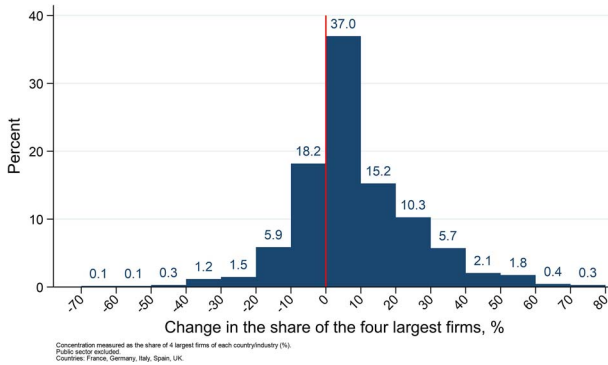
Figure 1. Distribution of change in the share of the four largest firms in France, Germany, Italy, Spain, and the United Kingdom, 1998–2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Histogram of the change in C4 (four largest firms' industry share) across 685 industry/country pairs.

concentration increased across all countries and industries. The increase in concentration is widespread: the share of the four largest firms increased in 73 percent of industries, or in 498 industries out of the 685 observed in the five countries. Only in 36 percent of the industries, concentration increased by more than 10 percent.[18] Accordingly, the average concentration increased moderately, by 7 percent.

To see the trend of average concentration in more detail, Figure 2 displays the evolution of average concentration from 1998 to 2019. The solid (blue) line reports unweighted concentration, the dashed (red) line shows the same data weighted by industry production, and the dotted (yellow) line weighed by the largest firms' turnover weighted (dotted line) averages. All three trends are increasing (notice though the temporary dip around the financial crisis), therefore the direction of concentration change does not depend on weighting. However, the three trend lines also demonstrate the sensitivity of average concentration levels to weighting. This suggests that findings on changes and relative magnitudes are more robust than findings on concentration levels, when using industrial concentration data.

The unweighted and large firm turnover weighted trends show an average increase above 7 percent, whereas the total industry turnover weighted average trends show an increase of 3.6 percent. Despite having different samples and covering different periods, these figures are very similar to those published by the OECD (Bajgar et al., 2019) that showed an increase of 4 percentage points in the share of the eight largest firms in Europe between 2000 and 2014.

Average trends and changes in industrial concentration provide an overview for the whole economy. However, it is not straightforward what competition policy should conclude from the observation that average industry concentration increased by 7 percentage points. At the end, for competition policy, industries with low concentration are less pertinent, since most problematic mergers and antitrust investigations typically take place in concentrated industries. This raises the question whether industry concentration is a useful proxy for market power. Although there is a lively debate about this issue, the evidence is rather scarce.

We turn to DG Competition's public merger decision database to address the question.[19] Merger interventions identify markets where there is market power before or after the merger.

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18   Here, we count industry/country pairs. Not all countries have all industries.
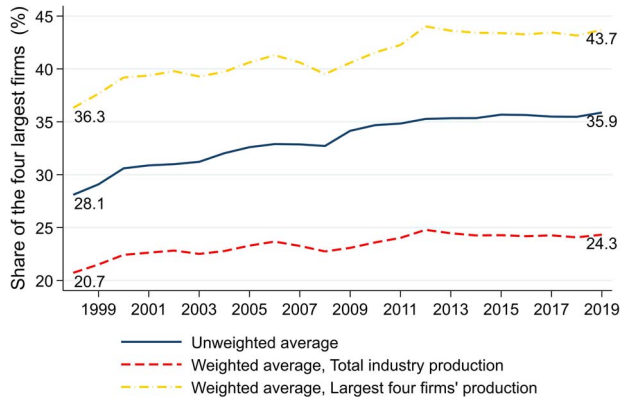19   https://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=1%2C2%2C3

Figure 2. Evolution of average industry concentration in France, Germany, Italy, Spain, and the United Kingdom, 1998–2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Evolution of C4 (four largest firms' industry share). Unweighted: simple average of 685 industry/country pairs. Weighted: using the respective production weights.
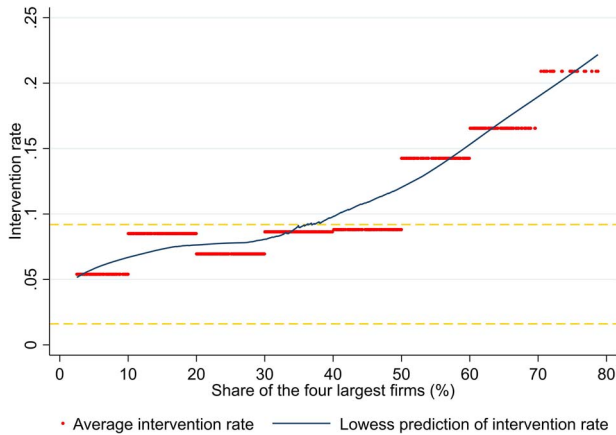

Figure 3. Intervention rate and industry concentration. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database, and the European Commission DG Competition's public merger decision database. Intervention rate: average number of merger interventions per industry. Red line: averages at deciles. Yellow line: confidence interval of the lowest decile. Blue line: nonparametric regression fit of intervention rates.

The intervention rate in an industry, that is, the number of interventions per mergers notified, can be used as an indicator of market power in antitrust markets in that industry.

If industry concentration is a useful proxy for market power, one should observe that industries with higher concentration are associated with higher intervention rates. To see whether this association holds, we link in Figure 3 the average industry concentration in the five countries in our sample to the EU merger decisions at the three-digit NACE level.[20]

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[20] Some of the industries in the concentration data are at the four-digit level. These industries had to be aggregated; therefore, the initial 158 industries were reduced to 100. Also, the industry codes in the concentration data set are ISIC codes; therefore, the NACE codes of the merger database had to be translated to ISIC codes.

As expected, industry concentration turns out to be an imprecise proxy for market power. In the cross-section of 100 industries the correlation between the average share of the four largest firms and the intervention rate is positive, but not especially strong: the correlation coefficient is 0.34. Industry concentration becomes an even less reliable indicator of market power when we look at it at the year-industry level: the correlation coefficient drops to 0.13.

A more detailed look at these correlations reveals the source of the imprecision: at low levels of industry concentration there is almost no relationship between industry concentration and the intervention rate. Figure 3 shows the relationship between the intervention rate and the industry concentration in the sample. The red dotted lines show the average intervention rate for each decile of industry concentration (there is no observation above 80 percent) and the yellow dashed lines show the confidence interval around the average intervention rate of the lowest decile. The blue line is the fit from a nonparametric regression of the intervention rate on industry concentration.

At low levels of industry concentration, where the share of the four largest firms is below 50 percent, the average intervention rates are flat and are not significantly different from the intervention rate in the lowest decile. There is a positive relationship between industry concentration and the intervention rate only above 50 percent industry concentration in our sample. In this region, the average intervention rate is significantly different from the one in the lowest decile. As Figure 3 shows, in most industries, the share of the four largest firms is below 50 percent, indeed most merger interventions (61 percent) happen in these industries. However, in this lower part of the distribution industry concentration is simply not a good proxy for market power: an increase in industry concentration cannot be associated with an increase in market power.

The key insight of Figure 3 is that increasing industry concentration can be associated with increasing levels of market power for concentration levels above 50 percent in our data set. Only in these high-concentration industries is there an approximate relationship between industry concentration and market power. Therefore, in our ensuing analysis, we will focus on this upper tail of the industry concentration distribution, because that is the most informative about underlying trends in market power. We will use the change in the share of these high-concentration industries as a proxy for market power trends.

A simple way to see how the share of high-concentration industries changed between 1998 and 2019 is to compare the industry concentration distribution in 1998 to that of 2019. Figure 4 shows these distributions, the red dashed line representing the 1998 distribution, whereas the blue solid line depicting the 2019 distribution of industry concentration. The change in the distribution indicates that there were more high-concentration industries in 2019 than 20 years before. The high end of the 2019 distribution is above the 1998 distribution for all deciles. In particular, the share of industries where the four largest firms account for at least 50 percent of turnover grew from 15 to 28 percent when counting the number of industries. The increase in the share of high-concentration industries is robust to weighting with industry turnover.[21]

Hence, the industrial structure in Europe became more oligopolistic, that is, the share of high-concentration industries steadily increased. This increase is in line with the moderate increase of average (across all industries) concentration: the share of high-concentration industries and the average industry concentration show similar dynamics. First, these two indicators show

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[21]   To see whether these changes in high-concentration industries are sensitive to weighting, we also looked at the same distributions, based on industry turnover and on the four largest firms' turnover. Counting industry turnover, the share of high-concentration industries increased from 11 to 18 percent, whereas counting the turnover of the four largest companies the share increased from 27 to 45 percent. In relative terms, these figures imply a similar increase: the share of high-concentration industries increased by more than 50%, either way one weighs industry distribution.
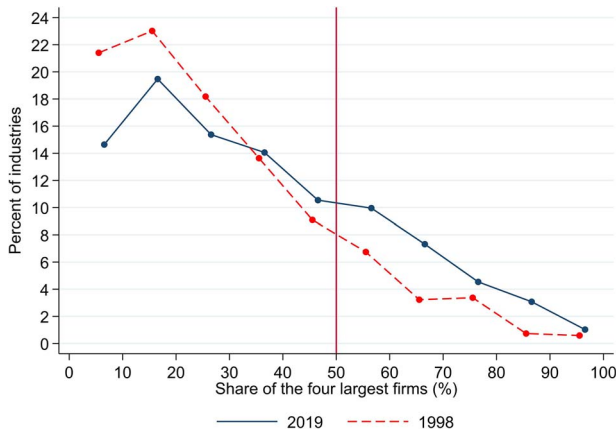
Figure 4. Distribution of the share of the four largest firms, counting the number of industries, 2019 and 1998. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Distribution of C4 (four largest firms' industry shares), averages across all country/industry pairs, separately for 1998 and 2019.
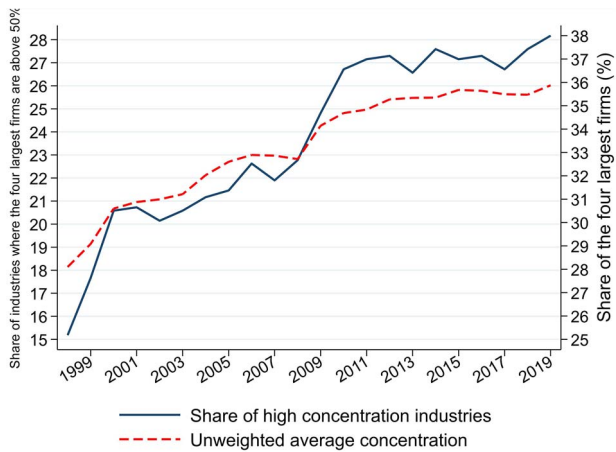

Figure 5. Evolution of the share of high-concentration industries and average concentration. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. High-concentration industry: the four largest firms account for at least 50 percent of the industry.

very similar trends over time. Figure 5 shows the evolution of the share of high-concentration industries (i.e., where the four largest firms account for more than 50 percent of turnover value) and the evolution of the all-industry average concentration. Both indicate concentration growth was strongest in the boom period before the dotcom crisis and the period of the last recession. Second, even the yearly changes of the two indicators follow each other closely.

Does the increasingly oligopolistic industry structure also mean that one should expect an ever-increasing industrial concentration? In other words, are we witnessing a trend of monopolization? To address these questions, one should look at how concentration changed depending on the starting concentration level of the industry.
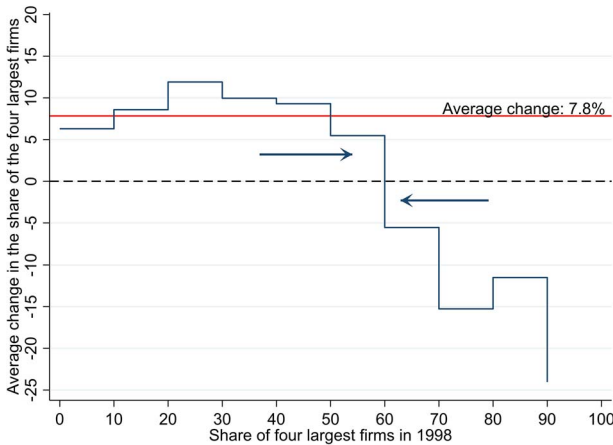
Figure 6. Average change in the share of the four largest firms by the starting share of the four largest firms in 1998. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Change in concentration (share of the four largest industries) relative to 1998. Simple averages across all industry/country pairs.

The concentration dynamics suggests a spread of oligopolies rather than monopolization of industries. Figure 6 displays the deciles of the share of the four largest firms in 1998 and the corresponding average change in between 1998 and 2019. For example, this graph shows that the share of the four largest firms grew by more than 10 percentage points in industries that in 1998 started at a level between 20 and 30 percent. Figure 6 implies that the share of high-concentration industries increased, because more and more low-concentration industries shifted toward oligopolies. Conversely, very high-concentration industries tended to deconcentrate somewhat. As a result, there was a convergence toward a "long run" concentration level of about 60 percent. That is, in the last two decades concentration increased in industries where the share of the four largest firms was below 60 percent and decreased in industries that started above 60 percent.

We observe 115 industries that move from low to high industry concentration between 1998 and 2019. These industries account for 17 percent of our total industry sample. In 1998, 85 percent of these switching industries had a C4 of 20–50 percent. For half of these switching industries, the concentration increase was substantial: they reached concentration levels of 60 percent or above. These switching industries are of particular interest to competition policy, because these are the ones where market power potentially increased. As Section V will reveal, some of the most extreme switching industries are in manufacturing.

To sum up this section, in the last two decades:

  (i) There was a widespread increase in industrial concentration, with more than 70 percent of industries experiencing growing concentration;
 (ii) The average magnitude of this concentration increase is between 3.6 and 7 percentage points;
(iii) Underlying this moderate average change there is a significant increase in the share of high-concentration industries, which are typically associated with market power: in relative terms, their share of industries or industry output increased by more than 60 percent;
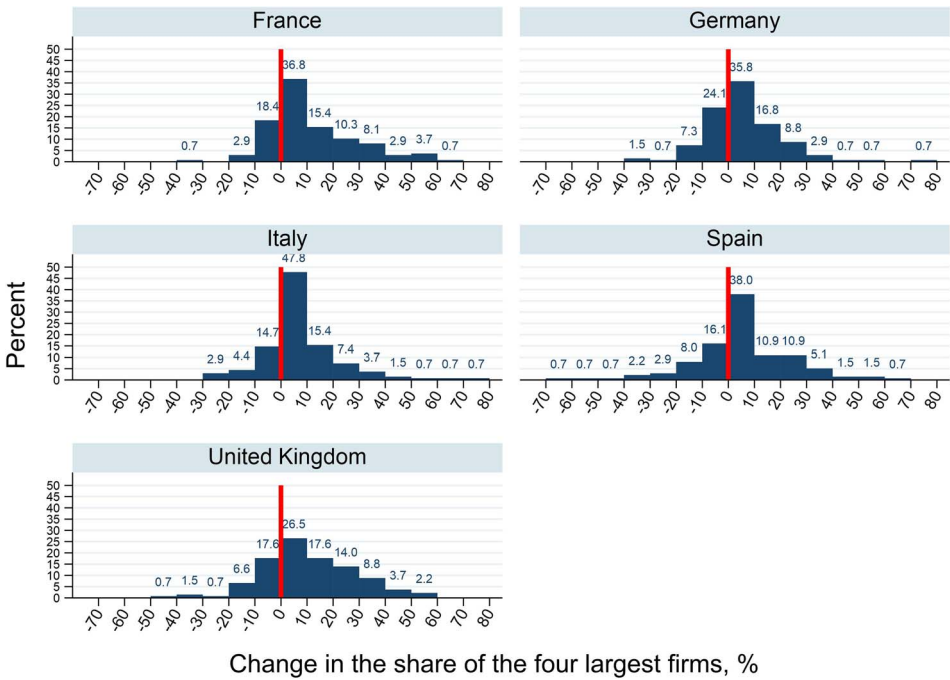
Figure 7. Distribution of change in the share of the four largest firms, by country, 1998–2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Histograms of the changes in C4 (four largest firms' industry share) across all industry/country pairs in the respective countries.

(iv) Concentration changes suggest a tendency toward oligopolies, not full monopolization: low and mid concentration industries became more concentrated on average, whereas industries with concentration higher than 60 percent became less concentrated.

The next section looks at how these industrial concentration trends differ across countries.

IV. CONCENTRATION TRENDS ACROSS COUNTRIES

Across countries, there are many strong similarities, but also some important differences in concentration trends.

In all countries, more than two-thirds of the industries experienced an increase in concentration between 1998 and 2019. As Figure 7 shows, there are no large differences across countries in the share of industries with increasing concentration change. Industries with a growing share of the four largest firms range from 78 percent in France, 78 percent in Italy, 73 percent in the United Kingdom, 69 percent in Spain to 66 percent in Germany.

There are more marked differences in the share of industries where the increase in concentration was above 20 percent. France and the United Kingdom have a large proportion of industries with strong increases in concentration. In particular, in 26 percent of French and 29 percent of British industries the share of the four largest firms grew more than 20 percent. In comparison, the share of high-concentration-growth industries was only 14 percent in Germany and 15 percent in Italy.
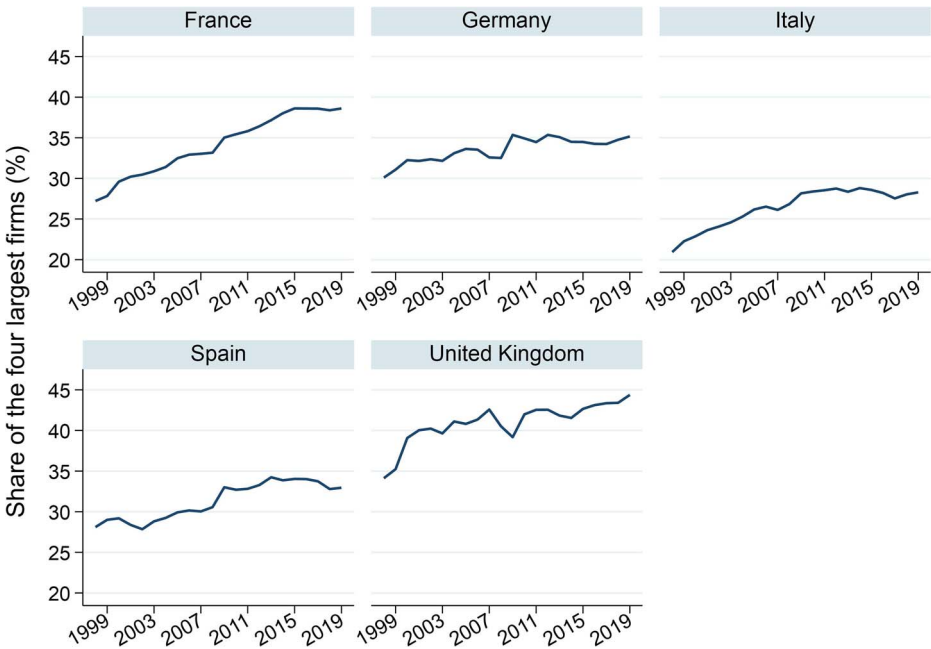
Figure 8. Evolution of average industry concentration in France, Germany, Italy, Spain, and the United Kingdom, by country, 1998–2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Evolution of C4 (four largest firms' industry share) in the five countries. Simple averages.

The average concentration trends vary more significantly across countries. Figure 8 breaks down the average trends by the five countries. The results show that in France and the United Kingdom the average industry concentration grew by 11 and 10 percent, respectively, whereas in Germany and Spain it increased by only about 5 percent over the last two decades. In Italy, industrial concentration grew around the overall average European rate (7 percent). In all countries, most of the average concentration increase took place before the financial crisis of 2009. It is only in France that average concentration increased substantially after the crisis.

The concentration *levels* show some notable differences between countries. Italy's industries are on average the least concentrated (between 21 and 28 percent), whereas average industrial concentration in the United Kingdom is the highest (34–44 percent).

The share of high-concentration industries, where the four largest firms accounted for more than 50 percent, further nuances the country-level concentration trends. Figure 9 shows the distribution of the share of the four largest firms in 1998 and 2019 for all five countries. In all five countries, the share of high-concentration industries grew substantially compared with the initial level in 1998.

In summary, the country trends indicate:

(i) A general increase in concentration across industries in all five countries, with more than two-thirds of industries experiencing growing concentration in each individual country;
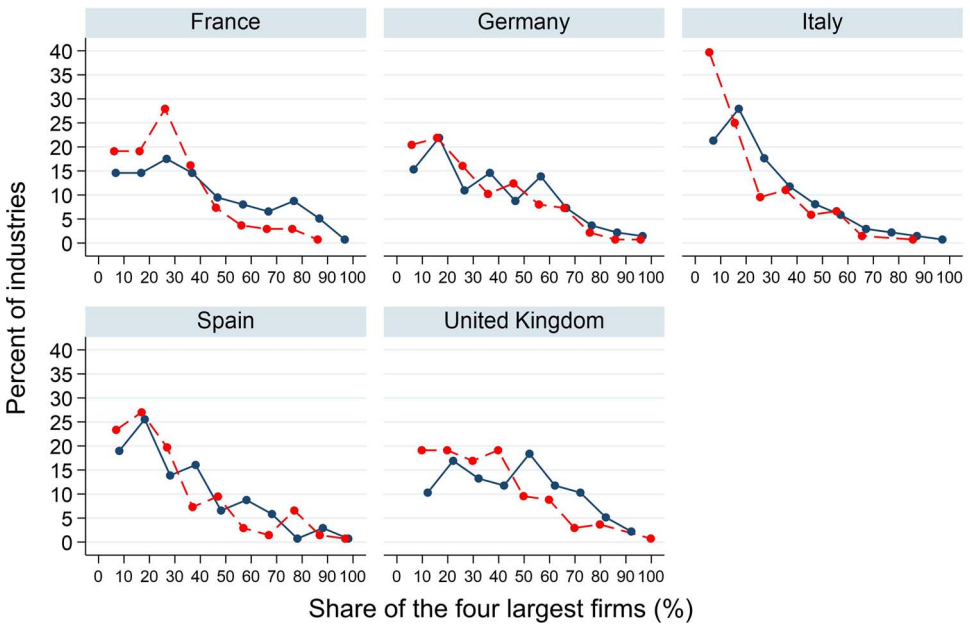(ii) A substantial increase in the share of high-concentration industries compared with the initial share in 1998;

Figure 9. Industry distribution of the share of the four largest firms, by countries, 2019 and 1998.
Source: Authors' calculations based on Euromonitor International's Passport Industrial database.
Distributions of C4 (four largest firms' industry shares), averages across all industries in the given
countries, separately for 1998 and 2019.

(iii) The increase in the share of high-concentration industries was strongest in the United
    Kingdom and France had the second strongest increase. Italy and Spain showed both a
    smaller absolute increase and a lower final share of high-concentration industries.

V. CONCENTRATION TRENDS ACROSS INDUSTRIES

To compare concentration trends across industries, we begin with broad industry sectors (ISIC
one-digit classification).[22] Looking at average changes and levels sheds more light on which
industries experienced the strongest concentration trends. Figure 10 shows the average share
of the four largest firms in 1998 and 2019 for the broad industry groups.[23] Communication
services is clearly the industry with the highest level and largest increase of concentration.
Transport and storage and finance were two other industry groups that grew substantially and
reached concentration levels substantially above the overall average.

Manufacturing deserves a more in-depth look, as it contains 70 percent of the observed
industries. Figure 11 shows the average share of the four largest firms in 1998 and 2019 for ISIC
four-digit manufacturing industry groups. Manufacturing industries with both a high starting
level of concentration and an increase in concentration are raw material processing, transport

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[22] These are: agriculture and forestry; communication; construction; electricity, gas, and water production; finance; fishing;
    hotels, restaurants, and cafés (HORECA); manufacturing; mining; real estate and business services; trade; as well as
    transport and storage.

[23] The aggregate concentration measures are weighted averages of the underlying industries, weights given by the size of the
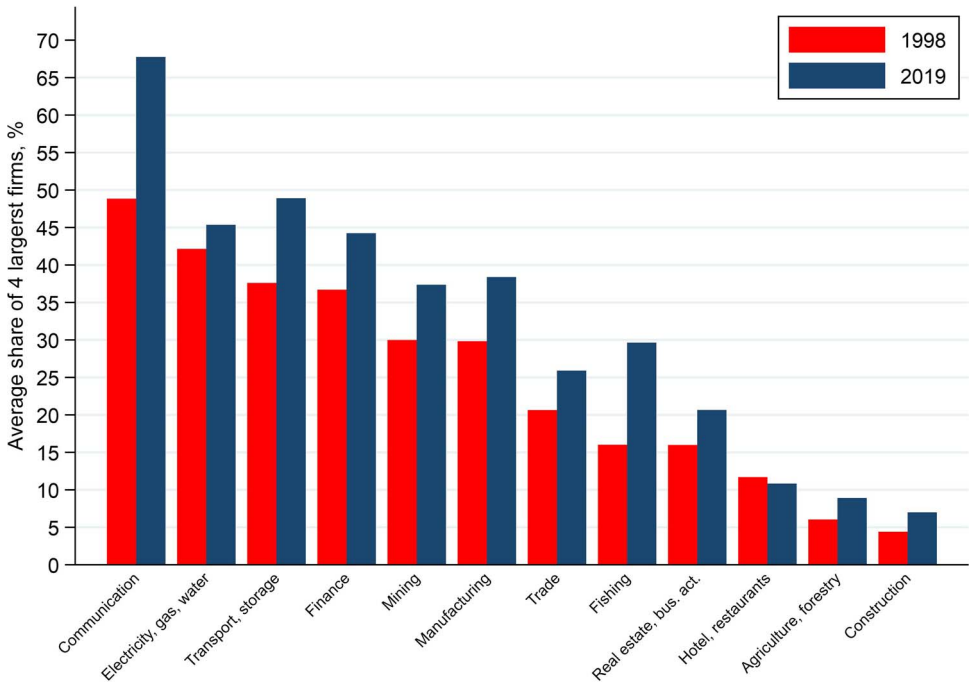   industry.

Figure 10. Average industry concentration by broad industry groups, 1998 and 2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Broad industry group concentration is the weighted average of the underlying industries' concentration measures (weights given by industry size).

equipment and motor vehicle production as well as the tobacco industry. The computers and office equipment industry recorded the largest increase in concentration, although it started from a low level.

To keep the figures tractable and less cluttered, a simplification is introduced. Instead of the full unweighted distributions, we now focus the analysis of the distribution-based indicators on the percentage of industries where concentration was increasing, as well as on the percentage of industries where the share of the four largest firms had a share larger than 50 percent. We do this as it seems naturally more in line with the typical focus of competition policy.

If one looks at the proportion of industries with an increasing share of the four largest firms for each of the broad industry blocks, data (not reported here for lack of space) show that in all broad industry sectors more than half of the industries became more concentrated. The sectors with the greater shares of increasingly concentrated industries were communication services, construction, and fishing. At the lower end of the spectrum, there are trade, the hotel and catering industry, as well as electricity, gas, and water supply.

The share of high-concentration industries confirms the concentration ranking of the average concentration levels. Figure 12 shows the percentage of industries in each industry group where the share the four largest firms was above 50 percent. The industry groups with the highest share of high-concentration industries also have a high level of average concentration: communication, transport–storage, and finance services. A strong increase in the share of high-concentration industries is particularly notable in manufacturing, followed by communication.
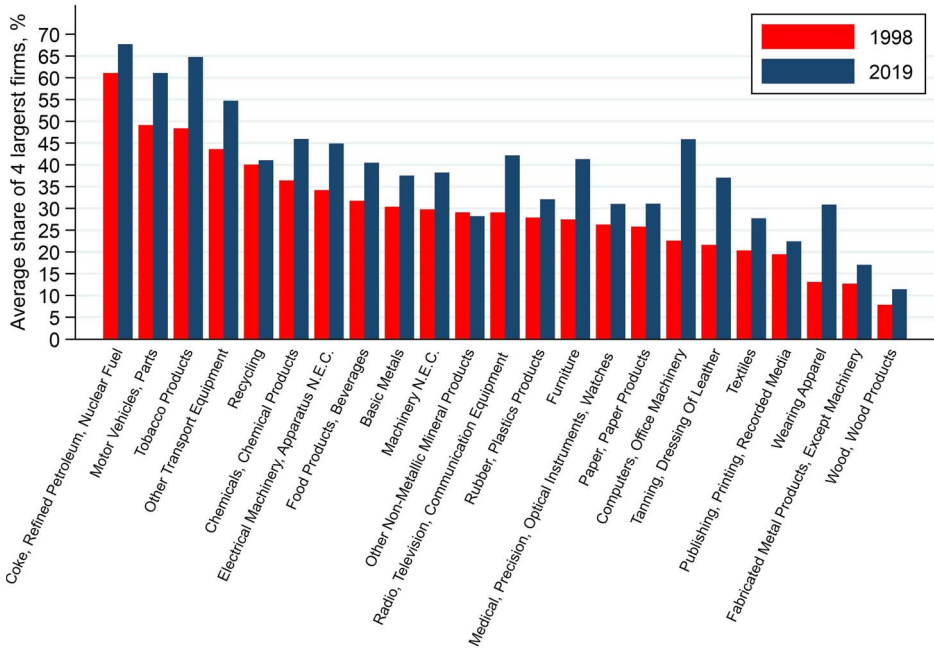
Figure 11. Average industry concentration in ISIC four-digit manufacturing groups, 1998 and 2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Simple averages of C4s of the respective industries across the five countries.
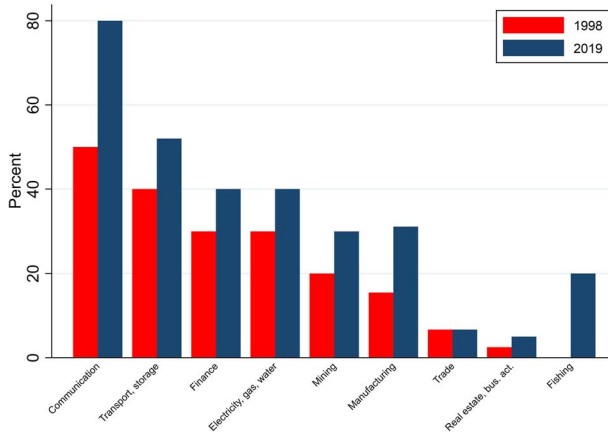

Figure 12. Percentage of industries where the share of the four largest firms was above 50 percent, by broad industry groups, 1998 and 2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Broad industry group concentration is the weighted average of the underlying industries' concentration measures (weights given by industry size).

Once again, manufacturing is such a large group that it calls for a more detailed analysis. Figure 13 shows the share of high-concentration industries separately for ISIC four-digit manufacturing industry groups. There are two groups, tobacco production and motor vehicles,
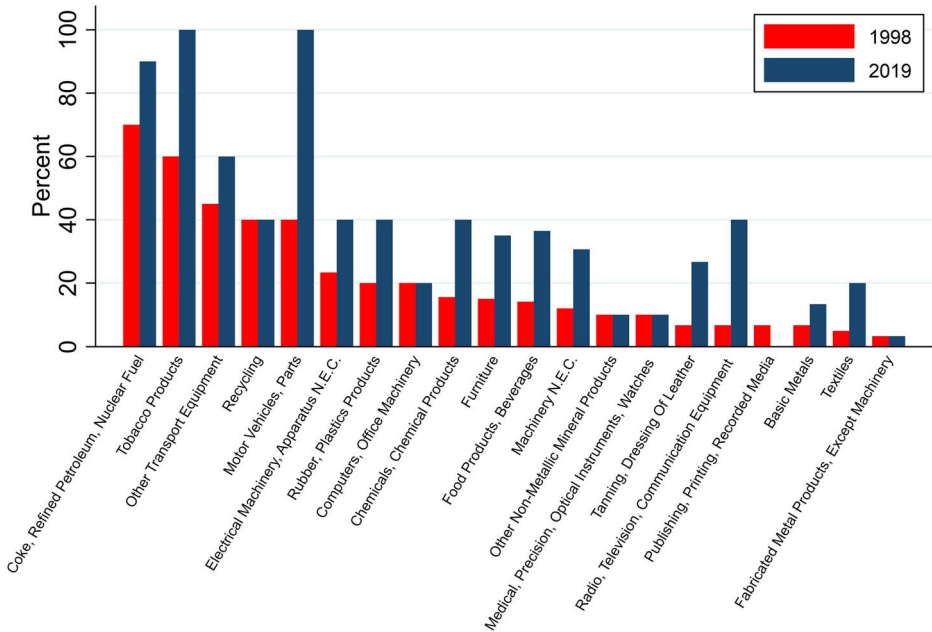
Figure 13. Percentage of industries where the share of the four largest firms was above 50 percent, ISIC four-digit manufacturing groups, 1998 and 2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Simple averages of C4s of the respective industries across the five countries.

that already had a large proportion of high-concentration industries in 1998, and by 2019, the share of the four largest firms was above 50 percent in all industries of these groups. There are also several manufacturing industry groups that started from a low share of high-concentration industries and experienced a strong increase in this share: chemical products; furniture, food, and beverages; leather products; radio, television and communication equipment.

One can also cut the data differently, and simply look at the industries that experienced both the strongest concentration increase *and* reached a high level of concentration in 2019 at the country level. In Table 1, we show those industries where the share of the four largest firms grew by more than 10 percent and reached a level above 70 percent in 2019 in *at least* two observed European countries. In line with the general perception, the telecommunications sector experienced strong concentration at high levels in three countries. In addition, three industries of the transportation sector were characterized by both strong concentration increase and high levels in 2019 as well. Moreover, among the manufacturing industries most affected by concentration, five are related to the transportation sector. Most of the manufacturing industries are also switchers: they were low-concentration industries in 1998 and became high-concentration industries by 2019. Finally, extraction of petroleum experienced a strong concentration increase as well.

Country-specific differences in concentration trends are related to underlying differences in concentration trends across industry groups. The previous section identified France and the United Kingdom as the two countries with the strongest increase in concentration indicators, either by looking at averages or the share of high-concentration industries. Figure 14 shows the average concentration trends separately for industry and the service sector (average C4 across

Table 1. Industries most affected by concentration: concentration increase above 10 percent, and share of the four largest firms above 70 percent in 2019

	France		Germany		Italy		Spain		United Kingdom	
	Change	**2019**	**Change**	**2019**	**Change**	**2019**	**Change**	**2019**	**Change**	**2019**
Communication										
Telecommunications	31%	84%			18%	76%	37%	80%		
Manufacturing										
Accumulators, Primary Cells and Primary	23%	79%					10%	91%	30%	81%
Aircraft and Spacecraft					32%	72%			18%	70%
Bearings, Gears, and Driving Elements	45%	91%							33%	84%
Domestic Appliances	44%	73%	32%	79%			49%	90%		
Man-made Fibers	52%	89%	47%	75%			63%	90%	58%	87%
Ships and Boats	34%	71%							52%	73%
Mining										
Extraction of Crude Petroleum and Natura	58%	80%	21%	79%						
Transport, storage										
Air Transport	30%	74%	27%	79%	61%	94%				
Transport through Railways			23%	89%	71%	75%				
Water Transport	15%	83%			47%	76%				

Source: Authors' calculations based on Euromonitor International's Passport Industrial database.

all industries in the respective sectors). It reveals that, both in France and the United Kingdom, concentration increased more in industry than in the service sectors. In the three other countries, the evolution of the two sectors was either parallel, or service sector concentration converged to industry concentration.

Figure 15 reveals that there is a relatively small composition effect within the larger industry blocks. In other words, overall concentration increased in each large industry block mainly because most industries experienced an increase in concentration, and not because the more concentrating industries became more important in their respective block.

Finally, Figure 16 compares the concentration trends of "digitally intensive" industries to those of the others. An OECD study by Calvino et al. (2018) defines digitally intensive industries based on their exposure to ITC technologies. The industries with digital intensity "medium-high" or "high" are selected.[24]

Three findings are worth emphasizing. First, digitally intensive industries started from a higher level of concentration in 1998 compared with other sectors. Second, digitally intensive industries showed a larger increase in the last two decades. Still, both the levels (33 percent in 2019) and changes (6 percent) of concentration in the digitally intensive sector seem moderate. Qualitatively, these results are consistent with the findings of Calvino et al. (2018). Furthermore, Calligaris et al. (2018) also shows that markups are higher and increased more in digitally sensitive industries, whereas Bessen (2020) demonstrates that these patterns might be associated with higher fixed sunk costs. Overall, these observations are consistent with the hypothesis of technology-induced market structure change.

In summary, this section showed that:

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[24] Calvino et al. (2018) define digital intensity of an industry based on its ICT investment, purchase of ICT intermediates, robot use, ICT specialists, as well as the importance of online sales. Hence, the sector of digitally intensive industries is a larger concept than big tech or digital markets (see also Criscuolo, 2018). (Also, note that the OECD used NACE industry categories, so a matching had to be done between the ISIC and NACE categorisations.)
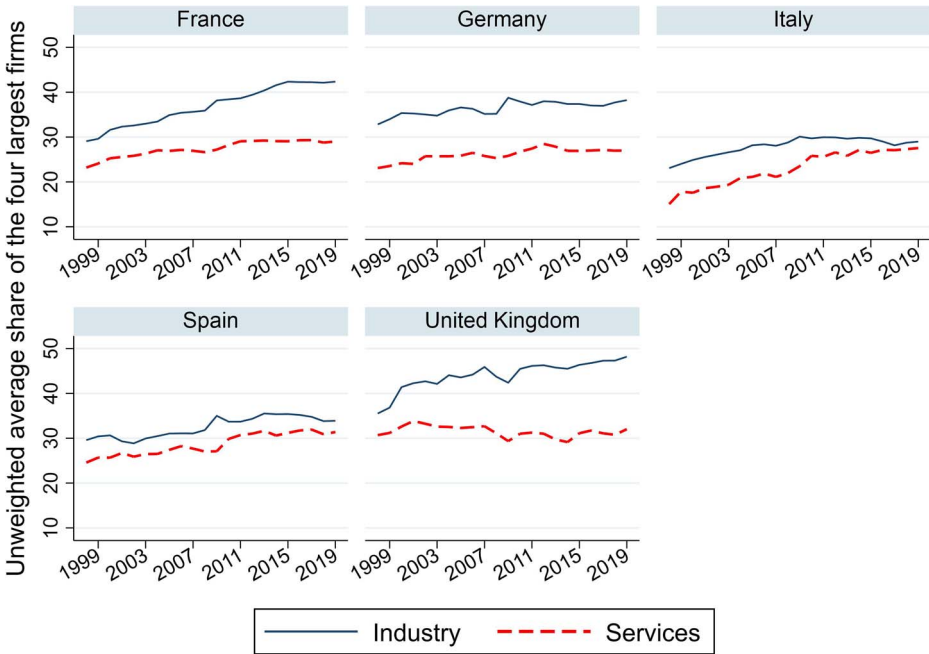
Figure 14. Evolution of average industry concentration in industry and services, by country, 1998–2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Evolution of simple average C4 (four largest firms' industry share), services vs. industry.
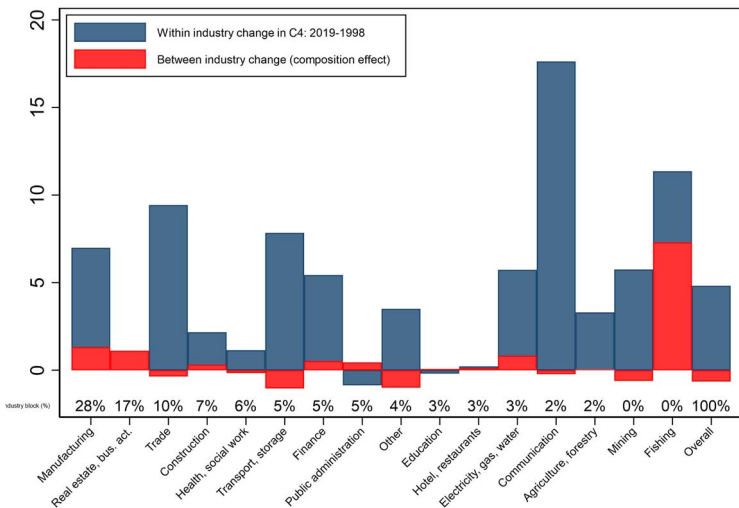

Figure 15. Decomposition of the change in concentration, EU4 + UK, 1998–2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database.
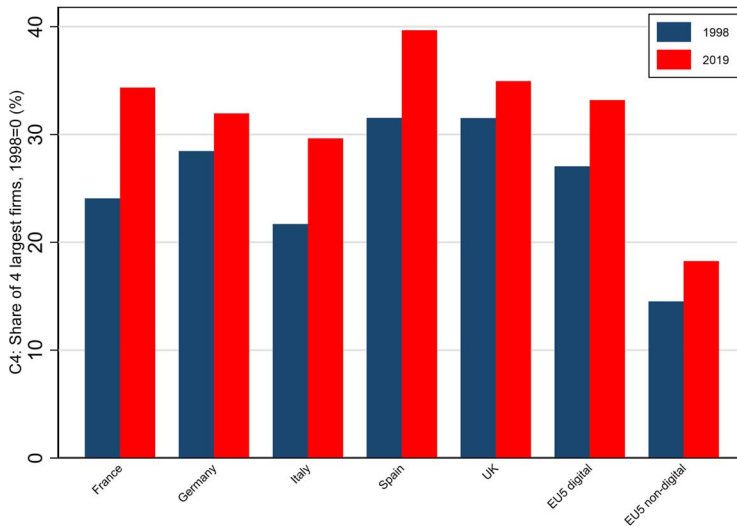
Figure 16. Industry concentration in the digitally intensive sector, EU4 + UK, 1998–2019. *Source*: Authors' calculations based on Euromonitor International's Passport Industrial database. Aggregate sector concentration is the weighted average of the underlying industries' concentration measures (weights given by industry size).

- Within the service sector, communication and transport and storage experienced the strongest concentration trends between 1998 and 2019;
- Among industrial activities, transport-related industries showed the highest levels and the strongest increases;
- Countries with stronger concentration trends, France and the United Kingdom, demonstrated larger concentration growth in industry than in services;
- Digitally intensive industries showed average concentration increase.

VI. INDUSTRIAL CONCENTRATION AND MERGER INTERVENTIONS

This section takes a look at merger competition policy interventions during the last two decades. The focus will be on merger enforcement of transactions that were notifiable under the EU merger regulation. The analysis uses the publicly available merger database of the European Commission.[25] Our analysis is not meant to be an ex post assessment of any particular decision, which is a very important but separate exercise that would necessitate establishing counterfactuals.

On average, there were 312 merger cases per year between 1998 and 2019. However, there were large yearly fluctuations in the number of cases. Figure 17 shows that the yearly (absolute) change in merger cases (dashed red line) ranges from an increase of 79 cases to a decrease of 96 cases compared with the previous year.[26] The change in the number of EU merger cases closely tracks the business cycle, that is, the yearly GDP growth of the EU (solid blue line). The correlation between GDP growth and change in the number of cases is 71 percent.

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[25] https://ec.europa.eu/competition/elojade/isef/index.cfm?fuseaction=dsp_result&policy_area_id=2.
[26] Years indicate the starting year of the merger investigation, that is, the year the merger was notified (filed) to the Commission.
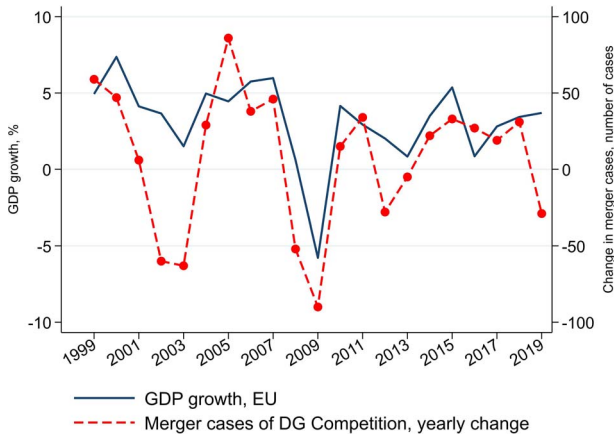
Figure 17. Change in the number of merger cases notified to DG Competition and GDP growth, 1998–2019. *Source*: European Commission, DG Competition, and Eurostat.
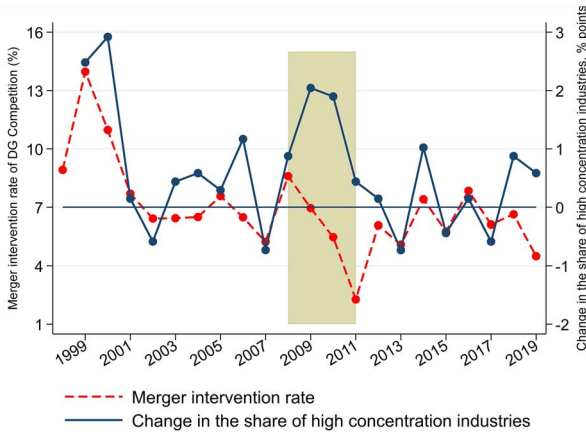

Figure 18. Evolution of DG Competition's intervention rate and the change in the share of high-concentration industries, 1998–2019. *Source*: European Commission, DG Competition, and authors' calculations based on Euromonitor International's Passport Industrial database.

We next report the EC's intervention rate over the same period. Intervention cases are defined as the sum of mergers that are either prohibited (a rare occurrence), cleared with remedies, or withdrawn in a Phase 2 (i.e., in depth) investigation. The intervention rate is simply the number of intervention cases divided by the total number of cases. As the red dashed line in Figure 18 shows, from 1998 to 2019 the intervention rate of the EC was stable between 8 and 5 percent, with the exception of two periods. In the boom period of the late 1990s, the intervention rate was on average above 10 percent and in the aftermath of the 2008 recession, it dropped to only 2 percent in 2011.

Figure 18 also compares the intervention rate to changes in the share of high-concentration industries, as defined in Section III. Comparing the intervention rate to changes in industry concentration provides insight into the broader economic context of merger enforcement. To be sure, there is no direct causal relationship between industry concentration and merger

enforcement: merger enforcement is based on the specific cases notified in a year, and industry concentration changes not only because of mergers but also because of exit of smaller firms and faster growth of large companies.

Figure 18 reports the *changes* in the share of high-concentration industries (whereas Figure 5 reports their *levels*), to capture the cyclical pattern of concentration. The blue line in the figure shows how the share of high-concentration industries changed between 1998 and 2019. There were two periods when concentration changes were positive and large for several years. The first was the boom period of the late 1990s and the second was the recession following the financial crisis, indicated by the shaded area. Indeed, looking back at Figure 5, most of the increase in concentration levels is attributable to these two periods. Looking at the intervention rates in these two periods reveals some fundamental differences between competition policy's relationship to the broader economic environment. In the first period, the increase in concentration was accompanied by a higher than average intervention rate. However, during the second, recessionary period following the financial crisis, the intervention rate decreased until eventually reaching its low point in 2011, whereas concentration was increasing between 2008 and 2011[27]. The 2011 minimum of the intervention rate is mostly because of the drop in the number of interventions for the cases notified that year (from 15 in 2010 to 7 in 2011).

It appears that, in the period after the financial crisis, EU merger enforcement was below its historical average, whereas the underlying economies experienced a period of increasing concentration. Data suggest that the slightly increasing intervention rates after 2011 are a return to the precrisis intervention rate, rather than a historically tougher regime of merger control.

An alternative calculation for the intervention ratio is also shown in Figure 19. Here, the number of intervention cases is divided by the total number of cases under non-simplified procedure.[28] This alternative measure reflects the idea that only non-simplified cases can eventually become intervention cases. There is an important difference between the total number of cases and the number non-simplified cases. The total number of cases reflects the underlying economic activity (as indicated by its strong correlation with the business cycle); the number of non-simplified cases also reflects the policy rule that determines what should be considered as a simplified case. Thus, the number of non-simplified cases is already a policy outcome.

With all these caveats in mind, the non-simplified-based intervention rate shows a moderately increasing trend between 2001 and 2008. This trend is broken in the post-financial crisis period, when, similarly to the simple intervention rate, the intervention rate declined in 3 consecutive years. After 2013, the non-simplified-based intervention rate grew, although part of this increase is because of the change in the definition of the simplified merger procedures adopted in 2013.[29] Therefore, this alternative intervention indicator confirms the finding that concentration trends and enforcement stance were moving in the opposite direction in the 5–6 years following the financial crisis. However, it also indicates a steadily tightening enforcement stance in the long run, instead of a stable merger policy.

Finally, we examine differences across broad industry groups. Table 2 shows, for each broad industry group, the share of high-concentration industries in 2019, the change in this share from

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[27] The financial crisis was a negative shock to both components of the C4 indicator: industry turnover (denominator) and turnover of the four largest firms (nominator). The share of high-concentration industries was increasing in this period, because in 2008 and 2009, industry turnover decreased faster, whereas in 2010 and 2011, the turnover of the four largest firms rebounded more quickly.

[28] Non-simplified cases are the ones with substantive assessment, whereas simplified cases are mostly procedural because of low market shares or lack of overlapping activity of the companies. In 2017, 28% of all mergers under EU enforcement were non-simplified cases.

[29] Commission Notice on a simplified procedure for treatment of certain concentrations under Council Regulation (EC) No. 139/2004(2013/C 366/04).
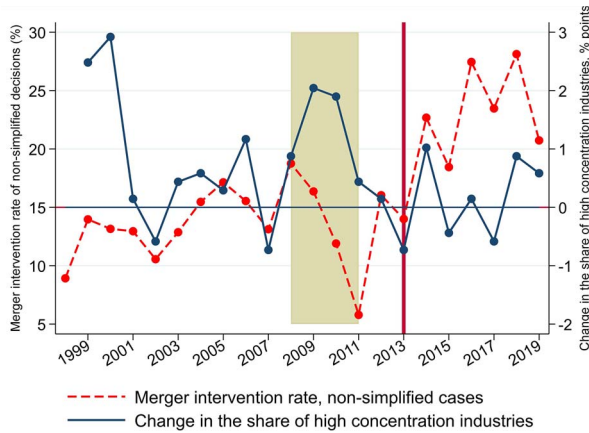
Figure 19. Evolution of DG Competition's intervention rate for non-simplified cases and the change in the share of high-concentration industries, 1998–2019. *Source*: European Commission, DG Competition, and authors' calculations based on Euromonitor International's Passport Industrial database.

Table 2. Concentration and merger enforcement by broad industry groups

	Percent of high concentration industries in 2019	Change in the share of high concentration industries 1998–2019	Number of mergers 1998–2019	Intervention rate (%) 1998–2019
Communication	80	23	620	9.1
Electricity, gas, water	51	−2	530	5.5
Transport, storage	49	11	471	9.1
Finance	37	10	649	2.5
Manufacturing	25	12	2745	9.8
Mining	23	10	195	11.5
Hotel, restaurants	10		125	0
Trade	8	0	673	2.3
Agriculture, forestry, fishing	7	0	55	13.8
Real estate	3	0	458	2.8
Construction			120	0
Total	32	8	6,641	6.1

Source: European Commission, DG Competition, and authors' calculations based on Euromonitor International's Passport Industrial database.

1998 to 2019, the aggregate number of merger cases, and the intervention rate.[30] Communication, transport, and finance are the three groups that show both the highest share of high-concentration industries in 2019, as well as the largest increase in this indicator. Two of these industry groups, communication and transport, also had high intervention rates. The outlier is the finance sector, where the intervention rate was below the overall average.

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[30] A merger case was assigned to multiple industry groups if the case concerned several industry groups. Therefore, adding up merger cases for all broad industry groups results in a number higher than the total number of cases.
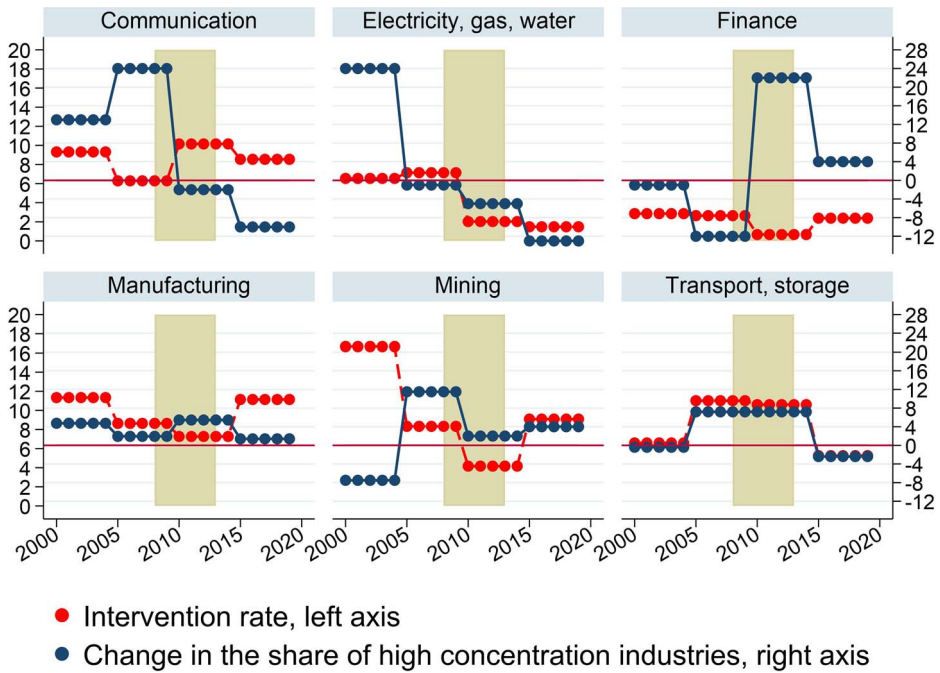
Figure 20. Evolution of DG Competition's intervention rate and the change in the share of high-concentration industries, by NACE one digit industry groups, 5-year averages from 2000 to 2019. *Source*: European Commission, DG Competition, and authors' calculations based on Euromonitor International's Passport Industrial database.

Manufacturing, an industry group with a moderately average share of high-concentration industries, but the fourth largest increase, also shows an intervention rate above the average. The industry groups with the highest intervention rates were Agriculture, Manufacturing, and Mining. However, Agriculture and Mining had relatively few mergers; therefore, even a low number of interventions results in a high intervention ratio. In general, those industry groups that had a larger increase in the share of high-concentration industries also show a higher level of intervention. The exceptions are (i) finance, where the intervention rate was low while concentration increased, and (ii) agriculture, where the extremely low number of mergers notified to the European Commission lead to a high intervention rate.

Comparing the intervention rate and the change in the share of high-concentration industries for large industry groups also confirms the outlier nature of finance. Figure 20 shows the 5-year averages of the intervention rate (red dots) and change in the share of high-concentration industries (blue dots) between 2000 and 2019 for those industry groups where the share of high-concentration industries was substantial.[31] In the industry group of electricity, gas, and water, the group of mining, and the group of transport, the intervention rate and the change in the concentration indicator were moving in the same direction since 2005. In manufacturing and communication, the intervention rate was fluctuating at a high level. Finance was the only industry that experienced strong industry concentration, but intervention rates remained low.

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31   The use of 5-year averages was necessary because of the low number of interventions in some industry groups.
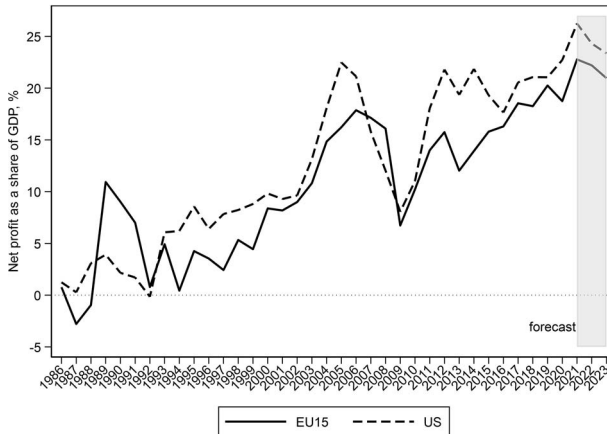
Figure 21. Net profit as a share of GDP, EU14 + UK, and United States, 1986–2022. *Source*: European Commission (AMECO) based on National Accounts from Eurostat and Bureau of Economic Analysis. EU14 + UK: AT, BE, DE, DK, ES, FI, FR, GR, IE, IT, LU, NL, PT, SE, UK. Net profit = net operating surplus − capital costs. Capital cost = lagged net real capital stock times Moody's AAA bond yield minus expected capital good inflation plus depreciation. Forecasts (2022–2023) are based on the Commission's AMECO database (November 2021 update), the Moody's bond yield is assumed to be fixed at the 2022 January value for the subsequent periods. See Appendix for details.

VII. AGGREGATE PROFITABILITY TRENDS

Since the 1980s, both Europe and the United States have experienced a trend increase in the aggregate profit share from around 0–5 percent to around 15 percent in 2019. Since data for this exercise are more readily available, Figure 21 shows the aggregate profit share, as a percent of GDP, for a longer time period and for the aggregate of 15 European countries, and separately for the United States. Our findings are consistent with those of Barkai (2020) for the United States. Although the 2008–2009 financial crisis had a negative impact on profits, there was a quick recovery, especially in the United States. Throughout the 1990s, the European aggregate profitability was below the American, perhaps also reflecting the pro-competitive effect of the creation of the Single Market. During the 2010s, however, Europe's profitability gradually closed its gap with the United States. By the end of the decade, both regions' profitability figures passed their pre financial crisis levels.

In general, the evolution of the profit share seems to be broadly aligned with the business cycle. Figure 21 compares the net profit share evolution for a group of 15 European countries with that of the United States.[32]

In terms of components, the increase in the share of profits came to a large extent from a steady decline in capital costs. These in turn might be related to macroeconomic factors, such as monetary policy and supply shocks like energy prices. These factors are important to illustrate that the profit share in itself is not a pure measure of market power or competitive conditions

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[32] For ease of comparability, we have also rerun the analysis only for the aggregate of the five European countries (Germany, France, Italy, Spain, and the United Kingdom) that are in the industry concentration data set. The trend increase is present in this smaller group of countries too, although somewhat less strong than for the fifteen-country block.

and care has to be taken when interpreting aggregate measures of profits. Of course, increasing market power can also be among the underlying causes.[33]

As a comparison, the literature reports estimates of markups (price minus marginal costs) based on firm-level data. These estimates also show increasing pricing power, both for Europe and the United States.[34] The magnitude of these estimates is larger than the increase in the aggregate profit share reported above. The difference might stem from the fact that the aggregate calculations use a total profit concept, whereas the markups measure the extent prices are above marginal costs. Hence, increasing fixed costs might be an important feature of the structural changes of the recent decades. These patterns, coupled with the documented rise in industry concentration, might be consistent with the hypothesis of Autor et al. (2020) of industries becoming increasingly dominated by "superstar" firms with high markups and a low share of labor in firm value-added and sales. Overall, this picture is also consistent with increasing market power.

VIII. CONCLUSION

We present new evidence that European industry concentration increased in the period 1998–2019. In particular, the share of high-concentration industries grew by more than 60 percent. High-concentration industries, industries where the four largest firms account for more than 50 percent of turnover value, are the most likely to contain antitrust markets where firms have market power. Therefore, the data suggest that industrial structures potentially conducive to the exercise of market power were on the rise in the last 20 years.

There are important differences across countries and industries to these general trends. France and the United Kingdom showed the strongest increase in concentration indicators and the highest level of concentration in 2019. In these two countries, concentration grew more in industrial sectors than in service sectors. In the service sector, in general, communication and transport and storage experienced the strongest concentration trends between 1998 and 2019, whereas, in industrial sectors, transportation related showed the highest levels of industrial concentration and the strongest increases.

Finally, a joint look at EU merger intervention and concentration trends suggests that they moved in opposite directions after the financial crisis. The share of high-concentration industries was increasing, especially between 2008 and 2011, whereas the merger intervention rate was decreasing below its historical average in the same period. This is in contrast to the precrisis period when concentration changes moved more similarly to changes in the intervention rate. This observation indicates that crisis periods may be characterized by an increasing importance of large firms in the economy and suggests that competition policy should remain agile in these periods.

Meanwhile, estimates of aggregate profitability indicate a trend increase over the last decades, also consistent with recent findings in the literature. Together with the industry concentration data, these findings are consistent with increasing market power.

Although there is a debate on the possible explanation of the origin of increased market power, some tentative policy conclusion can be drawn. The data suggest that EU merger enforcement has not been tougher in the last decade than its historical average, and it might have even been

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[33] A word of caution is also necessary because of the methodology. For example, in some countries and especially in the early periods, volatile, inflationary environments might result in more volatile estimates of capital costs, and especially estimates of expected capital goods inflation (the latter is based on the national accounts reported deflator of gross fixed capital formation). This could imply that using country specific equity premia would result in more flat EU-wide profitability trends. In our current calculations, we used the same premium across the component European countries. See also Gutiérrez (2017).

[34] De Loecker and Eeckhout (2018), De Loecker et al. (2020).

more lax (at least for some part of the period). This observation, coupled with the evidence on increasing market power, suggests that this is not a time to make merger policy less stringent. In fact, competition policy should stay vigilant and prevent any further dampening of competition, regardless of the cause of market power. That is, while it might not be possible to settle the historical causal questions, including the role played by past policy decisions, prescriptions on the stance of future policy may still be given. The larger the firms' market power to begin with, the higher the risk that mergers in already concentrated industries will hamper the competitive process or that dominant firms can engage in anticompetitive conduct (Valletti and Zenger, 2019).

The analysis of concentration trends in this paper relies on a new data set. The process of assembling the data showed that there is no "right" way of organizing data on industrial concentration, or to construct market power indicators other than crude proxies. Nor is it easy to make a straightforward link between industry and market concentration, or establish causality between policy and endogenous market power. Hence, results will always come with strong caveats. Hopefully, further research will generate additional data sets and insights, also on antitrust markets, to confirm or refute our findings.

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A. APPENDIX-DATA

A.1. Concentration

For the industry concentration calculations presented in the paper, we used a data set compiled and constructed by Euromonitor International as described in Sections A.2–A.4.

A.2. ORBIS/AMADEUS

The primary source of company-level data is Bureau van Dijk's (BvD) databases. BvD collects, arranges, and standardizes administrative data from business registers to harmonized financial and balance sheets. The global BvD database is ORBIS, whereas AMADEUS is its European subset. Four separate versions of BvD's databases have been used to cover the time period of 1998–2019.

First, version 2003 of the AMADEUS database gives information for the years 1998–2003 on 250,000 companies in Germany, France, Italy, Spain, and the United Kingdom. Second, version 2008 of the ORBIS database gives information for the years 2003–2007 on 10 million companies in Germany, France, Italy, Spain, and the United Kingdom. Third, version 2016 of

the ORBIS database gives information for the years 2007–2016 on 26 million companies in Germany, France, Italy, Spain, and the United Kingdom. These data sets identify company names, turnover, NACE industry codes of primary and secondary activities, geographical locations, the global ultimate owner (GUO) of the company, and exchange rate information. Furthermore, the third data set contains more granular information on production site locations, assets, and shareholders. Finally, 2019 is covered by the current version of ORBIS.

A.3. Aggregate Data, Desk Research, and Reclassification

Total industry turnover is taken from Euromonitor International's Industrial Passport (IP) database. The IP database in turn is based on publicly available data from national accounts, national statistical offices, and data collections from Eurostat's, as well as the UN Statistics Division's, tables. The IP data uses the UN's ISIC 3.1 industry classification.[35]

Note that the total industry turnover figures have to come from an external database and not from ORBIS. This is because the coverage of the full population of companies in ORBIS is not complete; moreover, it is changing (increasing) over time as more and more small firms are covered in later years. The coverage of the largest firms is complete across the whole time period. The increasing, yet incomplete, coverage implies that if the ORBIS turnover figures are summed up for a given industry/year and the sum is used as the denominator of industry shares the results would be biased. In particular, an increasing coverage could easily result in decreasing industry shares for the largest firms and, hence, decreasing industry concentration, even when the actual shares and concentration are increasing. That is why the denominators for share calculations, the total industry turnover figures, are taken from the external databases.

Desk research was used to complete various aspects of the firm-level data. In particular, the operational segmentation of the largest firms required detailed inspection of online available company accounts and descriptions, in addition to the ORBIS/AMADEUS databases' activity categorisations. If a company had multiple industry codes in the underlying databases, shares were calculated using the total industry turnovers. Furthermore, information from the unconsolidated (affiliate level) version of ORBIS was used to assess the importance of a given (consolidated) company's activity profile.

Geographic segmentation had to be worked out for the cases when the activity covered several countries. For manufacturing firms, if no geographic breakdown is directly available, company turnover is proportionally allocated to geographical location, locations of factory, or assets. For service companies, revenues are assigned to the country where the service is provided. For transport companies, geography is defined by the country of the employees' registration. Whether and how much of the turnover is to be allocated is driven by the identification of the main locations of the firms, and then using ORBIS unconsolidated accounts, company accounts, and desk research. The total industry size variable is calculated in a consistent way.

Finally, industry codes have to be reclassified as while Euromonitor's IP database uses ISIC 3.1 industry codes, the ORBIS/AMADEUS database carries NACE codes (Rev. 1.1 until 2008, Rev. 2 thereafter). Using the official Eurostat correspondence tables between the different NACE systems, and between NACE and ISIC, all NACE codes were reclassified into ISIC 3.1.

A.4. Data Construction

The three main issues in constructing industry level concentration measures are ownership, industry classification, and industry size. As explained above, for the industry size it is important that an estimate based on the full population of companies is used to avoid biased share and concentration estimates. This rules out databases with incomplete and changing coverage, such

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[35] International Standard Industrial Classification of All Economic Activities, United Nations (2002).

as ORBIS for the estimation of industry size. Hence, the publicly available industry aggregate data are preferred.

As for the ownership classification, it is important that in a given country/industry pair different affiliates of the same parent company should be treated as the same entity for the purposes of market share calculations. Otherwise, company shares and concentration might be biased downward. The GUO of a company is obtained from ORBIS, and in some cases its shareholder structure as well. If GUO is missing, either the Domestic Ultimate Owner of ORBIS 2016 is used, or desk research yields the GUO or the shareholder with more than 50.01 percent of ownership. If ownership is still not defined after these steps, the company name is assumed to be the individual owner. Ownership might change over time as consolidation, company split, or sell-off happen. Firms in the final data set are country specific. This means that, for example, a German company's Spanish subsidiary is reported in the Spanish subset of the data. However, subsidiaries of a firm active within the same country are aggregated.

Industry classification and segmentation is an issue as a given firm, or less often, an affiliate, can be active in several different industries. In this context, it is important to be able to track company affiliates to split total turnover across countries and industries. Information on affiliate level primary and secondary industries of activities is gathered either from the unconsolidated (affiliate level) ORBIS database or by desk research of the large firms' accounts and publications. As such, the final firm-level figures are not the unconsolidated or consolidated figures, nor a trivial combination of these. When no further information is available on a given firm's industry split, industry total turnovers are used to segment the firm's activities.

Current yearly exchange rates are used to convert all figures into Euros. Data are validated to check that in each country/industry triplet, the total turnover of the largest four firms does not exceed the total industry turnover. Furthermore, it is checked that no firm has a combined turnover larger than what is implied by its consolidated account (simply adding up unconsolidated accounts might lead to double counting).

The final data set includes yearly turnover/production current Euro value estimates for 156 industry categories for five countries (France, Germany, Italy, Spain, and the United Kingdom), for the period 1998–2019. These industry categories cover the whole economies of the five countries. For the paper's analysis, the public administration and education sectors are excluded as they are sectors with heavy public sector involvement.

A.5. Weighting and Aggregation

Weighting changes the shape of the concentration distribution, but not the conclusion that the share of high-concentration industries is increasing. The left side of Figure A1 shows that weighting with industry turnover results in a distribution with more mass in the low concentration part: larger industries tend to have lower concentration. The share of high-concentration industries is lower with industry turnover weighting, but the share was increasing between 1998 and 2019 from 11 to 18 percent. The right side of Figure A1 shows the concentration distributions using the turnover of the four largest firms as weights. These distributions capture what fraction of large firm turnover was produced in high- or low-concentration industries. This distribution contains the most mass in high-concentration industries, but the conclusion in terms of change in the share of high-concentration industries remains the same: the share of high-concentration industries increased from 27 to 45 percent. Weighting introduces strong year-to-year variation in the trend of the share of high-concentration industries, as evidenced by Figure A2. The overall increasing trend remains, nonetheless.

Figure A3 shows the effects of industry aggregation. Aggregation effects are as expected: using broader industry classification, for example, moving from three-digit industry classification to two-digit, results in more low-concentration industries and more mass on the low end of the
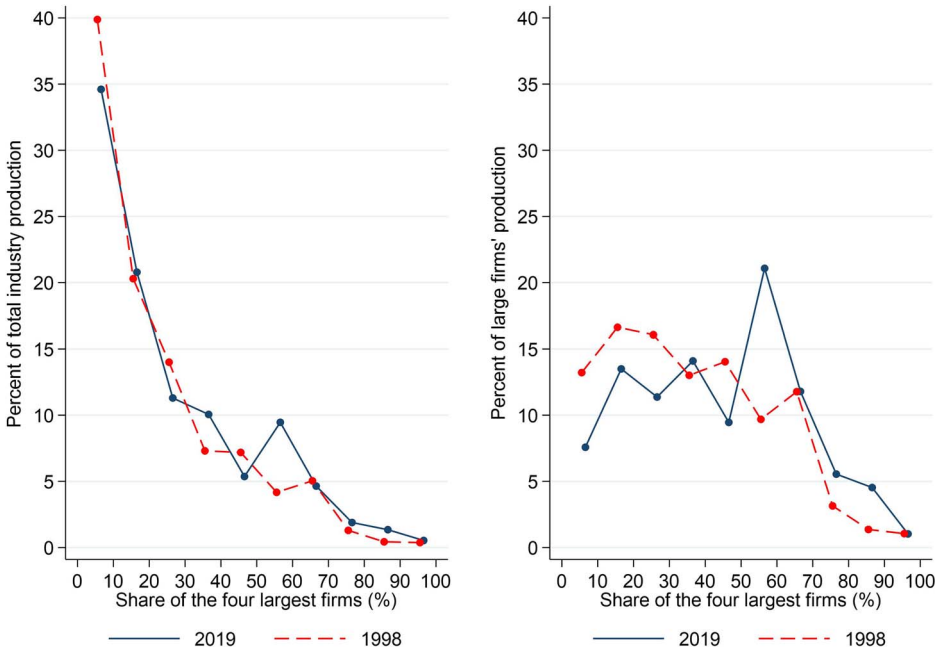
Figure A1. Distribution of the share of the four largest firms, counting total industry production and the production of the four largest firms, 2019 and 1998. *Source*: European Commission, DG Competition, and authors' calculations based on Euromonitor International's Passport Industrial database.

concentration distribution. However, the increase in the share of high-concentration industries remains the same, as long as a meaningfully large cross section of industries is considered (say two-digit industry classification). Under the most detailed industry classification, the share of high-concentration industries increases from 15 to 28 percent. Using a three-digit classification, the share of high-concentration industries increased from 11 to 21 percent, while using a two-digit classification, it increased from 6 to 16 percent.

B. AGGREGATE PROFITABILITY AND INVESTMENT
B.1. AMECO

The European Commission's AMECO database is used to gather macroeconomic time series.[36] The main source of information for AMECO is Eurostat's online database. The following variables are used: GDP, net operating surplus (NOS), consumption of fixed capital (CFC), net capital stock (NCS), price deflator of gross capital formation (DEFL), gross fixed capital formation (GFCF), and current Euro exchange rates.[37] These variables are expressed in current prices, denominated in current Euros for European countries, and in current dollars for the

[36] https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/macro-economic-databa se-ameco/ameco-database_en

[37] NOS is defined as the part of gross output that remains after subtracting the following items: intermediate consumption, consumption of fixed capital, compensation of employees, and indirect taxes less subsidies. Hence, NOS is a national account version of net operating results on an aggregate economy level. Gross output is the total sum of turnover values across the economy. This variable includes a long chain of double counting as it adds up the turnover values of each level of the production system. Intermediate consumption is the value of the previous level of the production chain that is used by a given level as input. Hence, subtracting intermediate consumption removes the double counting and yields value added figures. Consumption of fixed capital is a national account estimate of economic depreciation.
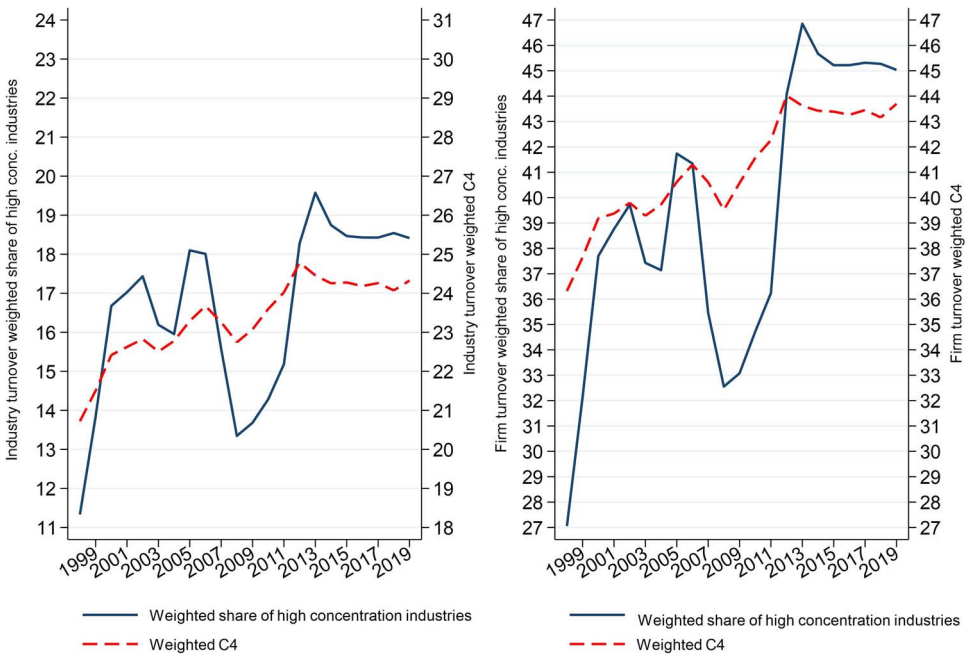
Figure A2. Evolution of the share of high-concentration industries and average concentration, weighted with total industry production and the production of the four largest firms, 2019 and 1998. *Source*: European Commission, DG Competition, and authors' calculations based on Euromonitor International's Passport Industrial database.

United States. There are 15 European countries included into the calculation, those for which data were consistently available for a long enough time span.[38] The time span of the yearly, country-level data is 1986–2020, with AMECO's internal forecast for 2021–2022. In addition, Moody's AAA corporate bond yield is downloaded from the U.S. Federal Reserve Bank of St. Louis.[39]

B.2. Data Construction

The aggregate profitability variable reported in this paper approximates that of Barkai (2020). In particular, to arrive at an estimate of net profit, an estimate of capital costs has to be further subtracted from the operating surplus. Table A1 summarizes the steps taken to calculate the aggregate net profit as a percent of GDP (NPS).

Barkai (2020) calculates net profits for the United States. For the capital cost estimation, he uses industry level data with capital (as well as its deflator and depreciation) further broken down into asset types. For Europe, however, the capital asset break-down with industry disaggregation is not available for a long enough time period. Hence, in the above calculations, country-level capital stock data were used.

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[38]   AT, BE, DE, DK, ES, FI, FR, GR, IE, IT, LU, NL, PT, SE, UK. These countries constitute AMECO's EU15 aggregate.
[39]   Moody's Seasoned Aaa Corporate Bond Yield, Percent, Monthly, Not Seasonally Adjusted, https://fred.stlouisfed.org
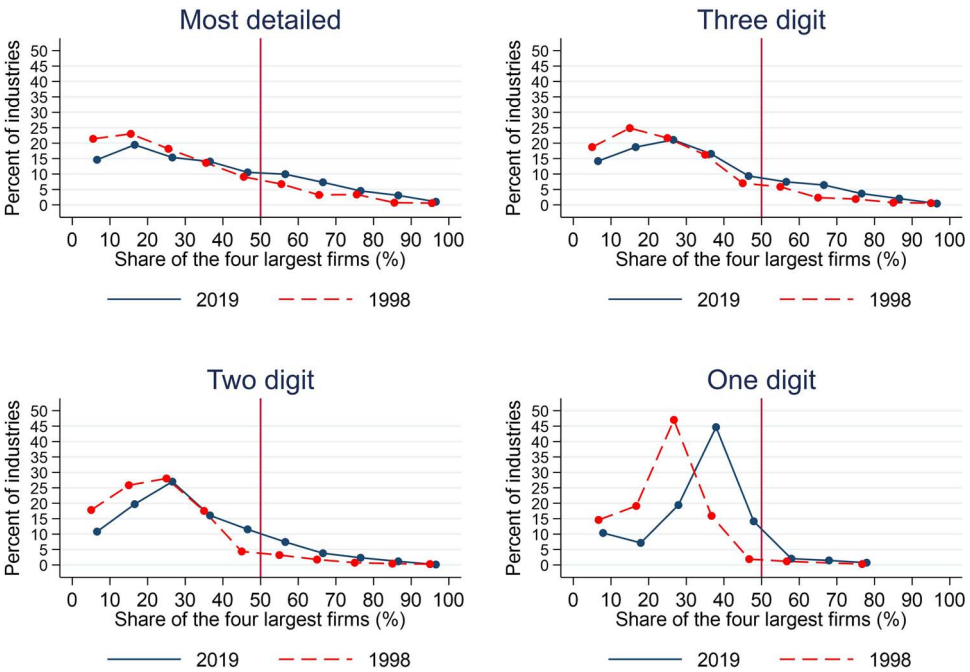
Figure A3. Distribution of the share of the four largest firms at different level of industry aggregation, 2019 and 1998. *Source*: European Commission, DG Competition, and authors' calculations based on Euromonitor International's Passport Industrial database.

Table A1. Constructing the aggregate net profitability variable

Variable	Label	Definition
gross operating surplus	GOS	NOS + CFC
gross capital stock	GCS	NCS + CFC
real net capital stock	RNCS	NCS/(DEFL/100)
capital depreciation rate	DR	CFC/L.GCS
realized change in relative price of capital	GCAP	(DEFL − L.DEFL)/L.DEFL
expected capital return	RETURN	(L.DEFL/100)∗(MOODYS_AAA − 100∗(1-DR)∗GCAP+100∗DR)
capital cost	CS	L.RNCS ∗ RETURN/100
net profit in currency	NP	GOS − CS
net profit as percent of GDP	NPS	100∗NP/GDP

Notes: The symbol "L" denotes the lag of the variable. NOS, net operating surplus; CFC, consumption of fixed capital; NCS, net capital stock; DEFL, price deflator of gross capital formation; MOODYS_AAA, Moody's AAA corporate bond yield.

B.3. Relationship to the Literature

Measures of profitability can be categorized based on (i) whether they follow accounting principles or are based on structural econometric estimation and (ii) whether they use aggregated or micro (firm, affiliate, or plant) level data.[40]

The advantage of aggregate, national accounts-based profit estimations stems from the relatively consistent data, relatively little additional computational needs, and the availability of

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[40]   See also Basu (2019) for an overview on the estimation of profits and markups.

longer time series. However, the profit estimates include all costs and all firms. Within this framework, it is not possible to calculate the economically more relevant markups (price minus marginal cost) or zoom into more disaggregated subsectors or firms of the economy.

This paper, and also that of Barkai (2020), uses aggregate data and applies (national) accounts principles to deliver estimates of total net profits. The results are consistent for the United States (Barkai does not report estimates for Europe). Covarrubias et al. (2019) also report aggregate measures of profitability, both for the United States and Europe. However, they approximate profit by the gross operating surplus. That is, capital costs and depreciation are not taken into account. This is arguably the reason why their European profit estimates show a declining tendency, contrasting this paper's reported increasing trends. Gutiérrez (2017) applies a similar methodology along the lines of Barkai's work, though he uses country-specific interest rates and risk premia for Europe. The results show a more stable European profit share.

Company-level accounting data can be used to extract EBIT(DA) margins. Although these data are relatively easily available (e.g., from ORBIS), it is also a total profit measure that includes fixed costs. Weche and Wambach (2018) report EU-wide EBIT margins for the period of 2007–2015. The main tendencies are not inconsistent with our results indicating a drop in profitability following the financial crisis and coming back in the second half of the data period. The reported trends are, however, more subdued than those of this paper based on aggregate data. Grullon et al. (2020) use U.S. accounting data with adjustments to show that while industries with the largest increases in product market concentration show higher profit margins, there is no evidence for a significant increase in operational efficiency. Cavalleri et al. (2019) report Euro-area price–cost margins based on firm-level data (as the ratio of sales to variable costs). Their findings show relatively stable margins over the last three decades.

Structural econometric models can be used to estimate markups from disaggregated data. In general, these estimates provide theoretical consistency as they aim at the economically directly relevant variable of pricing power, the markup (price minus marginal cost). However, the implementation of these models can be more involved. There are two main variants, the demand and production side models. The demand side models use demand forms such as those proposed by Berry et al. (1995), Nevo (2001), or similar demand forms. Using the demand estimates, the first order conditions of oligopoly equilibrium allows backing out marginal costs. The data needed include market level sales, prices, and product characteristics. These are often available, for example, from retail scanner data. The advantage of the method, besides theoretical consistency, is its ability to focus on a specific market, which can be an important factor, for example, in competition policy analysis. However, these models are difficult to implement, and are also less amenable for overall, economy wide estimations because of the large number of markets.

The production side models impose less structure on the data and, hence, can be more easily applied than the demand side approach. Building on Hall (1988), De Loecker and Warzynski (2012) propose a method to uncover firm-level markups from firm/plant level output and input data assuming cost minimization by producers. Using this method, De Loecker and Eeckhout (2018) and De Loecker et al. (2020) provide estimates for the evolution of markups for both the United States and other regions of the world. In particular, they report for both the United States and Europe steadily rising markups, especially in the last 20 years. Albeit with data on a shorter time period, Weche and Wambach (2018) also report European results using the production side method, implying increasing markups in the aftermath of the financial crisis. Díez et al. (2019) report both accounting-based profitability and De Loecker et al. (2020) type markup estimates for advanced economies. Their results suggest increasing market power.