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More documentation related to this discussion can be found at:
https://www.oecd.org/daf/competition/methodologies-to-measure-market-competition.htm

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Methodologies to Measure Market Competition*

The ability to reliably measure, track and compare the competitive intensity of a market is extremely valuable to competition authorities and other policymakers to inform decision-making. The fact that competition is a complex notion, and therefore not directly observable, has resulted in the development of numerous methods to capture and measure the degree of competition in markets over the years. Such methods, which vary in complexity and reliability, provide indicators often used to measure the intensity of competition.

Individually, each indicator provides limited information, but together they can provide useful information to help build a better understanding of the competitive dynamics at play. Therefore, a plurality of measures is needed when analysing the intensity of competition.

Given data and methodological limitations, the analysis of such indicators cannot be interpreted as providing a definite set of conclusions on the intensity of competition. However, it can provide useful information for identifying areas where competition authorities may want to do further research and/or be more vigilant.

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1 Introduction

1. The ability to reliably measure, track, and compare the competitive intensity of a market can be extremely valuable in informing the decision-making of competition authorities and other policymakers. It can inform a wide range of possible actions such as to remove barriers, impose restrictions on firm behaviour or strategy, or seek other remedies to increase competition.

2. In particular, competition authorities measure market competition for broadly three reasons. The first one is to apply competition law in markets affected by mergers and potential abuse of dominance (competition enforcement). The second reason is to assess whether pro-competitive intervention is needed and whether such intervention is likely to be net beneficial (competition advocacy). The third reason is to assess ex-post the effectiveness of competition policy of an authority.

3. However, the measurement of competition is not straightforward. Competition is a complex concept and not directly observable. Over the years, this has resulted in the development of numerous methods to capture and measure the degree of competition through what can be observed (e.g. through the observable causes and effects of the competitive process). Such methods, which vary in complexity and reliability, provide indicators that are often used to measure the intensity of competition. However, while indicators can provide useful information they also present limitations. In light of these, careful interpretation is generally necessarily.

4. To inform the debate on how indicators should be interpreted and used, this paper focuses on methodologies to measure market competition for competition authorities. Although measuring market competition is of interest to other government agencies given the impact of competition on these agencies objectives such as monetary policy, financial stability, international competitiveness, productivity or economic growth, this is not the focus of this paper.

5. To enable wider engagement, the paper has been written in a non- technical and focused manner while providing enough detail on the methodologies to measure market competition to enable drawing key issues and conclusions in relation to their usability for competition authorities.

6. The paper starts by describing in Section 2 the evolution of the concept of competition in economics, and how it has led to the different approaches for measuring it. Section 3 then follows by presenting the most commonly applied methods to measure market competition in the economic literature, and assesses their advantages and limitations (both conceptual and practical). Section 4 discusses the key issues to consider when selecting/using empirical measures to infer the intensity of competition in a market. Section 5 analyses the use of competition measures by competition authorities and the challenges they face. Finally, Section 6 concludes that:

- Individually, each measure of competition provides only limited information, but together they can provide useful information to help build a better understanding of the competitive dynamics at play. Therefore, the use of a plurality of measures is necessary when analysing the intensity of competition.
- Given data and methodological limitations, the analysis of such measures cannot (and should not) be interpreted as providing a definite set of conclusions on the intensity of competition. Moreover, analysis using competition indicators is not intended to replicate (or replace) the analysis competition authorities undertake to exercise their statutory powers. However, it can provide useful

information for identifying areas where competition authorities may want to do further research and/or be more vigilant.

- Competition authorities who may want to consider developing further their market screening intelligence using a combination of competition indicators could start with markets defined during casework. Subsequently, this can be extended to include other important markets, particularly as firm-level data becomes more available. This could allow an authority to obtain a more reliable view on how a market is evolving and hence identify where there could be problems, or alternatively myth-bust when indicators suggest problems are absent in well-defined markets.

2 Two concepts of competition

7. It is helpful to begin by describing the concept a methodology aims to measure. Therefore, this section sets out briefly the evolution of the concept of competition in economic thinking, and how this led to the different approaches for measuring it. It focuses on two main concepts of competition: competition as a static state, and competition as a process of rivalry.[1]

2.1 Competition as a static state

8. Standard economic theory refers to the result of competition as a static equilibrium outcome. Competition as a static state is defined as the equilibrium condition itself (Cournot, 1938[1]), rather than as the process that evolves towards a certain equilibrium in the long-term (Smith, 1776[2]). According to this theory, competition is a static end-state in which firms cannot persistently over charge and earn abnormal profits.

9. To obtain a competitive situation several criteria need to be met. These include having a considerable number of rivals, participants possessing common knowledge about market opportunities, and there being free entry and exit (Cournot, 1938[1])) According to this theory, the excess of the price over costs decreases as the number of producers increases. Perfect competition is the opposite of a monopoly. In a monopoly, there are no rivals and a monopolist can extract abnormal profits by pricing as high as the consumer will bear (i.e. as far as the elasticity of demand permits).

10. Based on the static concept of competition, the Structure-Conduct-Performance (SCP) paradigm was later developed (Mason, 1939[3]) (Bain, 1956[4]). It seeks to explain conduct and performance of firms in terms of the structural characteristics of the markets in which firms operate. The structural characteristics of a market include the number of firms (and the absolute and relative size of firms), the entry and exit conditions, and the extent of product differentiation. Market structure is expected to influence the conduct of firms. Conduct variables include pricing strategies, other forms of strategic decisions (e.g. on product quality, advertisement expenditure, etc.) and collusion. Conduct, influenced by structure, determines performance. The SCP paradigm's key insight is that the more concentrated an industry is, the easier it is for firms to operate in an anticompetitive manner. Remaining firms can exploit their market power in order to charge prices above marginal costs and to become more profitable at the expense of consumers. Therefore, empirical works based on the SCP paradigm focus on empirical measures based on the number of firms and their relative size in order to gauge market concentration.

11. However, this paradigm and its associated concentration measures suffer from major conceptual limitations. Under the SCP hypothesis, a rise in concentration is regarded as increasing collusive opportunities between firms, and hence would lead to higher prices and profitability. Alternative theories question the link between structure and conduct. The theory of contestability (Baumol, Panzar and Willig, 1982[5]) suggests that a concentrated market can behave competitively if barriers for entry and exit are low. The threat of entry can exert pressure on incumbents and keep the sector competitive. Other theories show that collusive actions can be sustained even in the presence of many firms.[2]

12. To overcome these deficiencies, the New Empirical Industrial Organisation (NEIO) developed measures to assess the competitive conduct of firms rather than simply relying on measures relating to

the structure of the market. The first generation of non-structural measures (also called performance measures) is still based on oligopoly theory and a static model of competition. This concept of competition is, however, challenged by another view that focuses on the dynamic aspects of competitive rivalry.

2.2 Competition as a process of rivalry

13. An alternative concept is that competition is a complex process of rivalry between firms rather than a static state. Here, the core of competition is the behaviour of firms in the market. Firms are engaged in a continuing dynamic competitive process. Less efficient firms are removed and replaced by more efficient entrants. A market is competitive when rivals are sufficiently threatening to incentivise an incumbent to improve (better quality, lower price, new services, more innovation, etc.) to maintain its competitive advantage. Inefficient firms are penalised by consumers while more efficient and innovative companies are rewarded.

14. The role of monopoly and market power is revised under this concept of competition. While firms are unable to raise prices over marginal costs in a perfect competition framework, in contrast for the rivalry concept of competition the existence of rents is a normal aspect of the competitive process. In a free competitive market, each firm innovates and develops risky strategies in order to gain a competitive advantage over its rivals. Firms that obtain such a temporary advantage derive static monopoly power during the interval before competitors replicate their innovation, or supersede it with one that is superior. Successful firms earn temporary monopoly profits as their reward for risky strategies. As a result, a competitive market is compatible with market power and abnormal profits at least for a certain time-period.

3 Measures of competition

15. In the last few years, there has been a growing body of empirical studies investigating whether competition is weakening. These typically analyse trends of competition measures such as concentration, mark-ups and profits since the 80's in many industries across the world. Broadly speaking, most of these find increases in all indicators. However, their suggested interpretation and implications differ widely. Some argue that increased concentration, mark-ups and profits are indicative of greater efficiency and superior technology arising from innovation (Autor et al., 2020[6]) (Hsieh and Rossi-Hansberg, 2019[7]) (Tambe et al., 2020[8]). Other studies argue that increasing concentration as well as mark-ups and profits is indicative of growing market power, strategic increases in barriers to entry, and of a less dynamic environment and declining productivity (Gutiérrez and Philippon, 2018[9]) (Grullon, Larkin and Michaely, 2019[10]) (De Loecker and Eeckhout, 2018[11]) (De Loecker, Eeckhout and Unger, 2020[12]) (Calvino et al., 2018[13]).

16. To inform the debate on how indicators should be interpreted and used, this section describes the most commonly applied measures of competition and discusses their advantages and limitations (both conceptual and practical). The different measures considered in this section are grouped by the specific aspect of competition they aim to measure (i.e. market structure, market performance, and other aspects). The purpose here is not to create a comprehensive checklist, but instead to discuss enough measures to enable a discussion on the key issues for competition authorities to consider when using such measures to measure the intensity of competition.

3.1 Structural measures

17. Structural measures are those that focus on elements of market structure. These are associated with the static concept of competition. Here we discuss different types of measures in relation to market concentration, and entry and exit conditions. We also discuss dynamic structural measures.

3.1.1 Concentration

18. Market concentration, or the extent to which the distribution of the market across firms is limited to relatively few firms, is an important structural characteristic of a market. Two of the most commonly used measures of concentration are concentration ratios (CR) and the Herfindahl-Hirschman index (HHI).

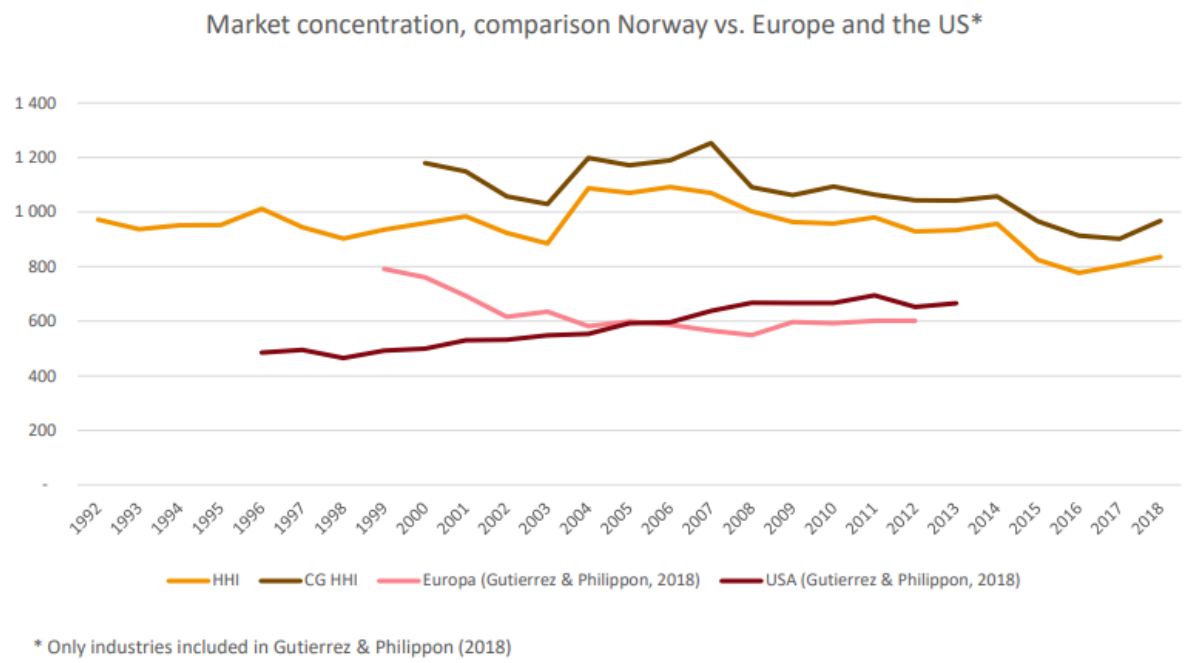
19. The concentration ratio (CR) requires information on the number of firms and the market shares of the largest firms. The N-firm concentration ratio measures the market share of the top N firms in the market. The index approaches zero for an infinite number of equally sized firms and equals 1 if the firms included in the calculation make up the entire market. Commonly used values of N include C3, C5, and C10. By focusing only on the market share of the top N firms, however, the concentration ratio takes no account of the the market share distribution of the remaining firms. For instance, CR5 denotes the combined market shares of the five largest firms. However, it does not distinguish between markets in which there are only six firms and those where there is a long tail of firms with smaller market shares. One way to deal with this issue is to look at say CR50, however, then this fails to distinguish between those

markets in which the five largest hold combined shares of 80 percent and those where they hold shares of 20 percent.

20. The Herfindahl-Hirschman Index (HHI), attributed to Herfindahl (1950[14]) and Hirschman (1945[15]), is the most popular concentration measure in the competition literature. The HHI is more data intensive than the CRN as it requires information on the firm size distribution (i.e. the market shares of each firm). The HHI solves the problem with concentration ratios by summing the squares of the market shares of all firms in a market. For a market with one single firm the HHI equals 10,000, while a HHI close to 0 means that there is a large number of firms with a low market share. By summing squares, the HHI stresses the importance of larger firms by assigning them a greater weight than smaller ones, thus reflecting their relative size importance. Contrary to the concentration ratio, the HHI avoids the arbitrary cut-off by incorporating each firm.

21. Figure 3.1 shows a practical application of the HHI index by the Norwegian Competition Authority as part of a study measuring the intensity of competition in the Norwegian economy (2019[16]). Such figure shows the market concentration trend over time in Norway compared to the EU and the US.

Figure 3.1. Market concentration measures used by the Norwegian Competition Authority



Note: In addition to the HHI index, the figure reports the corporate group adjusted-HHI that aggregates revenues of firms belonging to the same corporate group within the same industry.
Source: (The Norwegian Competition Authority, 2019[16])

22. Analyses of traditional concentration measures, as those described above, do not tend to take into account partial ownership (cross ownership where a firm owns shares in a competitor or common ownership where two rivals have shares in common). Partial ownership may reduce the incentives to compete for what seems independent firms. As a result, treating all firms as independent may underestimate the actual level of concentration and potentially overstate the intensity of competition (OECD, 2017[17]).

23. In recent years, competition authorities and academics have considered the impact of partial ownership on measures of competition (European Commission, 2020[18]) (Fitchner, Heemsskerk and

Gracia-Bernardo, 2017[19]). OECD work on industry concentration employs a novel methodology that aims to take into account the ownership linkages between firms by combining information from individual firms and business groups to more reliably assign the output of large business groups across industries and countries (Bajgar et al., 2019[20]).

24. Overall, more intense competition resulting from more entry into the market should be picked up by a decrease in concentration measures. However, the problem with concentration measures as indicators of competition is that a switch to more rivalrous behaviour by firms forces inefficient firms out of the market (selection effect of competition). Thus, a change in concentration of the market may reflect differences in efficiency rather than in a competitive situation (Demsetz, 1973[21]) (Peltzman, 1977[22]). This case shows that an increase in concentration cannot be interpreted by itself as indicative of a fall in the intensity of competition. Moreover, more rivalry among firms tends to raise the market shares of efficient firms at the expense of inefficient ones. Such a reallocation of market shares could also raise the HHI. Once again, concentration indices changes may reflect differences in efficiency. As a result, it is difficult to know what different levels (and changes in the level) of concentration actually reflect.

25. Another problem with concentration measures concerns the major practical problem of the appropriate definition of the market. Defining the relevant market can be difficult and time consuming (OECD, 2012[23]). As a result, often industry concentration measures are used instead as a proxy.

26. Industry concentration is related to, but is distinct from, the concept of market concentration, which is the focus of competition authorities. Market concentration is a far narrower definition than what it is typically reflected in industry concentration measures. The fact that a large share of industry activity is due to a handful of large firms does not necessarily mean that product markets within an industry are highly concentrated. While industry concentration can be used as an initial indicator to screen for potential changes in the intensity of competition, by itself it can say little about whether the intensity of competition in a market is changing. (This issue is further discussed in section 4.2)

27. Industry concentration measures also do not tend to take account of competition from foreign firms. As a result, the import ratio has been used to complement concentration measures, as an increase in domestic concentration may be partially compensated by increased imports from foreign markets (Gutiérrez and Philippon, 2017[24]). It indicates the contribution of foreign firms to competition in a domestic market. The import ratio is measured at the commodity level. It reflects the share of imports of a certain product in the total (domestic) use of that commodity. A higher import ratio is interpreted to mean that there is more competition from foreign firms on the domestic market. (This issue is further discussed in section 4.3)

28. In spite of the important limitations of concentration measures, they continue to be widely used, in particular where data are limited. However, it is important to acknowledge that concentration and competition are two concepts not always straightforwardly related.

3.1.2 Entry barriers

29. Several studies investigate other elements of market structure such as entry and exit conditions. The theory of contestability argues that firms behave competitively in the absence of entry and exit barriers. We consider here some commonly used measures for barriers to entry.[3] In particular, we consider measures for sunk costs, economies of scale, and regulatory barriers.

Sunk cost

30. Sunk costs,[4] which a potential entrant must incur before it can enter, may deter efficient entry thus preventing improvements in quality and reductions in price. In the presence of sunk costs, firms will enter the market provided the price is sufficient to cover any sunk costs of entry. The greater the level of sunk costs, the greater the required profitability which must be sustainable in equilibrium before further entry

can occur. Sunk costs are difficult to measure. We discuss some commonly used proxies to measure sunk costs.

31. The advertisement to sales ratio aims at capturing the level of advertising which a potential new entrant must pay to feasibly enter the market. It is an endogenous sunk cost – the higher the advertising rates the higher the entry barrier. In addition, this measure proxies product-differentiation, with greater advertising spend being linked to better established product niches. A caveat is that high levels of advertising can also be indicative of active competition, and so the resultant high concentration may not result in reduced consumer welfare (Sutton, 1991[25]).

32. The R&D expenditure to sales ratio is another measure of a barrier to entry caused by a different type of endogenous sunk costs – the level of research and development. Sutton (1998[26]) uses this indicator to verify his approach on the relationship between R&D intensity and the concentration of firms in the market. The findings are that for high R&D industries there is a lower bound to market concentration, which grows as R&D expenditure increases.

33. One of the key problems with this indicator is a lack of data for specific markets instead of at a firm level, which is what is generally available. R&D expenditure could be split across markets. In addition, high levels of R&D are compatible with active market competition for and in the market and so may indicate strong competition.

34. The gross book value of depreciable assets to sales ratio aims to measure exogenous sunk costs. These are entry costs not recoverable at exit where the firm has no discretion. They are determined by the technology of production (e.g. plant size, start-up working capital etc.). This measure was proposed by Sutton (1991[25]) and has been used in several empirical studies. One needs to be cautious when using such measure, however, as it is calculated using accounting data as proxies for economic costs, especially values that involve depreciation.

Economies of scale

35. Economies of scale represent a reduction in the marginal cost of production that accrue when large volumes are produced. All else being equal, firms will be more likely to enter the market if they can realise economies of scale to broadly the same degree as incumbents.

36. One commonly used measure is the cost disadvantage ratio (CDR) (Caves, Kahlilzadeh-Shirazi and Porter, 1975[27]). This ratio aims to capture the extent to which a firm is disadvantaged by operating at a level below the minimum efficient scale. The authors define this ratio as the value added per worker in the smallest plants accounting for 50% of market output divided by the value added per worker in the largest plants accounting for 50% of market output. This indicator should be less or equal to 1 where there are economies of scale. The smaller the indicator, the greater the economies of scale as workers in small plants produce less output and so add less value than workers working for large firms.

37. One of the limitations of this ratio is that plant data is not generally available. As a result, firms are typically ordered by turnover instead. This will be a relatively good proxy to calculate the CDR if the largest firms have plants of efficient scale. The value added per worker will then equal the value added per worker achievable by a firm of efficient scale. Another big disadvantage with this measure is that it produces unreliable results if the value added for large firms is negative and the value added for small firms is positive. In this case, this measure will wrongly signal industries as not competitive.

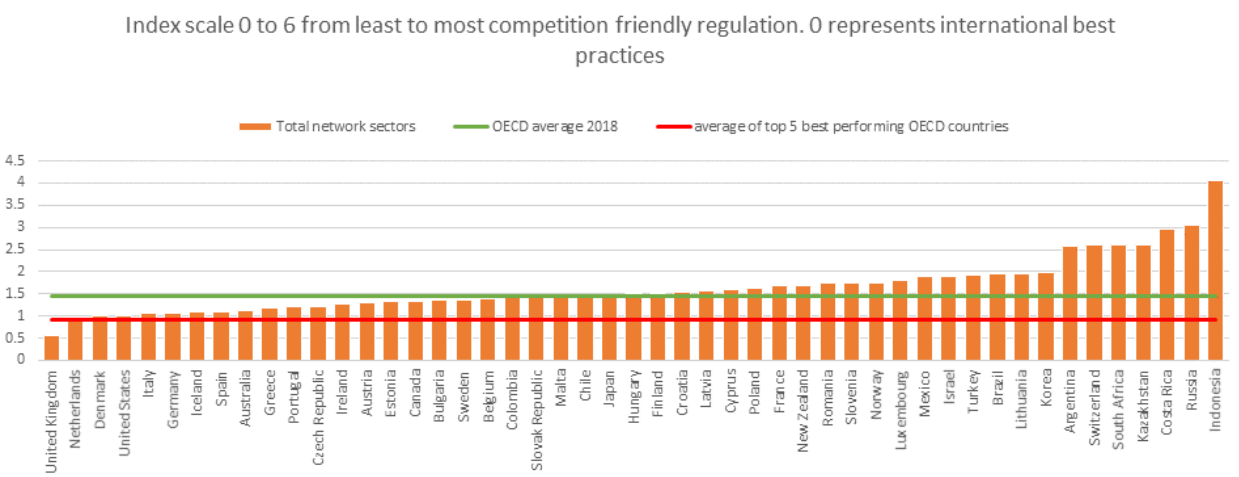
Regulatory barriers

38. A frequently used measure of regulatory barriers is the OECD Indicator of Product Market Regulation (the "PMR indicators").[5] Since 1998, both an 'economy-wide' PMR indicator as well as a group of PMR 'sector indicators' have been calculated every five years. The economy-wide indicator provides a

general quantitative measure of a country's regulatory stance across a variety of sectors and regulatory areas, while the sector indicators focus on regulation at the level of specific network and service industries (notably in energy, air and rail passenger transport, rail and road freight, telecommunications, professional services and retail distribution). The economy-wide PMR indicator is constructed as the average of two high-level indicators capturing two major ways that the economy is regulated: (i) through state involvement and (ii) through barriers to entry and expansion faced by domestic and foreign firms. Regulatory areas covered include, for instance, price controls, administrative barriers to entry for new entrants, and barriers to trade and investment

39. The data are derived from a survey of member countries and from other OECD databases (Vitale, Moiso and Wanner, 2020[28]) One of the key limitations, however, is that it does not take account of whether the regulations are enforced or not. Box 3.1 shows the 2018 PMR sector indicators for Network Sectors (energy, transport and e-communications) for OECD and some non-OECD economies.

Box 3.1. OECD PMR Sector Indicator for Network Sectors



Source: OECD PMR Indicators, https://www.oecd.org/economy/reform/indicators-of-product-market-regulation/#:~:text=The%20sector%20PMR%20indicators%20measure,professional%20services%2C%20and%20retail%20distribution.

40. Another measure of regulatory trade barriers is the OECD Service Trade Restrictiveness Index (STRI).[6] Obstacles to global trade can adversely impact competition, among other economy-wide impacts, when national trade and regulatory policies in individual service sectors are made with limited regard to their impacts.

41. The OECD STRI index measures services trade barriers in 22 sectors[7] across numerous countries including all OECD member countries. It is a measure of most-favoured-nation (MFN)[8] restrictions and does not take into account any specific concessions such as, for example regional trade agreements or mutual recognition agreements. The scoring and weighting system is applied to the STRI database, which contains factual information on laws and regulation.

42. The measures are grouped under the same five areas in all sectors: restriction on foreign entry, restrictions on the movement of people, other discriminatory measures, barriers to competition, and regulatory transparency (Grosso et al., 2015[29]). The key limitation is that the index does not take into account implementation of laws and regulations.

43. Another measure is the World Bank Doing Business score and ranking.[9] It measures aspects of business regulation affecting small domestic firms located in the largest business city of 190 economies.

It covers twelve areas of business regulation and ten areas[10] are included in the ease of doing business score and ease of doing business ranking. The ease of doing business ranking compares economies with one another, the ease of business scores benchmark economies with respect to regulatory best practice on each Doing Business indicator. When compared across years, the ease of doing business score shows how much the regulatory environment for local entrepreneurs in an economy has changed over time in absolute terms, whereas the ease of doing business ranking shows how much the regulatory environment has changed relative to that in other economies.

44. The World Bank Doing Business indicators are developed using standardised case scenarios with specific assumptions.[11] One key assumption is the location of the standardised business in the largest business city of the economy. The reality is that business regulation and their enforcement may differ within a country, particularly in federal states and large economies. Another key assumption underlying the Doing Business indicators is that entrepreneurs have knowledge of and comply with applicable regulation. In practice, this may not always be the case.

45. Overall, these measures of regulatory barriers are constructed with the aim to identify areas of potential regulatory reform by allowing comparability across economies and sectors with those with the most competition friendly regulation and comparability over time. The main limitation of these measures is that they do not take into account how such regulations are implemented in practice, and whether they are enforced.

3.1.3 Dynamic structural measures

46. In order to help interpret static structural measures of competition, it is important to combine them with dynamic measures. This is because in a well-functioning market, incumbents and new entrants will contest the position of other incumbents. In addition, new entrants may replace incumbent firms that exit. Therefore, a market that presents high levels of firm dynamism may be consistent with a high level of concentration. Thus dynamic measures provide information that go beyond to what static structural measures can provide. We follow to discuss some commonly used dynamic measures that focus on different elements of dynamism.

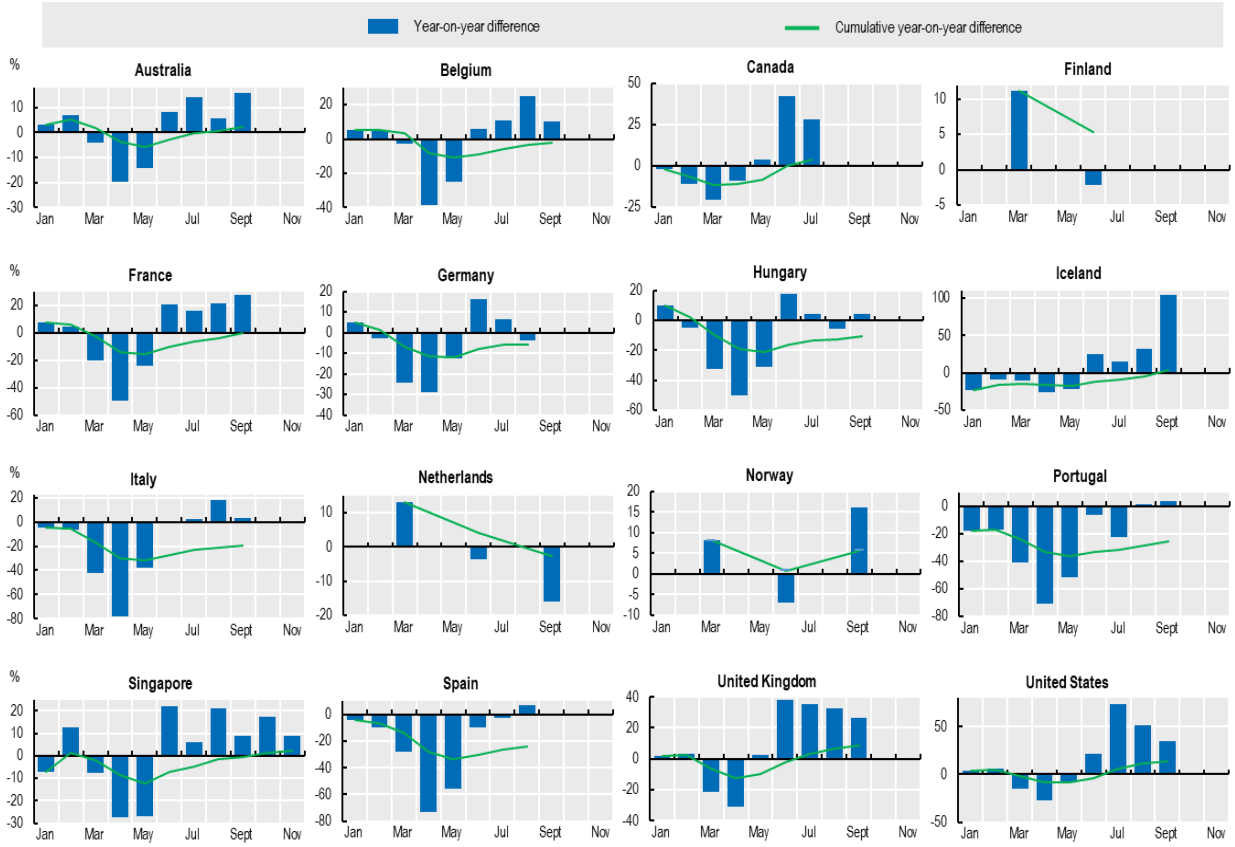
Entry and exit rates

47. Several studies look at the entry and exit of firms (Furman and Orszag, 2015[30]) (Valetti et al., 2017[31]). Entry and exit rates are the most commonly used dynamic measure. The entry rate is calculated by dividing the number of new firms in each year by the total number of active firms in that year. The exit rate is calculated likewise, using the number of exiting firms each year. This measure aims to capture the phenomenon that competition may attract new challenger firms to the market and force the exit of the least efficient producers. This is the selection effect of competition. From the view point of Schumpeter's creative destruction, high entry and exit would be a prerequisite for innovative and competitive markets. However, this is only part of the story.

48. The market mechanism may be at work without entry and exit when there is a strong rivalry among incumbent firms. In addition, high entry and exit rates do not necessarily indicate dynamism on the market. This would be the case when new entrants fail to challenge incumbent firms, and when the firms that exit are, in fact, recent new entrants rather than older incumbent firms. Moreover, entry and exit rates may not be a good proxy for dynamism in part of the market occupied by large firms. This is because entry and exit rates may mainly account for small firms' entry and exit. Finally, the exit of too many firms, particularly in a short period, may lead to an insufficient number of firms for the market to remain competitive. This is particularly the case when firms exit because of external factors such as financial crisis, and what could be the case because of the Covid-19 pandemic. Thus, some competition authorities are actively monitoring the number of companies created and closed during the Covid19-pandemic such as the CMA (2020[32]).

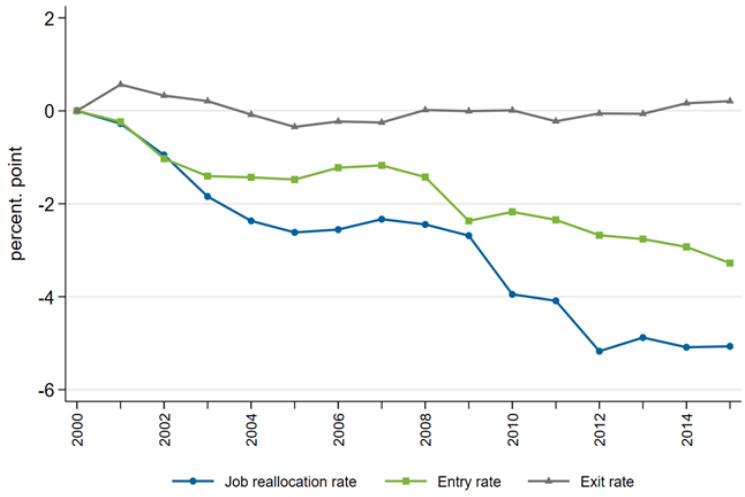
49. Figure 3.2 shows work by the OECD on business dynamism during the Covid-19 pandemic. The figure shows an overall drop in business registrations observed so far in several countries (OECD, 2021[33]). Although it is too early to tell what the full impact will be, the overall drop observed may exacerbate trends in declining dynamism observed across many OECD countries prior to the Covid-19 pandemic (Figure 3.3) (Calvino, Criscuolo and Verlhac, 2020[34]). Therefore, monitoring dynamic competition measures allows authorities to be vigilant to potential competition issues arising.

Figure 3.2. OECD: Aggregate business registration - differences 2020 vs. 2019



Note: some data are experimental and may differ from official statistics
Source: (OECD, 2021[33])

Figure 3.3. OECD: Average within country-sector trends on entry and exit rates



Source: (Calvino, Criscuolo and Verlhac, 2020[34])

50. Similar metrics to the entry and exit rate are the churn rate and the survival rate. The churn rate measures the number of firms entering and exiting the market relative to the total number of firms active in the market. The higher the churn rate, the more dynamic the market is likely to be, the lower the entry and exit barriers, and consequently the lower the probability of competition issues

51. The survival rate measures the number of firms that have been active for at least the last four years, in relation to the average existing number of firms for those years. The survival rate can serve as a proxy for entry and exit barriers. The absence of entrants and leavers (i.e. a survival rate of 1) suggests high barriers and impediments to effective competition. The survival and the churn rate are thus, to some extent, similar. An OECD Working Paper by McGowan, Andrews and Milllot (2017[35])analyses the survival rate of firms in OECD countries to assess if less-productive firms exit the market as typically would be the case in competitive markets.

52. Furthermore, a high survival rate can also imply repeated interaction among firms related to strategic decisions, when additionally the total number of firms is low. If, for instance, only a few firms have been consistently present in the market for the previous four years, that might suggest possible collusion, or at least mutual knowledge of the firms' strategic decisions

Average age of firms

53. Another dynamic measure is the change in mean firm age of larger firms from year to year. The size of the firm is measured by the number of employees. Although this metric is not commonly used, it is nevertheless worth mentioning as it focuses on a different element of dynamisms than entry and exit rates. The focus is on small firms. The expectation is that firms are likely to be small when they enter, and a large proportion of firms exiting are likely to be small also. Therefore, this measure aims to capture such an effect by measuring the extent to which the population of large firms changes over time.

54. In the absence of dynamism, there would be no change each year and the mean firm age would increase by 1 each year. A rate of increase lower than 1 would indicate new firms entering the population of large firms, older firms exiting, or a combination of both entry and exit effects.

Volatility of market share, concentration and rank

55. A range of different measures of volatility of concentration, market shares or rank can be used given data availability. Such measures are intended as an indicator of rivalry or competition more generally. In general, they are interpreted as the more volatile firms' market shares are, the less likelihood of competition issues. We describe here three commonly used measures.

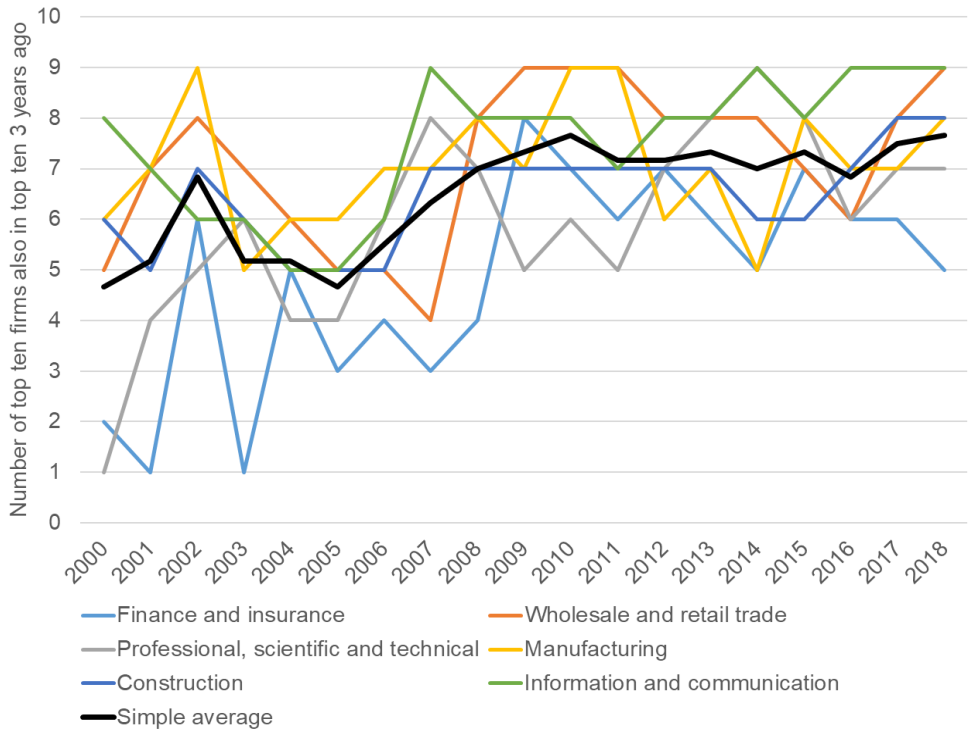
56. Market share stability is the average year-on-year change in market share. The average is calculated across firms and years. Changes may be measured in absolute or relative terms.[12]

57. Rank stability may be particularly interesting to analyse where there have been changes in the top firms in a market. This can be done by examining, for instance, the top five or top ten firms in each market by turnover, assessing for each year, the number of firms which were also in the top five or ten in the previous three or five years.

58. Figure 3.4 illustrates an application of the rank stability metric by the UK Competition Authority as part of the study on the state of competition in the UK economy (CMA, 2020[32]). The metric identifies the 10 largest firms in each sector of the economy, and counts the number of them that were also in the ten largest three years ago.

Figure 3.4. Application of the rank stability measure by the UK Competition Authority

Rank persistency in higher revenue sectors



Source: (CMA, 2020[32])

59. Concentration stability is another measure of volatility of concentration. It can be analysed by examining the coefficient of variation of the chosen concentration measure. This is a measure of variability and indicates the degree by which a variable varies across its average. In particular, the coefficient of

variation is defined as the ratio of the standard deviation to its mean. Other things being equal, the coefficient of variation is smaller the smaller the standard deviation.

60. A low value of the coefficient of variation is interpreted as an indicator of competition issues. This indicator has limitations, however. For example, the market shares of the three largest firms might have individually changed significantly over time though their aggregate share might have remained stable. This metric might therefore pick up markets with high market share volatility concealed by stable concentration ratios. In addition, a low value coefficient of variation may be determined by a very high concentration ratio. This metric therefore may practically pick-up the same markets as the analysis of concentration levels.

61. Overall, although concentration measures are open to criticism, these proxies have been often employed. However, it is important to be aware of the strong limitations of these indicators and to use dynamic structural measures to complement concentration measures. It may also be the case that the analysis of different dynamic measures can give contradicting results. When this contradiction arises, it indicates that dynamic indicators alone cannot give an answer on whether competition is improving or deteriorating. A detailed analysis of what dynamic metrics tell about individual, well-defined markets might be required.

Table 3.1. Summary: key advantages and limitations of structural measures

	Advantages	Limitations
Concentration measures	The main advantage of concentration measures are their simplicity. All that is needed to calculate them are firm-level revenue figures within reasonable defined markets.	Do not measure competition directly but the structural market outcome. Concentration arises because of competitive interactions of firms rather than determining the competitive interaction. Most methodologies rely on data gathered based on standard industry classification systems (SIC, NERA, etc.) and even the most granular codes are likely to be far broader than any product market. This makes it hard to draw direct conclusions about competition in a particular market. Turnover tends to be only available at national level, but geographic markets are not necessarily national and can instead be local or international. Concentration statistics, which only show the production of domestic firms will provide a misleading structure of the market where imports make up a material part of domestic consumption (the same applies where a large part of domestic output is exported)
Dynamic measures	Dynamic measures such as entry and exit rates contribute to interpret concentration measures. They provide an indication of firms dynamism, which is associated with healthy competition	Their key limitation is that the market mechanism may be at work without entry and/or when there is a strong rivalry among incumbent firms.

62. In what follows, we discuss measures of competition based on firm behaviour (or conduct). These are referred to as performance measures (or non-structural measures of competition).

3.2 Performance measures

63. In response to the deficiencies found in the structural approach, none-structural (or performance) measures of competition were developed by the New Empirical Industrial Organisation literature. These measures aim to directly assess the competitive conduct of firms. The most applied performance measures are mark-ups, profits, the Panzar and Rosse model, and the Boone indicator. Out of these

measures, the only measure based on the concept of competition as a process of rivalry is the Boone indicator. The other measures continue to be based on the static concept of competition although their focus is performance instead of structure. We describe each in turn.

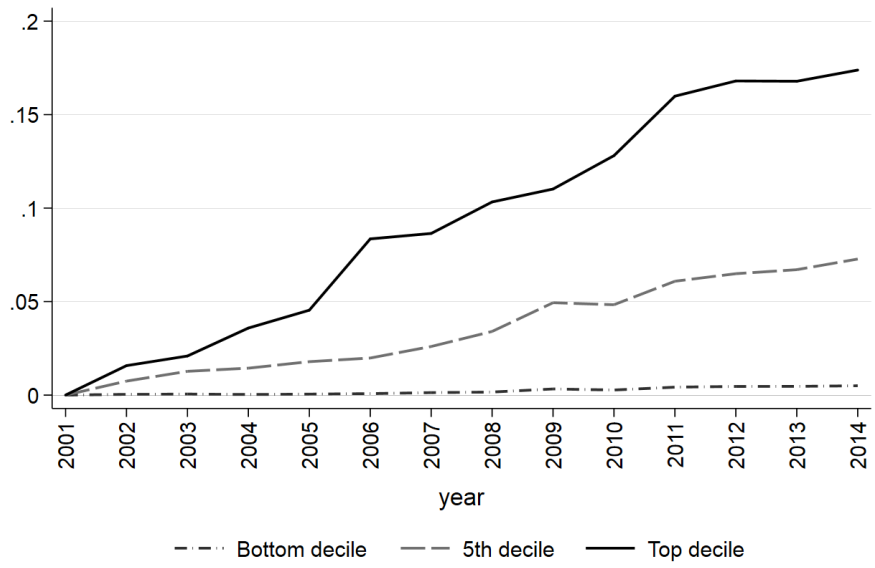
3.2.1 Mark-ups

64. Mark-ups measure the extent to which price exceeds marginal cost (or an approximation of marginal cost) as an indicator of market power. It reflects a firm's ability to set its prices above marginal costs. As competition increases, firms are forced to reduce their mark-up, the limit being perfect competition where prices equal marginal costs. Increases in mark-up mean that the Lerner index[13] by which competition authorities measure a firm's market power has increased. Hence, it provides a much better indication than changes in concentration on whether the competitive constraints upon a firm have weakened.

65. Firms' mark-ups are not observed directly, as data on marginal costs are not readily available and need to be estimated. Therefore, the literature largely relies on an alternative approach proposed by De Loecker and Warzynski (2012[36]). This approach is based on the assumption that if firms minimise their costs, then mark-ups can be estimated using information on the costs of an input as a share of firm's revenue, (the input costs revenue share), and the extent to which the firm's output varies based on changes in the quantity of that input used (i.e. the output elasticity).[14] Figure 3.5 illustrates an application by the OECD to analyse mark-ups in the digital era (Callagaris, Criscuolo and Marcolin, 2018[37])

Figure 3.5. OECD application of measuring mark-ups

Log-Mark-up growth over time (2001-2014) in different parts of the distribution



Note: Mark-ups are estimated using a Cobb-Douglas (Translog) production function. Mark-ups are estimated across 26 countries: Australia, Austria, Belgium, Bulgaria, Denmark, Estonia, France, Finland, Hungary, Germany, Indonesia, India, Ireland, Italy, Japan, Republic of Korea, Luxemburg, the Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, Turkey, US, and UK.
Source: (Callagaris, Criscuolo and Marcolin, 2018[37])

66. Mark-ups have the advantage of being a direct measure of market power and therefore can provide valuable information on how competition may have changed over time. However, they suffer from theoretical and practical limitations. In fact, they are a measure of market power and not a proxy of competition, which can be different. In other words, an increase of average market power over time can be consistent with an increase in the intensity of competition. Academic contributions also show that there are theoretically possible scenarios in which price-cost margins increase with more intense competition (Stiglitz, 1987[38]) (Stiglitz, 1989[39]) (Bullow and Klemperer, 2002[40]) (Amir, 2010[41]).

67. In addition, they present limitations related both to how to interpret trends, and the methodology and data used to estimate mark-ups. In terms of the methodology used to estimate mark-ups from accounting data, key limitations include:

- The choice of input used for estimation may have an impact on the estimated level and trends of mark-ups (Diaz, Fan and Villegas-Sánchez, 2019[42]) (Bond et al., 2020[43]).
- The methodology assumes that input markets are perfectly competitive and firms have no market power when purchasing inputs. If this is not the case, a firm's mark-up will be overestimated as it will capture a firm's market power in both the market in which it purchases inputs and the market in which it sells its products (Syverson, 2019[44]).
- Estimating output elasticities requires some assumptions on the form of the production function, and results may be sensitive to those assumptions (Raval, 2020[45]) (Bond et al., 2020[43]).

68. The observed mark-ups may also reflect two issues. The first one refers to the underlying trends in the cost structure of firms. The literature has only been able to estimate mark-ups based on short term marginal costs whereas the economic theory relies on long term marginal costs (i.e. there are no fixed costs in the long term). Therefore, mark-ups estimated in the literature do not take into account that to stay in business firms need to cover all of their costs in the long-term, including those that are fixed in the short term. This means that focusing only on mark-ups would not distinguish cases where increases in mark-ups are due to changes in the cost structure of firms (i.e. an increase in fixed costs) and not a reduction in competition.

69. The second issue refers to the extent to which firms are able to offer more differentiated products. Increased product differentiation makes consumers generally less price sensitive, allowing firms to sustain larger mark-ups, but could at the same time increase consumer surplus, if products match better consumer preferences. In this case, increases in mark-ups would reflect a trend towards a form of competition based on quality and differentiation, and less on price. This point is more likely to affect sectors that involve the manufacturing and distribution of consumer goods, or the provision of services to the end consumer.

70. The above issues mean that higher mark-ups may not result in a change in profits. Therefore, mark-ups do not necessarily coincide with increasing profits, and may instead reflect changes in technology and/or increased fixed costs. We therefore look next at measures of profits.

3.2.2 Profits

71. In a competitive market, firms would generally not be able to make more than the level of profit needed to justify keeping the capital employed by a firm (i.e. the 'normal' level of profits). Therefore, profits persistently above this level among a significant number of firms in a market may indicate problems with competition.

72. When looking at a market's profitability, high profits above the normal level might indicate that, overall, the market is characterised by low intensity of competition. However, there are several possible reasons as to why profits above the normal level might not be indicative of weak competition. For example, one firm may have higher profits than others, because it is more efficient or benefiting from past innovation or successful risk taking. At a market level, unexpected increases in demand or falls in costs can create a

temporary rise in profits and that again would not necessarily be indicative of weak competition in the market.

73. Similarly, low profitability does not necessarily mean that there competition is sufficient . After all, firms can face little or no competition, but have a low profitability because of their own inefficiencies. To address this risk, most studies focus on changes in profitability over time instead of absolute levels of profitability (Bessen, 2016[46]) (De Loecker, Eeckhout and Unger, 2020[12]) (Furman and Orszag, 2015[30]).

74. There are several limitations when assessing profitability which relate both to how to interpret trends, and the data used to estimate them. The first one refers to cyclical effects and macroeconomic shocks. These may affect profitability but are not necessarily related to changes in the intensity of competition. For example, a recession may lead to a short-term reduction in profits because of a sharp fall in demand. It could also lead to a long-term increase in profitability because exited firms have reduced the competitive pressure on remaining firms. Therefore, a long enough time-period of analysis is generally necessary to interpret profitability trends.

75. The second limitation refers to the use of accounting data. Profitability metrics that can be calculated using accounting data do not perfectly map to economic principles. In addition, accounting standards change over time, and firms registered in a country may have a large part of their business overseas. Therefore profitability may change because of changing accounting standards or be influenced by competition in overseas markets rather than because of a change of domestic competition.

76. Given these limitation, results cannot offer a conclusive view of the intensity of competition. However, they are informative, particularly when common trends are observed across other indicators of competition.

77. Having discussed the general advantages and limitations of profit measures, we follow to discuss in more detail the specifics of some commonly used profit measures when analysing competition. In particular, we discuss the return on capital employed and different return on sales measures.[15]

78. The return on capital employed (ROCE) is a commonly used profitability indicator. ROCE measures profitability by showing how successful a company is in using its capital to make profits. In other words, this indicator focuses on return relative to the total amount of capital employed in the firm. It is defined as earnings before interest and tax (EBIT) divided by total assets minus current liabilities. Low profit margins (EBIT – the numerator) or high levels of invested capital (assets minus current liabilities – the denominator) cause low values of the ROCE indicator, while the reverse is true for high ROCE. The appropriate benchmark for the ROCE indicator is the weighted average costs of capital (WACC) as it also focuses on the total capital invested in a firm (and it is often industry specific).

79. The return on sales measure (ROS) can be defined in several ways. In all cases, return figures will be expressed relative to the turnover (sales) of the firm. The following measures are commonly used:

- Operating profit margin: operating profit divided by total revenue.
- EBIT margin: earnings before interest and taxes divided by total revenue; and
- Net profit margins: net profits by total revenue.

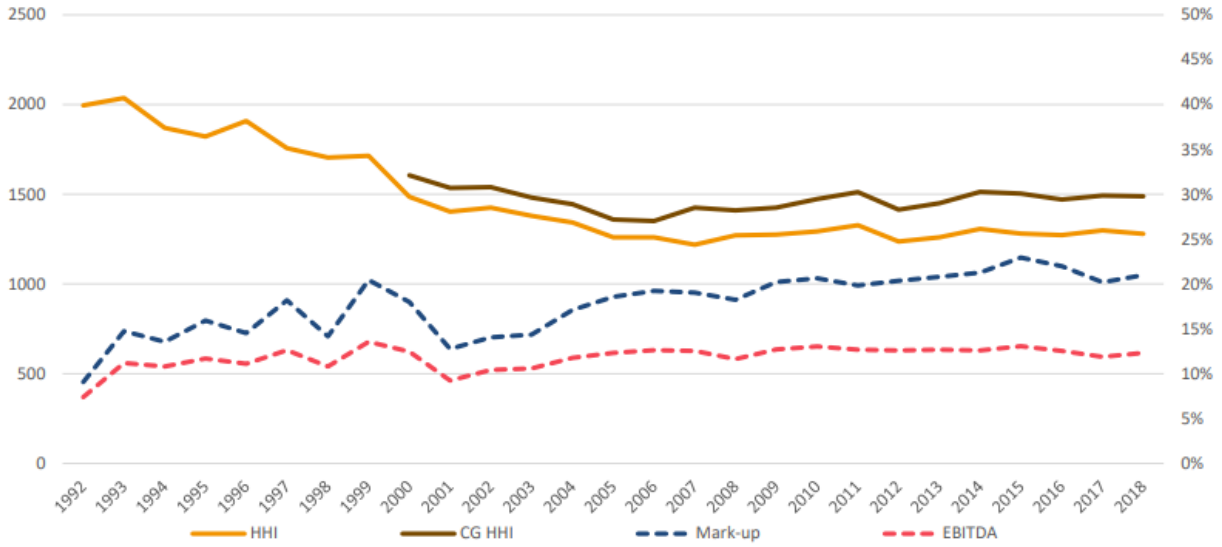
80. In contrast with the ROCE indicator, the ROS measures do not relate the amount of profit earned to the capital employed in the firm. ROS measures are a way of expressing profits but they do not have a normative value. Whereas a ROCE of 1% will often be regarded as low, and a ROCE of 40% regarded as high, ROS figures cannot be interpreted in that way. For capital intensive industries, even a ROS of 40% could be consistent with a competitive market; while for capital none-intensive industries a ROS of 5% could already suggest high levels of profitability. Therefore, ROS figures can only be used in a meaningful way for profitability comparisons of firms within a sector.

81. In addition, some difficulties may also arise within a particular sector. The reason is that the operating margin and EBIT measures take account of labour costs but do not take account of interest costs on capital. If a company in a sector embarks in a capital extensive expenditure programme, funded by issuing debt, and another company continues with a labour intensive business model, the more capital-intensive firm will report higher operating/EBIT margins even if there are no differences in the eventual profits and the intensity of competition.

82. Overall profits measures, although they cannot provide definite conclusions on the intensity of competition, they are valuable. In particularly, when common trends are observed across other indicators of competition. Figure 3.6 shows an application of profitability margin measures by the Norwegian Competition Authority (2019[16]). The figure also shows concentration measures.

Figure 3.6. An application of profit measures by the Norwegian Competition Authority

Concentration vs. profit margins in Norway



Note: Export industries are excluded
Source: (The Norwegian Competition Authority, 2019[16])

3.2.3 Comparison of firms' performance within industries

83. Here we discuss measures to assess the performance of firms within industries. We discuss the Panzar-Rosse model (based on the static concept of competition) and the Boone Indicator (based on the competition concept as a process of rivalry).

Panzar-Rosse model (the H-statistic)

84. The Panzar-Rosse model (Rosse and Panzar, 1977[47]) (Panzar and Rosse, 1982[48]) (Panzar and Rosse, 1987[49]), also referred to as the H-statistic, captures the transmission of input prices to firm's revenues. Weak transmission is taken to indicate an exercise of market power in pricing, while higher transmission values indicate more competition. The H-statistic is the sum of the elasticities of the total revenue of the firms with respect to their factor prices. It is worth stressing that the interpretation of the H-statistic requires that the sector be in a long-term equilibrium.

85. The intuition of the H-statistic is as follows. For a monopolist, marginal cost equals marginal revenue at the equilibrium. After input prices increase, marginal costs increase. To maintain the

equilibrium between marginal cost and marginal revenue, the monopolist should increase the marginal revenue by reducing the total quantity.[16] Rosse and Panzar (1977[47]) show that total revenue is reduced because of an increase in factor prices if the price elasticity of demand exceeds one. Intuitively, an increase in marginal cost reduces quantity but increases output price. If the demand elasticity exceeds one, the gain due to the price increase does not compensate for the loss due to the reduction in quantity.

86. By contrast, in a competitive setting, an increase in input prices induces an increase in total revenue. Because cost functions must be homogenous of a degree of one in the input prices, any increase in input prices generates an equal percentage increase in costs. A firm's revenue changes by the same percentage as the total cost, and so by the same percentage as its input prices to ensure the zero profit condition (total cost equals total revenue). The required adjustments in the total quantity are achieved by a reduction in the number of firms (long-term equilibrium). Consequently, an increase in 1 percent in input prices induces an increase of 1 percent in total revenue in competitive markets.

87. From this theoretical framework, the identification of competitive conditions is obtained by calculating the sum of elasticities of the revenue with respect to all input prices. The greater the transmission of cost changes into revenue changes, the more competitive the market is. Under perfect competition, input prices and total revenue increase by the same percentage and the H-statistic equals 1. It also equals 1 for a monopoly in a contestable market (free entry). The H-statistic is zero or negative for a monopoly. An increase in input prices induces a reduction of total revenue under certain assumptions (e.g. demand elasticity greater than 1). The H-statistic is not positive in the monopolistic competition equilibrium without a threat of entry or for a collusive oligopolist. The measure is between 0 and 1 for a monopolistic competitor.

88. The Panzar-Rosse model is relatively simple and does not impose stringent data requirements. Furthermore, it does not require a specific market definition. Nonetheless, this measure has several limitations. The major one concerns the econometric identification and the interpretation of the H-statistic. Theoretical studies report that the H-statistic can be negative in a competitive market and positive for a monopoly. A negative H-statistic can occur even in highly competitive condition in the short-term with a fixed number of firms (Shaffer, 1983[50]). In the case of constant average costs, (Shaffer and Spierdijk, 2013[51]) point out that the H-statistic can be positive in a highly uncompetitive setting. Furthermore, for firms facing constant elasticity of demand, higher values of the H-statistic do not necessarily imply lower market power (Shaffer, 1983[50]) (Panzar and Rosse, 1987[49])

89. Consequently, the interpretation of the value of the H-statistic is more complex than the original model predicts. In fact, the interpretation of the H-statistic depends on the assumptions made regarding market equilibrium, demand elasticity, and the cost function. In addition, the H-statistic is sensitive to monopsony power (inputs should be homogenous and their prices exogenously set). So monopsony power would tend to yield higher values of the H-Statistic and thereby mask any market power present on the output side (Shaffer, 2004[52]).

90. The performance measures discussed so far are based on standard oligopoly theory. Mark-ups assess pricing market power. The Panzar and Rosse model investigates how changes in input prices are transmitted to revenue. A major advantage of these approaches is that they allow differentiating between different situations (e.g. collusion, perfect competition, and imperfect competition (oligopoly). Nonetheless, these measures neglect dynamics in the market and none-pricing strategies. In the next section we discuss the Boone indicator which aims to consider the dynamics of the market.

The Boone indicator (or relative profit measure or profit elasticity)

91. The Boone indicator measure (Boone, 2008[53]), describes the relation between a firm's profit and its marginal costs. It is calculated as the percentage change in profits due to a one percent change in marginal costs (i.e. the elasticity of profits with respect to marginal costs). The main idea of the indicator is that intense competition enables efficient firms to earn relatively higher profits than less efficient

competitors. Thus, in a highly competitive market the elasticity of profits with respect to costs will be higher.[17]

92. The elasticity of profits to marginal costs was proposed by Boone (2008[53]) as a measure of competition. The author noticed that increases of competition associated with, for example, a fall in entry costs or an increase in pressure imposed upon competitors, were always associated with a transfer of profits from less efficient firms towards more efficient ones. Based on this, the author presented an alternative competition indicator with several theoretical and empirical advantages relative to the traditional competition indicators based on market profitability and concentration. First, the Boone indicator is monotonic in competition under the assumptions of product homogeneity, firms' symmetry (except on marginal costs), constant marginal costs, and simultaneous and independent choice of the strategic variable. Nevertheless, under predatory pricing, collusion and first mover's advantage, this result does not necessarily hold. Secondly the indicator does not require that the full universe of firms is observed (i.e. the estimated profit transfer among a subset of firms conveys the information for the market). Thirdly, it tends to be less sensitive to the business cycle than mark-ups.

93. The main limitation of the Boone Indicator is its need for a measure of efficiency (marginal costs) that is unobservable in the data, its dependency on the definition of the relevant market, its sensitivity to the sample of firms and estimation methodologies used, and the non-existence of an upper bound. Only these last two limitations do not also apply to the traditional (or classical) competition indicators discussed in this paper.

94. In addition, the Boone indicator focuses on one important relationship affected by competition, disregarding others. Efficiency gains may not translate into lower prices or higher profits in the shorter-term. For instance, a firm may invest these gains (developing new products) in order to cope with competition in the future. These distortions are more likely when the Boone indicator is assessed year by year rather than in estimations covering the full sample period. Differences in terms of quality, design and innovation are more or less similar among firms over the longer term. The Boone indicator model assumes that efficiency should be one dimensional and observable. Using costs is the simplest way to capture differences in efficiency. However, in markets where suppliers offer heterogeneous goods, changes in costs may merely reflect changes in strategies. In response to competitive pressure, firms may adopt strategies to cope with competition (offering well-designed products, targeting new customers, etc.) instead of reducing prices. In such cases, firms offering the most highly demanded products may not yield more profit but spend more. The relationship between marginal costs and performance turns positive (Florian, 2015[54]).

95. Comparisons of profit elasticity levels across markets must be made with caution because they reflect not only competition intensity but also features such as returns to scale, product quality, brand loyalty and firm reputation.

96. Table 3.2 summarises the characteristics of the H-statistic and the Boone indicator, and Figure 3.7 illustrates an application of both of these measures by the Bank of England (de-Ramon and Straughan, 2016[55])

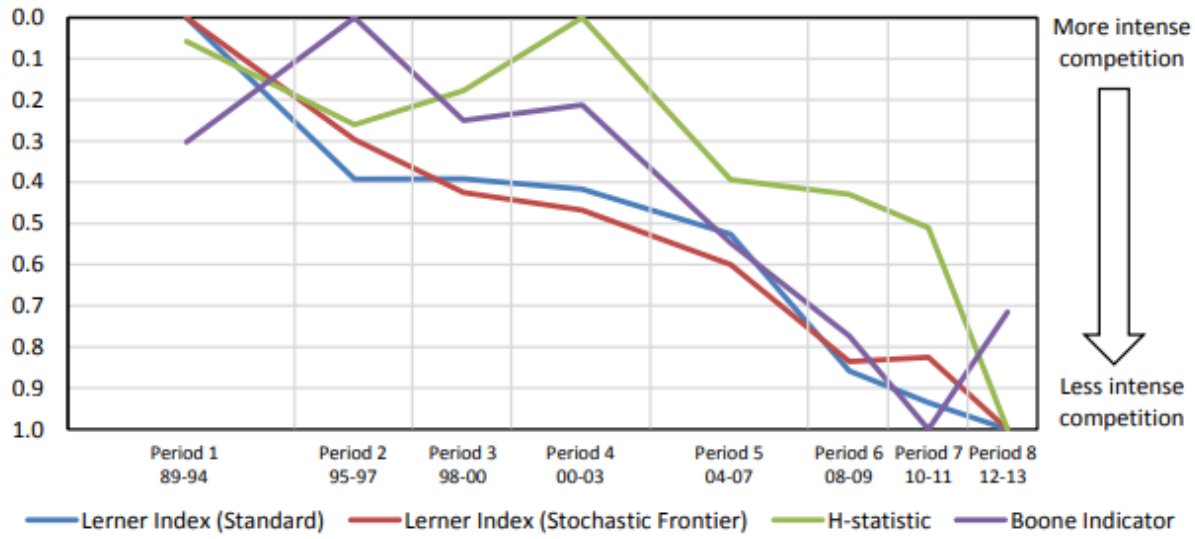
Table 3.2. Characteristics of the H-statistic and the Boone indicator.

Measure	Theoretical range	Value at perfect competition	Direction indicating increasing intensity of competition	Concept underpinning perfect competition outcome
H-statistic	0 to 1	1	↑	Full pass through of costs to revenue
Boone indicator	$-\infty$ to 1	$-\infty$	↓	Output relocated to more efficient firms

Notes:
[1] The H-statistic can take negative values for a pure monopoly but for practical purposes when estimating it, it is bound between 0 and 1.
[2] Under perfect competition, the elasticity of profit to costs is negative infinite as any increase in costs drives firms to exit the market. In practice, estimates of the Boone indicator will be negative, with values approaching zero as competition intensity increases.

Figure 3.7. Application of the H-statistic and the Boone indicator in the UK deposit-taking sector

Combined measures of competition: Lerner Index, H-Statistic, and Boone Indicator



Notes:
[1] Periods are derived from the Panzar-Rosse H-statistic stability test used for calculating the long-run equilibrium sub-periods
[2] Measures are normalised such that zero corresponds to the most competition intensity and one the least competition intensity for each measure
Source: (de-Ramon and Straughan, 2016[55])

97. Finally, we draw out the key advantages and limitations of the performance measures discussed in this section in Table 3.3.

Table 3.3. Summary: key advantages and limitations of performance measures

	Advantages	Limitations
Mark-ups	Direct measure of market power	An increase in market power might be consistent with an increase in the intensity of competition. Mark-ups do not distinguish cases where increases in mark-ups are due to increases in fixed costs and not a reduction of competition Increases in mark-ups could reflect a trend towards a form of competition based on quality and differentiation and less on price.
Profits	Persistently high profits among a significant number of firms in a market may indicate problems with competition.	High profits may not be indicative of weak competition. At firm level, it may be due to higher efficiency, and at market level due to cyclical or macroeconomic shocks. Low profits do not necessarily mean there is healthy competition given the possibility of inefficient firms. Profitability metrics calculated with accounting data do not perfectly map to economic principles. Also accounting principles may change over time, and firms registered in one country may have a large part of their

	Advantages	Limitations
		business overseas.
H-Statistic	Captures the transmission of input prices to firm's revenues. Higher transmission values indicate more competition. Does not require to define the market	The interpretation of the -statistic is complex. It depends on the assumptions made regarding market equilibrium, demand elasticity, and the cost functions. The H-statistic is sensitive to monopsony power
Boone indicator	Measures the elasticity of profits with respect to marginal costs. It aims to capture the dynamics in the market based on the idea that intense competition enables efficient firms to earn relatively higher profits than inefficient firms. Less sensitive to business cycles than mark-ups	Sensitivity to the sample of firms and estimation methodologies used. It focuses on one important relationship affected by competition (efficiency), disregarding others Using costs is the simplest way to capture differences in efficiency. However, in markets with heterogeneous goods, changes in costs may just reflect changes in strategies. Conclusions are more reliable if focused on the ranking of market elasticities instead of actual levels of the elasticities.

3.3 Consumer and business survey measures

98. Assessing consumers' and business' perceptions on how well markets are delivering outcomes can provide useful indirect evidence on whether competition is working well. Ultimately, competition is a means to achieve good consumer outcomes. However, it would be naïve to consider that consumers (or business) can judge whether what they perceive as a good market outcome results from effective competition. Their perceptions could also be due to unrelated factors. Nevertheless, survey evidence showing poor outcomes is often indicative of a problem in competition, consumer protection, or both. Therefore, survey evidence can still provide a useful starting point for further investigation.

99. There are important limitations with survey indicators. For example, when consumers are asked questions about how often they have had a complaint, or how much they are satisfied with their supplier, the answer tends to be specific to one aspect of the performance of the market. Responses are likely to be context specific, suffer from post-rationalisation, and the sample of consumers may not be the same over time. Thus, competition authorities are generally cautious when interpreting such metrics and tend to focus instead on broader trends.

100. It is important to note that when competition authorities analyse competition in a specific market through a market study or a market investigation, they would normally commission in-depth surveys specifically targeted to the theories of harm explored as part of the study or investigation. However, when assessing the intensity of competition at industry or economy level, it would not be practical for competition authorities to take such a detailed approach. In these cases, competition authorities might analyse relevant available survey evidence that looks at industries over time and across countries to assess consumers and business perceptions of competition. A good example of consumer survey evidence of this kind is the European Commission Consumer Market Scoreboard[18] described in Box 3.2.

Box 3.2. The EU Consumer Markets Scoreboard

The EU Consumer Markets Scoreboard monitors how consumers in the EU, Iceland and Norway assess the performance of key metrics for consumer goods and services. Market performance is assessed through the following five components.

- Comparability - How easy/difficult is it to compare offers?
- Trust – Do consumers trust that retailers/suppliers comply with consumer laws?
- Problems and detriment – Proportion of consumers who encountered problems and extent of harm (including but not limited to financial loss).
- Expectations – Does a given market live up to consumers' expectations?
- Choice – Are consumers satisfied with the number of retailers/suppliers in the market?

The consumer experience is also monitored through questions on complaints and switching (in selected markets).

These five components are analysed and aggregated to create a composite index (0 – 100) which indicates how well a given market performs – The Market Performance Indicator (MPI). The higher the score, the better the market performs as experienced by consumers.

The five components are mostly given equal importance by consumers when asked to rate their level of importance by market and so are given equal weight in the composite score. Such an approach enables for comparison across sectors and over time making it a valuable source of data.

The main source of data for the Scoreboard is the Market Monitoring Survey. This is a survey of consumers 'experiences and perceptions on the functioning of consumer markets. The survey is carried out among consumers who recently purchased good and services in the assessed markets. Most of the data underpinning the Consumer Market Scoreboard is accessible to everyone

Source: EU Consumer Markets Scoreboard (2018), https://ec.europa.eu/info/sites/info/files/consumer-markets-scoreboard-2018_en_0.pdf; EU Market Monitoring Survey data, https://ec.europa.eu/info/policies/consumers/consumer-protection/evidence-based-consumer-policy/consumer-scoreboards_en#dissemination-database

101. Typical consumer survey indicators of competition include:

- the degree of choice,
- the level of shopping around,
- the level of switching,
- consumer complaints, and
- the level of satisfaction or trust in a market or sector.

102. However, these metrics are not without limitations. For example, choice is generally considered a good outcome of competition but too much choice can lead to confusion and impair consumers' decision-making. This is referred to as choice overload, a cognitive impediment in which people face difficulties making a choice when faced with many options. Therefore, consumers perceiving they have sufficient choice in a particular market does not necessarily indicate that competition is working well. A perceived lack of choice, however, is a useful starting point for further investigation.

103. It is also not an easy task to establish what is the optimal level of shopping around and switching, which is likely to differ across markets. Generally, one would expect shopping around and switching rates

to be higher in markets where there is low product differentiation or there is the possibility of price discrimination relative to markets where this is not the case. A lack of shopping around and switching may also represent that the consumer is satisfied with the product and the provider or it could also be indicative that the consumer perceives high search or switching costs. So careful interpretation is required.

104. In a similar vein, consumers reporting a high level of satisfaction and trust may or may not indicate competition is working well. This will be particularly the case in markets where it is difficult for the consumer to assess the quality of the product or service purchased. This is typically the case in credence goods[19] markets.

105. In relation to business survey indicators, these may include barriers to expansion, innovation, and firms' perception of competition in the market they operate. These indicators have clear limitations in terms of selection bias, incentives to miss-report, and risks of capturing other factors that are not related to competition.

106. Both consumer and business survey indicators can nevertheless be helpful complementary competition indicators to other metrics explored in this note on the intensity of competition. They help to give a fuller picture of the competitive dynamics at play.

Table 3.4. Summary: key advantages and limitations of consumer and business survey measures

	Advantages	Limitations
Survey measures	Provide useful indirect evidence on whether competition is working well Complementary indicators to other competition measures to give a fuller picture of competition	Answers may suffer from being context-specific, post-rationalisation, selection bias, incentives to mis-report, and risks of capturing other factors not related to competition. Values in levels may be difficult to interpret and therefore focus tends to be on broad trends.

3.4 Other measures

107. We have discussed the different types of competition measures commonly used in empirical studies measuring the intensity of competition. For completeness, we briefly mention here other competition measures used in some studies such as price, productivity, and innovation measures. We also acknowledge other more miscellaneous measures.

Price

108. Prices can be used to identify sectors that may present low competition levels. The hypothesis being that increasing prices may reflect competition is not working well. Price studies include different methodologies such as international price comparison, price concentration measures, and sectoral price trends. However, the methodologies present limitations that make price measures not as usable as the other types measures discussed in this paper. For example, international price comparison limitations relate to issues with product comparability, exchange rate fluctuations, taxation, and cost differences across countries.

109. Price concentration studies, which examine the relationship between price and concentration, need to consider other factors that affect price, such as local differences in costs.[20] In addition, the implementation of an analysis of price concentration raise a number of practical issues such as the appropriate measure of concentration, the homogeneity of the product compared across regions, and whether to use prices or mark-ups.

110. Sectoral price trends, such as analysis of the average annual growth of producer prices per sector, has the principal draw back that there are alternative explanations that may justify an increase that is not indicative of a reduction of the intensity of competition. For example, specific costs increases in a sector (e.g. regulation, rent, fuel); or an increase in quality of the good sold.

Productivity

111. There is empirical evidence that links competitive markets with firms being more productive than their counterparts in uncompetitive markets are.[21] However, it is not the case that productive firms only exist in competitive markets. There may well be some highly efficient firms operating in relatively uncompetitive markets. Nevertheless, using productivity as an indicator of competition has value. Finding industries with relatively low levels of productivity (as compared to other industries or the same industry in other countries) would not allow to conclude that sufficient competition is lacking, but rather highlight the need for a close look at the industry.

112. Perhaps, the most simple productivity measure is the Labour Productivity (LP). This can be defined as output per worker. This indicator aims to capture the extent to which firms are able to convert man-power into value through the products sold. It can be calculated as the sales value by the total number of employees' hours, or the value-added by the total number of employees' hours.

113. If the LP indicator is low, this is indicative of competition not working well. It is important to consider whether an industry has been subject to a shock as this will reduce the level of productivity in the short term until firms exit or recover. In addition, high value of sales may be the result of efficient firms, or a firm with market power. Productivity indicators cannot discriminate between these two effects. This can only be done by combining productivity indicators with other indicators such as concentration or profitability measures.

114. Another measure of productivity is the Total Factor Productivity (TFP). This measure aims to capture how efficient an industry converts all of its inputs into outputs. It does so by calculating the elasticity of outputs with respect to capital or labour. If the TFP score is high then this implies a firm is able to generate a great value from its inputs. The empirical evidence suggests that this is more likely to occur in competitive markets where firms are actively striving to improve their position. A low TFP value on the other hand, would be compatible with reduced levels of competition in the market.

115. Many of the terms in the calculation of TFC can be difficult to capture. Nickell (1996[56])provides clear guidance on the variables required.

Innovation

116. Following from productivity measures, innovation is one of the key drivers of productivity growth. Innovation can lead to new products and to a more efficient production of existing products.

117. Empirical indicators of innovation include the R&D expenditure to sales ratio. This is the most widely used measure. The OECD[22] collects data on R&D expenditure across sectors and countries regularly. Although data on R&D expenditure is available by both sector and country, one cannot make reliable conclusions on whether competition is working well based on R&D expenditure comparisons between different sectors. R&D expenditures will inherently show substantial differences between sectors, since innovation is more important in some sectors than in others. Moreover, R&D expenditure is only one input into the innovative process. Other inputs include product design, market analysis, trial production, etc. In view of this, studies tend to focus on international comparisons of R&D expenditure in a given sector.

118. Another indicator is the number of patents relative to sales. This can be regarded as an intermediate indicator of innovation. It is the result of, among other things, the R&D expenditure and can

be regarded as one of the outputs of the innovative activity of a firm. However, since not all patents are in practice put into use, the number of patents cannot be regarded as a final output measure of innovation.

119. The use of patent data as indicator of innovation is subject to a number of limitations. These include that not all innovation results in patents, the fact that the propensity to patent may differ between industries and the fact that not all patterns are equally significant. These limitations have important implications for comparison across industries but they appear to be less serious for comparison across countries.

Miscellaneous measures

120. There are other more miscellaneous measures that capture important market characteristics but generally, they are not considered systematically in studies to measure the intensity of competition. This is because it is likely to be impractical to construct indicators that would capture all market characteristics across sectors and that could be evaluated for further investigation. Such measures relate to characteristics such as multimarket contacts,[23] spare capacity,[24] buyer power,[25] bidding markets,[26] the presence of maverick firms,[27] and the existence of trade associations.[28] However, that is not to say that they are not relevant when assessing certain competition issues in certain markets.

4 Key issues to consider when measuring market competition

121. Analysis using competition measures can be helpful at identifying patterns and trends in competition. However, given the described limitations in terms of data, methodologies, and interpretation of the different competition measures outlined in the previous section, we here discuss key issues to consider when using such empirical measures to infer the intensity of competition in a market. This section draws on the recent discussion held at the OECD Workshop on Methodologies to Measure Market Competition (2021[57]).

4.1 The need for a plurality of competition measures

122. While some may prefer one measure over another, there is no consensus on the best measure to infer the intensity of competition. In addition, the different indicators of market competition do not necessarily provide the same inferences about competition. Therefore, the choice of indicator influences conclusions regarding competition. The choice of method thus involves trade-offs. The usefulness of the different approaches hinges on data availability, the concept of competition assumed, and the questions of competition being addressed.

123. For instance, in 2018, the OECD held a session on market concentration (OECD, 2018[58]) where the above mentioned issues with concentration measures were discussed. While it was acknowledged that competition agencies do form a preliminary assessment of the strength of competition in a given market using market concentration, which is an imperfect indicator, this is done with caution. Given the ambiguous relationship between structure and the intensity of competition in a market, making inferences on the intensity of market competition requires looking at other measures to assess if they these align with the concentration indicators.

124. It is important to remember that market competition can take different forms because firms can use several strategic variables (e.g. price, product quality, brand, etc.). Given the wide range of channels at play, there is not a unique indicator of competition that can unequivocally detect changes in competition intensity. Therefore, the safest approach is to use a plurality of different measures. Ideally, one should use a combination of measures covering both sides of each the following dichotomies (Davies, 2021[59])

- Structural or performance
- Static or dynamic
- Firm or industry data
- Inter-industry or intra-industry comparisons

125. To illustrate the need for a combination of competition measures along the four above dichotomies, Box 4.1 summarises the measures used by the UK Competition and Market Authority in its recent study of the UK state of competition (CMA, 2020[32]). In the study, a combination of competition measures were used to analyse the likely trend of competition over time. In addition, a series of metrics were used to

assess the likely impact of the pandemic on competition. The metrics included business formation and closure during the pandemic as well as survey measures on consumers and business experiences during this time.

Box 4.1. CMA study on the UK state of competition

Competition measures

In February 2020, the Chancellor of the Exchequer and the Secretary of State for Business, Energy, and Industrial Strategy asked the Competition and Markets Authority (CMA) to prepare and publish a state of competition report to raise the collective understanding of the level of, and the trends in, competition across the UK economy.

The main objective of this work was to better measure and understand the state of competition in the UK. This was considered important due to the direct benefits to individual consumers and the economy as a whole from competition. It was also considered especially important given the need to support the recovery in the UK economy following the coronavirus (COVID-19) pandemic.

The CMA acknowledged that there is no one metric of the level of competition. Instead, their analysis would be based on a range of metrics covering the UK economy, including:

- concentration – the structure of industries and the extent to which industry turnover is taken by the largest firms;
- indicators of dynamic competition – the rates of business entry and exit, and the stability of the positions of the largest firms in the economy;
- profitability and mark-ups – the levels of UK businesses' profits, the mark-ups of prices over costs charged by businesses and the distribution of profits among businesses;
- profit and mark-up persistence – how likely the most profitable businesses are to remain the most profitable businesses;
- consumer surveys – broad measures such as trust in and satisfaction with consumer markets;
- high frequency data on business formation and closure during the pandemic; and
- data on consumer and business experiences during the pandemic.

Overall, the CMA finds that all the measures of competition considered deteriorated during the recession in 2008 to 2009. The recovery in most measures since that recession was only partial and did not lead to a return to where they were before. The CMA interprets these findings to mean that even though some recent trends in the years prior to the pandemic have been positive, there is a need to be vigilant in protecting and promoting competition. This is especially the case considering the current economic context, which may lead to further deterioration in competition.

Source: (CMA, 2020[32])

126. Individually, each of the measures provides only a limited amount of information, but together they can provide useful information to get a fuller understanding of the trends in competition.

127. Given the limitations of each indicator, such analysis cannot (and should not) be interpreted as a definitive set of conclusions on the intensity of competition across an economy or individual sectors. Moreover, this type of analysis is not intended to replicate (or replace) the analysis competition authorities would undertake in exercising their statutory powers.

4.2 The level of data aggregation

128. One of the key issues with measuring market competition is that the data readily available risks not being fit for purpose. Nearly all studies employ data that is more aggregated than is ideal to measure competition, which takes place in finely defined antitrust markets.

129. These studies use mainly two types data. The first type is Industry level data from official sources. This type of data is used to define industries at the 4, 5, or at best 6 digit NAEC/SIC[29] levels of, equivalent, 6 digit NAICS.[30] For example, Philipson's (2019[60]) disaggregates the manufacturing sector into 360 NAICS level 6 industries; The Economist's (2016[61]) disaggregated the economy down to 893 NAICS level 6 industries; the UK CMA's (2020[32]) uses SIC data on 615 4-digit industries; and DG COMP (cross Europe concentration) disaggregates down to just 156 ISIC categories.

130. Normally, the relevant antitrust markets are more finely differentiated than 4-6 digit codes and therefore each code is composed of many relevant markets[31]. Therefore, even if, using such data showed that there was a high concentration and profitability at the 4 or 6 digit level, without additional data at a finer level it is not possible to determine which particular markets this arises from.

131. In addition, as NAEC/SIC or NAICS codes typically consist of a large number of relevant markets, problem markets may be missed through aggregation and averaging problems. For example, assume a simplistic situation for illustrative purposes: there are 10 relevant markets within an industry digit code and in each one different firms have a 100% market share. Then, at that industry digit-code level, the concentration ratio C3 would be 30% even though this in fact represents 10 monopolies.

132. A separate way in which markets may be missed is through averaging results across relevant markets. For example, assume the industry digit-code consists of two markets, one of which is highly profitable and the other which is severely loss making, but average profitability at the level of the industry digit-code level is normal. As a result, the highly profitable market will be hidden. Problems of similar nature would also apply to a number of other competition measures using industry data.

133. While aggregation issues are inevitable, given the data available, the challenges these present run the risk that the data is not fit for purpose – competition occurs between firms in finely defined antitrust markets.

134. For example, Werden (1998[62]) considered the divergence of SIC industries from anti-trust market using evidence from price fixing cartel cases. In order to do this he constructs a rough measure of the validity of SIC industries – the Commerce Quotients (CQ). The QC measures the size of the antitrust market as a share of the aggregate SIC industry to which it belongs (size measured by turnover). The ideal value of this measure for SIC to be a valid measure of an antitrust market is 1%. However, his study showed that in 52 of a sample of 80 cartels in the US the CQ was significantly less than 1%. He also analysed merger cases where the study found that in 17 of 47 merger cases the CQ was less 1%, and in only 14 was CQ was more than 14%. In 2018, a similar study was carried out (Werden and Froed, 2018[63]). It found that 32 of 44 mergers cases analysed in the US had a CQ of less 1%. These results are indicative that SIC industries are much broader than anti-trust markets.

135. More recently, Alfred et al. (2021[64]) construct a database of 2 000 EC mergers (1995-2014) and find that these mergers covered 20 000 product/geographic antitrust markets This study finds that the typical antitrust market is far more concentrated than the typical SIC industry. Alfred et al. (2021[64]) report a typical HHI is 3 000 (with a standard deviation of 2 000). This is 10 times greater than the typical HHI reported in most studies of SIC industries. One could argue that this result in itself is unsurprising and what is important is whether the HHI observed at the SIC level is representative (albeit scaled up) of concentration in its constituent anti-trust markets. This we do not currently know. Davies (2021[59]) argues that what matters is how homogenous are antitrust markets within SIC industries, and how diversified firms are across those markets.

136. The second type of data is company-level databases reporting financial information such as profits, value added, investment for the aggregate firm or its broad divisions. The issue here is that large firms will be typically diversified in different economic activities and some will operate multinationally. Aggregation across different areas (economic activities and geographic location) presents analogous issues as those discussed above.

4.3 The need to take account of the dynamic aspects of competitive rivalry

137. We have discussed the limitations of using aggregate measures such as measures of structure and profitability at the industry level. Here we discuss the need also to move beyond static comparisons of firms within the industry at a point in time.

138. Competition is a dynamic process. A never-ending flow of firms growing and failing, and maybe growing again. Competition implies a range of actions aimed at ensuring the realisation of choices of a given firm while restraining at the same time the sphere of actions of its rivals. In other words, competition involves a dynamic process of rivalry between firms. This includes rivalry in prices, in improved techniques of production or products, in R&D, etc.

139. Therefore looking at static measures of competition may give a misleading picture of the intensity of competition. For instance, high concentration and profits may indicate a weakening of competition, but it could alternatively be the outcome of a process of intense competition (i.e. the survival of the fittest) leading to a few very efficient firms earning high profits. To help assess which of the two hypotheses is more likely, one needs to delve deeper into the market by also considering dynamic measures of competition.

140. The Boone indicator (see section 3.2.3) was developed with the objective of capturing the dynamics of the market rather than focusing on static analysis. Applications of this measure have included Joae Amador and Ana Cristina Soares (2013[65]) who analyse competition in the Portuguese economy; Sebastian Jose de Ramon and Michael Straghan (2016[55])who analyse competition in the UK deposit-taking sector, and the Netherland Competition Authority (2021) which assessed the intensity of competition in banking.

141. When comparing the Boone indicator with more traditional indicators such as HHI and PCM, the competition assessment is not always consistent across measures in the literature. This may be explained by the intrinsic nature of the indicators. An increase in competition may lead to reallocation and selection effects. These are not captured by traditional indicators such as HHI and PCM. This is likely to be an important reason for the partial divergence between indicators.

142. Other dynamic measures include measures of firms dynamism such as entry and exit rates, churn, average age of firms; the stability of the positions of the largest firms (volatility of firm's market share); and the likelihood the most profitable firms remain the most profitable over time (profit and mark-up persistency).

143. However, the stability of market shares and persistent profits by a few firms may be due to repeated success in innovating and distinguishing themselves from their rivals and/or cutting costs and improving their productivity. Autor et al. (2017[66]) describe this as the superstar firm hypothesis. This situation is not uncommon in pharmaceutical markets where firms often manage to string together pipelines of new treatments that each give rise to their own period of temporary market power. The development of such superstar firms may result in the increase in profits, mark-ups and concentration that does not appear to deteriorate over time (persistency) and would be consistent with there being an intense on-going competition to obtain the next extension of temporary market power.

4.4 The importance of imports, exports and multinational firms

144. Most studies construct competition measures on a national basis. The implicit assumption is that the geographical market is the national economy. However, in reality the relevant geographic market may be narrower (e.g. regional or local market) or wider (e.g. global markets)).

145. Where geographic markets are narrower, the problem faced is that, through considering competition measures computed at national, problem markets may be missed through the aggregation and averaging problems. By contrast, where geographic markets are wider than the national economy, the competitive measures may give a false positive, suggesting that there is a problem when there is none. For example, where concentration measures relative to the national economy are high, concentration measured at supranational, the European level for instance, may be lower. Similarly, an industry with a low churn at the national level may be more dynamic when considering entry and exit on a European level.

146. This is particularly important at a time when recent studies show that top firms command a disproportionate share of sales and wealth. For instance, the Economist (2016[61]) showed that 10% of the world's public companies generated 80% of all profits, and the share of GDP generated by the Fortune 100 biggest US firms rose from about 33% of GDP in 1994 to 46% in 2013. A large number of papers have documented that, since the 1990's, the fraction of sales accrued by the top firms and other concentration measures has risen in most US sectors (Autor et al., 2017[66]) (Rossi-Hansberg, Sarte and Trachter, 2018[67]). International evidence also indicated that the concentration measures have risen in most OECD countries (Callagaris, Criscuolo and Marcolin, 2018[37]). These findings have raised serious concerns that the growth of these firms may be synonymous with lower intensity of competition (De Loecker and Eeckhout, 2018[11]).

147. Using US data, Bonfiglioli, Crino and Gancia (2019[68]) investigate the concentration of import sales by country at the origin. Their results show that among foreign firms selling to the US, the concentration of sales has remained stable by origin of country, but has fallen when pooling firms from all origins. The authors interpret this result as suggesting that intensified competition in international markets can coexist with growing concentration among national producers. This result suggests a more benign view, according to which national concentration and international competition coexist. Global competition may force unproductive firms to exit and top firms to consolidate on their best products (Melitz, Mayer and Ottaviano, 2014[69]).

148. However, these results also show that firms are growing more and more unequal at the firm level, which can potentially have adverse effects on labour market outcomes and the distribution of income. Some possible explanations for this widespread trend may include changes in innovation strategies (Perla and Tonetti, 2019); rises in earnings dispersion between workers due to increasing dispersion in average wages paid by the employers of these individuals (Song et al., 2019[70]); or the uneven adoption of automation technologies (Acemoglu, Lelarge and Restrepo, 2020[71]) (Hubmer and Restreto, 2021[72]). Therefore, a better understanding through further research on what might be the causes would be required before firmly concluding about changes in the intensity of competition.

5 The use of competition measures by competition authorities

149. There are broadly three reasons why competition authorities measure market competition. The first one is to apply competition law in markets affected by mergers and potential abuse of dominance (competition enforcement). The second reason is to assess whether pro-competitive intervention is needed and whether such intervention is likely to be net beneficial (competition advocacy). The third reason is to assess ex-post the effectiveness of competition policy of an authority. Each purpose will influence which measures of competition are likely to be most appropriate and their usefulness. We discuss each of the different purposes in turn.

5.1 Competition enforcement

150. When measuring competition in enforcement cases (mergers and abuse of dominance), broadly speaking competition authorities assess whether there is a "significant lessening of competition", a "significant impediment to effective competition" or an "adverse effect on competition". The competition measures used are case by case specific, depending on the market characteristics and the data availability. To illustrate this point, Table 5.1 provides examples of case investigations presented by DG COMP (OECD, 2021[57])describing the dimension of competition of interest in the particular case and the resulting competition measures used.

Table 5.1. Measures of competition used in enforcement cases

Dimension of competition	Measures of competition used	Examples
Market concentration	Market shares of merging parties, market share increment HHI levels before and after the merger, HHI delta, C4	Siemens/Alstom, Ball/Rexam
Market contestability	Number of remaining competitors Market shares of main competitors/importers Bidding market (Y/N) Import/turnover	Heidelberg/Cemex CR H3G/O2 IE GE/Alstom Outokumpu/Inoxum
Price/Profits	Margin/mark-up evolution and comparison across agents	Wieland/Aurubis
Entry barriers	Capital investments/turnover R&D Spending/turnover Market entry/exit	Telefónica/E-Plus DE Dow/Dupont DEMB/Mondelēz, Ryanair/Aer Lingus
Countervailing buyer power	Share of sales to main customers Switching behaviour of customers	WD/Viviti Praxair/Linde
Risk of collusion	Number of competitors Price transparency Symmetry of market shares	ABF/GBI ABInBev/SAB Miller H3G/Wind IT
Stage in product cycle	Changes in production capacity (investment) Changes in sales/turnover	Ineos/Solvay

Source: DG COMP, Application of Measures of Market Competition, OECD Workshop on Methodologies to Measure Market Competition (OECD, 2021[57])

151. It is important to note that when a competition authority conducts analysis of competition indicators as part of an enforcement case, this analysis may be more detailed than it otherwise would. For example, when investigating profitability, a competition authority would generally undertake a detailed analysis of the appropriate adjustments that need to be made to the accounting data to estimate economic profits. However, this level of detail analysis would probably not be practical or realistic when, for example, analysing trends in profitability across industries.

Prioritisation

152. Faced with budget constraints, competition authorities cannot monitor every market or sector. From this perspective, some competition authorities have used competition indicators to develop tools for detecting sectors where the probability of finding competition problems is higher than in other sectors. These tools, commonly known as screening tools, aim to help competition authorities prioritise their efforts within the authority's principles-based prioritisation policy.[32]

153. In relation to competition enforcement, economic tools have been developed to detect cartels. Such tools are designed to analyse observable economic data and information on various market characteristics, data on costs, prices, market share, etc. and flag markets which may either have been affected by collusion, or which may be more susceptible to collusions. Results from cartel screening are only intended to be a signalling tool of markets worthy of further review.

154. Screens are subject to a number of limitations. Some of them are intrinsic to the nature of screens (e.g. they generally do not provide actual evidence of cartelisation, and they generally do not distinguish tacit from explicit collusion). Others important limitations relate to the resources and skills required to run screening programmes on a regular basis. Access to data and information also represent a serious challenge to screening in situations where reliable data are not easily accessible. Because of these limitations and the success of leniency programmes, many competition agencies do not implement systematic empirical screening programmes (OECD, 2013[73]) (OECD, 2018[74]). Box 5.2 summarises the experience in cartel screening of the Netherlands and the UK Competition Authorities.

Box 5.1. Cartel screening – Experience of the Netherland and UK competition authorities

The Economic Detection Instrument of the Netherland Competition Authority (the Competition Index)

The Economic Detection Instrument of the Netherland Competition Authority (the Competition Index - CI) (Petit, 2012[75]) uses competition indicators described in this note to identify sectors at risk of cartel behaviour. The methodology used is the structural type. The measures used include the number of trade associations, prices (NL vs. EU), concentration (HHI, number of firms and import rate); and market dynamics (market growth, churn rate, survival rate, and R&D). The CI evaluates industries on the basis of public data and it assigns to every industry a score indicative of the likelihood of being affected by collusion through a weighting scheme. Industries that score high on the CI may be considered worthy of further scrutiny by the NMa. The results of the CI were tested against detected cartels in other countries, which revealed a high degree of overlap. In addition, a statistical comparison of the CI with other measures of competition such as the price-cost margin and the Boone indicator was conducted, resulting in signs of weak but significant correlation.

One of the main criticisms of the approach is the lack of alignment of industry classifications with antitrust markets. One of the main advantages of the CI methodology is that the entire economy is under scrutiny and it is easy to apply, requiring little capital and labour input.

The UK Office of Fair Trading (OFT) methodology for predicting cartels

The UK Office of Fair Trading (OFT) also commissioned several projects to gain knowledge of possible uses of measures of competition in competition enforcement. Following a study (OFT, 2004[76])) on the use of possible competition indicators for the identification of market problems, Grant and Sonderegger (OFT, 2005[77]) developed a detailed methodology aimed at predicting cartels. The dataset was of structural characteristics identified as potentially relevant for cartel formation/stability. The methodology had two steps. The first step used regression analysis and existing EU/US evidence on detected cartels to identify structural characteristics that seem important for the formation of (formerly workable) cartels. The second step used the analysis form the first step to predict the probability of cartels in sectors where they had not previously been identified. The analysis found, on the one hand, that cartel likelihood increased with total turnover, growth in turnover per firm, C3 concentration ratios, and per employee costs. On the other hand, cartel likelihood decreased with variability per firm growth and economies of scale.

Similarly to the Dutch experience, the methodology has been subject to similar criticisms because of the lack of alignment of industry classification with anti-trust markets, and the difficulty in distinguishing between explicit and tacit collusion. The UK authority recognised that while structural factors can contribute to predict the incidence of cartels in an industry, the method is not a perfect science. A better approach is a combination of approaches including consumers and competitors' complaints, and in some cases internal research.

Source: (Petit, 2012[75]) (OFT, 2004[76]) (OFT, 2005[77])

5.2 Competition Advocacy

155. The analysis of competition measures at industry or economy level can provide useful information in terms of the patterns and trends to inform an authority's competition advocacy priorities but also to support competition advocacy initiatives. Such an analysis can potentially help identify industries where an authority may need to be vigilant, identify areas for further work, or potential candidates for market studies.

156. Several competition authorities have carried out one-off studies of the trends in competition in their economies recently such as the UK (CMA, 2020[32]), New Zealand (2019[78]), and Norway (2019[16]). In terms of implementing such analysis on an on-going basis, the Romanian Competition Council (RCC) developed an analytical instrument to measure the propensity of competition of industries in the economy in 2013 (OECD, 2021[57]). The tool does not measure (or intents) the actual degree of competition on those industries. The tool, called the Aggregate Index of Competitive Pressure (AICP), ranks industries from the worst situation in terms of competition to the most favourable situation. The index continues to be produced today and published every year as part of the RCC's annual report. It is also used internally for market monitoring and externally to support advocacy efforts.

157. It is worth noting, that given the number of limitations already discussed with individual competition indicators to reliably identify problematic markets, a combination procedure aggregating the results of a number of indicators into a composite index inherits the problems of the individual indicators. This should be borne in mind when considering whether to develop a composite index and when interpreting the results of such index.[33]

158. The combination of measures chosen by different authorities differ depending on data availability and methodology used. However, they all aim to capture, to the extent that is feasible, the different dimensions of competition. Box 5.3 summarises the experience and challenges faced by the Norwegian and the New Zealand Competition Authorities when measuring the intensity of competition.

Box 5.2. Measuring the intensity of competition: the experience of the Norwegian and the New Zealand Competition Authorities

The Norwegian Competition Authority's experience (2019[16])

The analysis focuses on the development in market shares and profitability in Norwegian industries for the period 1992 to 2018. It uses accounting data of all limited companies and ownership data collected from the notes of the companies' financial statements, and cover the entire accounting dataset. The data set covers 137 industries, half of the gross product of the private sector in Norway.

It uses two different types of measures:

- Concentration measures: HHI, corporate adjusted – HHI, and Modified-HHI in an attempt to capture common minority ownership of companies.
- Profitability measures: operating margin, EBITA-margin, return on assets (ROA), and mark-ups.

The key challenges identified by the Authority include:

- The level of data aggregation (industry vs. relevant market).
- The importance of using a dataset including small companies (vs. listed companies only).
- Aggregation of several industries due to a change in relative weights affecting the trends.
- Excluding export industries

The Commerce Commission of New Zealand's experience *(2019[78])*

To measure competition in a given industry, four competition indicators were computed: profit elasticity, price-cost margin, the HHI, and the concentration ratio of the 20 top firms (CR20). These indicators were applied to a 30-industry dataset over the time-period 2001-2016.

The key challenges identified by the Commission include:

- Different indicators can give different indications of the degree of, and changes in, competition in an industry.
- Industry classifications do not typically correspond with anti-trust markets.
- Marginal costs are difficult to compute in practice.
- Margin indicators do not account for fixed costs, which can play an important role in competition (e.g. barriers to entry)

Prioritisation

159. A few authorities have looked at the feasibility of using competition measures to select markets, which may be failing for market studies. For example, the UK Office of Fair Trading (OFT) in 2004 attempted to develop a holistic data intensive methodology using publicly available data to identify sectors that have characteristics that would suggest competition concerns are likely to arise (OFT, 2004[76]). Further work in 2007 developed thinking on the use of sector productivity indicators, to be used alongside other competition indicators such as market shares and levels of firms' entry and exit (OFT, 2007[79]), this has been further developed by the (CMA, 2015[80]). Box 5.4. Summarises the UK approach and experience with market screening tools.

Box 5.3. The UK experience with market screening tools

Empirical Indicators for Market Investigations (OFT, 2004[76])

This was an analysis of economy-wide data sets in an attempt to identify sectors that have characteristics that could suggest suitability for the use of competition and consumer protection tools. The methodology was based on 4-digit standard industry classification (SIC) and involved four steps:

- Step 1: collects data on 32 empirical indicators of problems in markets, groups into 8 categories (barriers to entry, productivity, concentration, profitability, prices, consumer complaints, innovation, switching costs, and others). Then it considers the worst ranked sectors in respect to each indicator.
- Step 2: where possible (for the 8 groups of indicators), it applied weights to gain a weighted average indicator and considered the worst 15 sectors on this basis.
- Step 3: it adds back 3-5 worst sectors key non-included indicators (complaints, advertising-to-sales ratio, innovation).
- Step 4: considered the 26 sectors thus identified in more detail.

Significant data and methodology issues were identified that made the results had to interpret. These included:

- The level of aggregation of the data at 4-digit SIC can still be too wide/narrow than markets. In addition, firms active across more than one SIC code have all their information allocated to a single primary SIC code.
- Significant data gaps and not all the data was collected based on SIC sectors, which made it difficult to translate.
- Any weighting was subjective.

Productivity and Competition (OFT, 2007[79])

The methodology was based on 4-digit standard industry classification (SIC) and it involved three steps:

- Step 1: calculate the growth in labour productivity and total factor productivity for the UK and the EU
- Step 2: calculate the following competition measures for UK: market share variance, entry and exit, persistency, productivity dispersion.
- Step 3: identify candidate sectors on the basis of differences in productivity growth between the UK and the EU, and difference in productivity growth through time.

Similar concerns regarding data and methodology as before.

Productivity and Competition (CMA, 2015, p. 34[80])

The greater availability of firms-level micro-data in the UK in recent years has reduced some of the previous difficulties of obtaining sufficiently disaggregated measures. As a result, the CMA announced in 2015 that it was beginning to carry out analysis on firm-level data to produce disaggregated sectoral indicators, and although work was at an early stage, it may be able to use it as part of its prioritisation decisions.

160. The analytical exercises described above have highlighted the conceptual and practical difficulties of basing prioritisation decisions solely on indicators. However, they have also shown the potential value

when used in combination with different forms of intelligence such as direct evidence of harm, consumer complaints or public concern.

161. Overall, it may be unrealistic to expect a mechanistic tool to do more than provide useful information on market dynamics. Wider intelligence remains crucial. That said the data and the measures of competition created are potentially useful to competition authorities as part of prioritisation work for thinking about the relative strengths of possible candidates for further scrutiny and for supporting advocacy initiatives.

5.3 Ex-post evaluation of competition policy

162. Some competition authorities have also used the analysis of competition measures at industry and economy level to inform the debate around the fitness of competition policy[34]. For example, the Norwegian Competition Authority recently commissioned a study focused on market concentration and profit margins at industry level for the last 25 years (2019[16]). They found a slight reduction in concentration levels and that profit margins had been fairly stable over the period. These findings are in marked contrast to the US, where studies have shown an increase in both concentration levels and profit margins. The results in the US have been used by some to question the fitness of competition policy more broadly. As a result, the Norwegian Competition Authority decided to initiate this study. In addition, during the OECD Workshop on Methodologies to Measure Market Competition (OECD, 2021[57]) several jurisdictions discussed the potential use of measuring competition at the industry and economy level as a way to (imperfectly) assess their performance.

163. Measuring the economic effects of competition policy on competition can contribute to defend its legitimacy and this issue has received increased interest in the last few years as concerns about weakening competition have increased and the effectiveness of competition policy[35] has been questioned. However, the analysis of competition policy on competition at the sector or economy level requires measures of the strength of competition policy as well as competition measures such as those discussed on Section 3.

164. There are few studies assessing the link between the strength of competition policy and competition. Most of the empirical literature either analyses the effects of competition policy on macroeconomic performance directly (e.g. productivity) or measures the impact of competition on drivers of growth such as mark-ups, entry'/exit and innovation. Further academic research linking the impact of competition policy on competition, although challenging, could contribute to the empirical debate on the effects of competition policy on competition. (See DG COMP (2015[81]) for a review of the literature on this topic)

6 Conclusion

165. The measurement of competition is not straightforward. Competition is a complex concept and not directly observable. Over the years, this has resulted in the development of numerous methods to capture and measure the degree of competition. This paper has described the most commonly used measures and analysed their theoretical underpinning as well as their advantages and limitations. The following key conclusions emerge from such analysis.

166. Individually, each measure of competition provides only limited information, but together they can provide useful information to help build a better understanding of the intensity of competition. Therefore, the safest approach is to use a plurality of different measures. Ideally, one should use a combination of measures covering structure and performance; static and dynamic measures, firm and industry data; and inter-industry and intra-industry comparison.

167. It is important to consider the level of data aggregation when interpreting results. Ant-trust markets are more finely defined than industry level data from official sources can provide. While aggregation issues might be unavoidable, given the data available, there is a risk the data might not be fit for purpose. Therefore, care should be taken when interpreting the results.

168. In a similar vein, most studies construct competition measures on a national basis. The implicit assumption is that the geographical market is the national economy. However, in reality the relevant geographic market may be narrower (e.g. regional) or wider (global). In relation to the latter, one should consider the importance of imports, exports and multinational firms.

169. A final key consideration when measuring market competition is the dynamic aspects of competitive rivalry, as competition is a dynamic process. Therefore looking at static measures of competition may give a misleading picture of the intensity of competition.

170. Overall, given the data and methodological limitations when measuring the intensity of competition, the analysis of such measures cannot (and should not) be interpreted as providing a definite set of conclusions on the intensity of competition. Moreover, analysis using competition indicators is not intended to replicate (or replace) the analysis competition authorities undertake to exercise their statutory powers. However, it can provide useful information for identifying areas where competition authorities may want to do further research and/or be more vigilant.

171. Competition authorities who may want to consider developing further their market screening intelligence using a combination of competition indicators could start with markets defined during casework. Subsequently, this can be extended to include other important markets, particularly as firm-level data becomes more available. This could allow an authority to obtain a more reliable view on how a market is evolving and hence identify where there could be problems, or alternatively myth-bust when indicators suggest problems are absent in well-defined markets.

Endnotes

[1] We acknowledge, however, that these two concepts can arguably be thought of not being fully distinct at their origins. Vickers (1995[82]) argues that the claim that there are two concepts of competition is somewhat misleading. The notion of perfect competition had its roots in the broad concept of competition as rivalry. Whether or not it is sensible to assume perfect competition depends on the questions that one wants to address. Perfect competition (including competitive equilibrium) models are extremely helpful for analysing many economic issues, but they are not suitable (or intended for) thinking about others. In particular, questions about the competitive process and their effects on productive and dynamic efficiency require other approaches.

[2] For instance, multimarket contracts raise incentive for collusion by changing the relative costs and benefits of co-operation (Bernheim and Whinston, 1990[85]).

[3] For a discussion on barriers to exit in competition see (OECD, 2019[88])

[4] Sunk costs are investments that are fully committed to the market once made. A firm cannot recover these if it exits a market. Sunk costs are often confused with fixed costs, but the two are not necessarily the same. Fixed costs are costs that do not vary with the level of output but some of them may be recoverable by ceasing production and selling or redeploying the related assets. Selling or redeployment are not options with sunk costs.

[5] For further information on the OECD PMR indicators and underlying data see https://www.oecd.org/economy/reform/indicators-of-product-market-regulation/

[6] For the latest OECD STRI index statistics, see https://stats.oecd.org/Index.aspx?DataSetCode=STRI

[7] The sectors measured by the OECD STRI index are accounting, air transport, architecture, commercial banking, computer services, construction, couriers, distribution, engineering, insurance, legal, logistics, maritime transport, motion picture, rail freight, sound recording, telecommunications, television and broadcasting.

[8] An MFN clause requires a country to provide any concessions, privileges, or immunities granted to one country in a trade agreement to all other World Trade Organisation member countries. In international trade, MFN treatment is synonymous with non-discriminatory trade policy by ensuring equal treatment among all WTO member countries.

[9] For detail information, data and the latest analysis see https://www.doingbusiness.org/en/doingbusiness

[10] The ten business arears are: starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders,

enforcing contracts, and resolving insolvencies. Each business area is measures with a number of indicators, totalling 41 indicators of Doing Business.

[11] Data collection are based on a detail reading of domestic laws, regulations and administrative requirements as well as their implementation in practice as experienced by the firms. The data are collected through several round of communication with expert respondents (both price sector practitioners and government officials) through responses to questionnaires, conference calls, written correspondence, and visits.

[12] With measures in absolute terms a change from 50% to 60% market share counts as a 10% change. With measures in relative terms the same change in market share counts as a 20% change.

[13] The Lerner Index is a measure of market power. It measures the price-cost marging and it is calculated as the difference between the output price of a firm and the marginal cost divided by the output price. The Lerner Index lies between zero (perfpect comkpetition where prices equal marginal costs) and one (strong market power where prices are above marginal costs).

[14] The input must be a variable input, and this is referred to as the elasticity of output to a variable input. This is measures as the percentage change in output resulting from a change in the quantity of input used.

[15] Other accounting ratios used as proxies for profitability are the Return on Invested Capital (ROIC), Returns on Assets (ROA) or Return on Equity (ROE). They are similar proxies of profitability that differ in the denominator.

[16] This assumes marginal revenue is a decreasing function of quantity.

[17] The empirical implementation of the profit elasticity indicator involves estimating the slope of the relationship between profits and a measure of efficiency for firms in the relevant market in each year. The first methodology is non-parametric and consists in computing the frontier between profits and efficiency using Data Envelope Analysis. The second methodology is parametric and relies on regression to the estimate the relation between profits and efficiency. The non-parametric approach may be a better choice in markets with a reduced number of players, where regression-based methods may turn out to be relatively weak due to the reduced number of degrees of freedom. Conversely, non-parametric methods face converge problems for several markets and years, hindering their practical usefulness.

[18] https://ec.europa.eu/info/sites/info/files/consumer-markets-scoreboard-2018_en_0.pdf

[19] These are goods and services where the consumer cannot assess the quality of the product even after purchase. A typical example is insurance where the consumer will not be able to experience the quality of the product until a claim is made.

[20] In more sophisticated price-concentration studies, these factors can be controlled by performing a multiple regression with the other relevant variables affecting price added to concentration.

[21] For a helpful review of the empirical evidence between competition and productivity see (CMA, 2015[80])

[22] See https://www.oecd.org/innovation/inno/anberdanalyticalbusinessenterpriseresearchanddevelopmentdatabase.htm

[23] Multimarket contract can facilitate collusion. The first difficulty in establishing multimarket contract is that the main empirical finding relates to geographical separation. However, the data generally available is too

aggregated. Given that, the key effect of multimarket contract is that it can facilitate higher prices in each of the markets individually; indicators such as high profits may therefore identify situations where multimarket contract is leading to consumer detriment.

[24] The effect of the extent and distribution of spare capacity for firm's pricing behaviour is not straightforward. On the one hand, where firms hold spare capacity they will have strong unilateral incentives to reduce prices to fill that capacity. On the other hand, the existence of spare capacity, particularly when distributed systematically, may promote co-ordinated behaviour. There is also a relationship between spare capacity and entry deterrence. The existence of spare capacity enables incumbent firms to threaten to increase supply and lower price in the event of entry, which may deter potential entrants if they are aware of the existence of the spare capacity.

[25] Buyer power can act as a countervailing force to seller-power. However, the exercise of buyer power by a firm (or a group of firms) against their suppliers may result in prices that are too low. The obvious proxy would be concentration on the buyer side of the market, measures for example with the HII measure.

[26] In bidding markets, sales are made through a tender process. Typically, the firm that supplied the tender will supply the entire tender, and the other firms will supply nothing. These type of markets have very different characteristics from standard markets in which firms post prices and consumer chose amongst the suppliers. In particular, competition may be intense with only a very limited number of suppliers. An indicator that merely registers whether a market took the form of a tender process would be of very limited use. In general, competition in bidding markets is more likely to be intense where tenders are large, infrequent lt placed and there is a degree of confidentiality as to the outcome of the tender.

[27] Mavericks are firms actively engaged in competition and seeking to grow their market share at the expense of their competitors. For this reason, mavericks are typically firms of below average size. The pressure of such maverick firms would break a cartel and can induce competitive behaviour. One way by which mavericks can be identified is to see which firms are actively engaging in market expansion activities more than proportionally to their size. This could be identified by a firm's marketing budget or selling budget, or potentially easier, by the ration advertisement spend to sales, for example. If this ratio is high for a small firm, as compared to a large firm, then it would suggest that the firms is behaving as a maverick.

[28] There are a number of legitimate purposes for the existence of trade associations such as providing a forum for self-regulation and quality control. Nevertheless, they might facilitate collusion between existing industry players and the exclusion of new players.

[29] The statistical classification of economic activities on the European Community (NACE) and the Standard Industry Classification (SIC) established in the US but also used by other countries, classify industries up to four digit codes. These codes categorise companies by their source of activity. The SIC system is no longer being maintained by the federal government in the US. However, SIC codes still appear some databases.

[30] The North America Industry Classification system (NAICS), which replaced the SIC system, contains up to 6-digit codes classification system. The longer the code, the more narrowly defined the industry.

[31] Some examples of 6 digit code NAICS are: 011901 Pea and bean farms (legumes); 011902 Feeder grains; 011903 Oil grains; 011904 Cereal crop farms; 011999 Cash grains

[32] Prioritisation policies are generally based on a series of principles. Such principles depend on factors such as the individual country-specific legal and institutional characteristics and available resources. There

is no one-size-fits-all design of a prioritisation policy. Some common principles, however, include the impact on the economy, the potential scale of harm, and whether it is a government priority sector.

[33] Competition authorities currently considering developing a similar composite competition index include the Ukraine and their Competitive Environment Monitoring Index, and Morocco's project to establish a National Barometer of Competition.

[34] The term competition policy is used to refer to competition legislation covering the prohibition of cartel and abuse of dominants positions and the control of mergers.

[35] Measures of the strength of competition policy include variables measuring whether an antitrust regime is in place or not, variables measuring human and budget resources employed by CA's, variables related to the quality of competition laws; survey results on the perceived effectiveness of competition policy and variables describing the interventions made by the CA's.

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