Competition Bureau Canada
Bureau de la concurrence Canada
Canada

COMPETITION IN CANADA FROM 2000 TO 2020:

AN ECONOMY AT A CROSSROADS

This publication is not a legal document. It is intended to provide general information and is provided for convenience. To learn more, please refer to the full text of the Acts or contact the Competition Bureau.

For information on the Competition Bureau's activities, please contact:

Information Centre
Competition Bureau
50 Victoria Street
Gatineau QC K1A 0C9

Telephone: 819 997 4282
Telephone (toll-free in Canada): 1 800 348 5358
TTY (for hearing impaired): 1 866 694 8389
Fax: 819 997 0324
Website: www.competitionbureau.gc.ca

This publication can be made available in alternative formats upon request. Contact the Competition Bureau's Information Centre at the numbers listed above.

ISED Citizen Services Centre
Innovation, Science and Economic Development Canada
C.D. Howe Building
235 Queen Street
Ottawa, ON K1A 0H5
Canada

Telephone (toll-free in Canada): 1 800 328 6189
Telephone (international): 613 954 5031
TTY (for hearing impaired): 1 866 694 8389
Business hours: 8:30 a.m. to 5:00 p.m. (Eastern Time)
Email: ISED@ised-isde.gc.ca

Cat. No. Iu54-125/2023E-PDF
ISBN 978-0-660-68103-0

Date: 2023-10-19

Aussi offert en français sous le titre : *La concurrence au Canada de 2000 à 2020 : Une économie à la croisée des chemins.*

Table of Contents

Executive summary

THE COMPETITION BUREAU'S ROLE IS TO PROTECT AND PROMOTE COMPETITION TO BENEFIT CANADIAN CONSUMERS AND BUSINESSES. COMPETITION DRIVES ECONOMIC GROWTH. IT ENCOURAGES BUSINESSES TO INNOVATE AND BECOME MORE PRODUCTIVE. IT BENEFITS CONSUMERS BECAUSE IT LOWERS PRICES, INCREASES CHOICE AND IMPROVES QUALITY.

When businesses operate in a healthy competitive market, consumers get to choose the best option available to meet their needs and price point. Fair competition means that businesses must make a strong case to consumers that their products or services are the best choice. This leads to more, and better, products and services that meet the diverse range of consumer tastes.

As the enforcer of Canada's competition laws, the Bureau has collected extensive knowledge about the dynamics of competition in important sectors and markets. However, the purpose of this research project is not to study any particular sector or market. Instead, we wanted to get a broader view of competition in the economy as a whole.
In this report we present the findings of this research. Our objective was to examine:

- the general state of competition across the Canadian economy
- how competition in Canada has evolved from 2000 to 2020

HOW WE GATHERED OUR INFORMATION

To understand how the state of competition has changed, we used data on Canadian firms to compute several indicators that are often used to measure competition. These indicators, or measures, help us understand how the industries that firms compete within are structured and how firms perform as a result of competition.

Recent studies on the evolution of competition have largely focused on other countries. Studies in Canada have focused mainly on specific industries or on a smaller group of firms. Our project used data from Statistics Canada that tracks all firms that file taxes in Canada. This data gave us a more complete view of how competition in Canada has evolved from 2000 to 2020.

The Bureau conducted this research project with the assistance of Dr. Matthew Osborne of the University of Toronto and his team of research assistants.

WHAT WE LEARNED

We found that Canada's competitive intensity has decreased from 2000 to 2020. Competitive intensity describes how hard businesses feel they need to work to gain an advantage over their rivals. The result is that both consumers and businesses have seen fewer of the benefits that greater competition offers.

The indicators we measured give us reason to be concerned about how competition evolved between 2000 and 2020. Here are some of our key findings:

1. Concentration rose in the most concentrated industries

Concentration is a common way to measure competition. It tells us about the relative size of firms in an industry. An industry is highly concentrated when a few large firms earn a large share of revenues compared to smaller firms.

We were especially interested in looking at industries where concentration was already high. We found that the most concentrated industries saw an increase in concentration.

We also found that the number of industries that are highly concentrated has increased.

2. Top firms are less and less challenged

Concentration does not tell us whether the same firms remain the largest in their industry. To measure this, we need to look at rank stability. Rank stability counts how many of the ten largest firms in an industry kept their position over time.

We found that rank stability has risen over time. This means the top firms are less likely to be challenged in their position.

3. Fewer firms have entered industries

An industry is dynamic when new firms can enter it and challenge existing ones. When new firms can enter an industry, it encourages existing firms to:

- **innovate**
- **charge lower prices**
- **tailor their offers to their customers' demands**
- **offer better-quality products**

If the existing firms choose not to make these kinds of changes, customers can switch to new providers who offer those greater benefits. This dynamism is at the heart of the competitive process. It ensures that the market rewards firms offering the best value.

Therefore, knowing how many new firms have entered an industry gives us an idea of how strong the threat is for existing ones. Overall, we found that fewer firms have entered. This means these industries have become less dynamic over time.

4. Profits and markups rose

When firms have to compete aggressively against their rivals, they face pressure to keep their prices low. So we don't expect them to achieve substantially higher profits or markups. We looked at how profits and markups have evolved to understand how competition among rivals has changed.

We found that firms' profits and markups have both risen overall. We also found that these increases were generally greater for firms that were already earning higher profits and markups. Rising profits and markups may be another factor showing that competitive intensity in Canada is declining.

WE INTERPRET OUR FINDINGS WITH CAUTION

Our analysis is limited in some areas, so we are interpreting our findings with some caution. Our study of competition indicators used data that is organized by business activity through the North American Industry Classification System (NAICS). These NAICS industries do not align with the usual practices of competition law analysis and enforcement. To account for this, we rely on best practices to estimate and interpret our competition indicators.

WHAT WE CONCLUDED

Our findings highlight why it is important to vigorously protect and promote competition in Canada. They provide important context for our work at the Competition Bureau and help inform broader discussion regarding Canada's productivity and economic performance. They show how essential it is to modernize Canada's competition laws to respond to the realities of today's economy. And they highlight why it is important to implement pro-competitive public policies that do not shelter industries from healthy competition.

This report also contributes to the broader conversation of how to properly measure and improve competitive intensity in Canada. We hope that our analysis of data across the economy can help advance this field of research and the understanding of the factors that affect competitive intensity. We look forward to seeing what other research emerges, especially in the Canadian context, as this field of research continues to develop.

Competition in Canada from 2000 to 2020: **An Economy at a Crossroads**

WHO WE ARE

The Competition Bureau is an independent law enforcement agency that protects and promotes competition for the benefit of Canadian consumers and businesses. As a part of this mandate, we administer and enforce Canada's *Competition Act* and advocate for rules and regulations that promote competition at all levels of government.

We also investigate and take action when we uncover activities such as:

- **abuses of market power**
- **mergers that substantially decrease competition**
- **price-fixing and bid rigging**
- **deceptive marketing practices**

WHAT IS THE *COMPETITION ACT*?

The *Competition Act* is one of the laws the Bureau enforces. Its purpose is to maintain and encourage competition in Canada.

It contains both criminal and civil provisions.

It applies to all economic activity in Canada.

At the Bureau, we have a track record of advocating for competition and enforcing laws that protect a competitive marketplace. This experience has built our knowledge of competition across sectors and markets of the Canadian economy.

During our enforcement investigations, we often gather very detailed information from different sources. This information allows us to determine how competition works in a narrowly defined sector or market. However, we are limited to information specific to the areas of concern that the investigation is looking into. This is generally limited to specific locations, specific time periods or specific firms and customers. It also often includes confidential information that we can only use for the application of our laws.[1]

WHY THIS PROJECT IS NEEDED

The information we gather during our investigations does not provide a broader view of how competition has evolved in Canada over time. Our goal with this project is to fill that gap and gain that broader understanding.

We used data covering most economic activity in Canada to produce indicators of competition for the economy as a whole between 2000 and 2020. This research project is new for us at the Bureau. What we learned here is not intended to motivate law enforcement activities under the *Competition Act*. It is also not intended to focus on any specific sector or industry. What we learned will contribute to the ongoing discussion of the following questions:

[1] Competition Bureau (2013), *Information Bulletin on the Communication of Confidential Information Under the Competition Act*.

- **What is the state of competition and productivity in Canada?**
- **How might our competition laws and policies need to evolve in step with changing circumstances?**

Our research provides new, more detailed insights specific to Canada. Some international entities have done similar research. For example, in 2020, the United Kingdom Competition and Markets Authority (UK CMA) studied the state of competition in the UK economy. They updated this report in 2022.[2] In 2016, the New Zealand Ministry of Business, Innovation and Employment (NZ MBIE) published a study on how profit elasticity has changed over time across various industries.[3] With input from some member countries, the Organisation for Economic Co-operation and Development (OECD) also published guidance on how to measure market competition.[4]

WHY OUR STUDY IS DIFFERENT

Academic studies have also explored various measures of competition. However, the vast majority of these have focused on the U.S. economy or other countries.[5] Few studies have looked specifically at Canada, and those that have, while informative, are limited in some ways. For example, they may measure only a subset of the indicators that we produced for this project, include only publicly traded firms or date back many years.[6]

Our project uses data Statistics Canada granted us access to, which allowed us to include **all** firms that file taxes in Canada in our analysis. This research, therefore, contributes to the existing literature on competition in Canada. It provides empirical evidence, based on observation, that can contribute to the public discussions on competition policy.

It also benefits the Bureau by improving our knowledge base and increasing our research experience using administrative data. And finally, it provides a foundation for more detailed analyses in the future.

WHY COMPETITION MATTERS

Competition drives economic growth. It encourages businesses to innovate and become more productive. It benefits consumers because it lowers prices, increases choice and improves quality.[7]

When businesses operate in a healthy competitive market, consumers get to choose the best option available to meet their needs and price point. Fair competition means that businesses must make a strong case to consumers that their products or services are the best choice. This leads to more and better products and services that meet the diverse range of consumer tastes.

2 UK CMA (2022), *The State of UK Competition Report April 2022*; and UK CMA (2020), *The State of UK Competition Report November 2020*.

3 NZ MBIE (2016), *Competition in New Zealand Industries: Measurement and Evidence*.

4 OECD (2021), *Methodologies to measure market competition, OECD Competition Committee Issues Paper*.

5 See, for example, the following research:
- Autor, D. et al (2020), "The fall of the labour share and the rise of superstar firms." *The Quarterly Journal of Economics*, 135(2), 645-709.
- De Loecker, J., Eeckhout, J., and Unger, G. (2020), "The Rise of Market Power and the Macroeconomic Implications." *The Quarterly Journal of Economics*, 135(2) 561-644.
- Döpper, H. et al. (2023), "Rising Markups and the Role of Consumer Preferences." Harvard Business School Strategy Unit Working Paper No. 22-025, Georgetown McDonough School of Business Research Paper No. 3939126.
- Miller et al (2023), "Technology and Market Power: The United States Cement Industry, 1974-2019." Working paper.
- Peltzman, S. (2014), "Industrial concentration under the rule of reason." *The Journal of Law and Economics*, 57(3).

6 See, for example, the following research. We note the value of these works, and with this project we seek to advance research on this subject:
- Bawania, R. and Larkin, Y. (2019), "Are Industries Becoming More Concentrated? The Canadian Perspective." Working paper.
- Bérubé, C., Duhamel, M., and Ershov, D. (2012), "Market Incentives for Business Innovation: Results from Canada." *Journal of Industry, Competition and Trade*, 12 47-65.
- Crépeau, S. and Duhamel, M., Industry Canada (2008-2009), "Competition Intensity in Canada: a critique of recent OECD findings." Working paper.

7 Data demonstrates that, for decades, Canada has been less productive than many other countries, like the United States, Germany and the United Kingdom. Competition has a key role to play in fostering productivity in Canada. See, for example, the recent report from the Centre for Productivity and Prosperity. It details how Canada's policy on competition may have played a key role in slowing productivity and economic growth in Canada: HEC Montréal (2022), *Canada's Lagging Productivity: Could the Problem Be Insufficient Competition?*

Our research methods

HOW WE APPROACHED THIS STUDY

Competition is a complex process where firms' behaviours are rooted in rivalry. Firms react to their environment and their rivals; they will behave differently if they face greater competition. Generally, in a competitive environment, firms can't simply raise their prices to increase their profits. Instead, they must innovate and outperform their rivals.

WHAT DOES LOW COMPETITIVE INTENSITY MEAN FOR CANADIANS?

Low competitive intensity means that businesses are less likely to work to gain a competitive advantage over their rivals. This can lessen incentives to lower prices and innovate.

We used data to compute several indicators that are often used to measure competition. These indicators, or measures, help us understand how the industries that firms compete within are structured and how firms perform as a result of competition. We grouped the indicators into two main categories: **structural indicators** and **performance indicators**.

Structural indicators

An industry's structure and its dynamism affect how firms make decisions and price their products. We measured the following different structural indicators of competition:

- **Concentration** measures to what extent a few large firms control an industry. We can measure concentration either by calculating the share of industry revenues going to the largest firms or by measuring how revenue shares are distributed among firms in an industry.
- **Rank stability** measures how many of the top 10 largest firms in an industry have held that place for the past 3 years. This helps us understand how dynamic industries are and whether firms can easily challenge the largest players in their industry (also called "contestability").
- **Entry and exit rates** measure how many firms enter and exit an industry. This is a measure of an industry's dynamism and helps indicate the pressure firms face from new competitors.
- **Survival rates** measure the percentage of firms in an industry that have been active over the last five years. This helps indicate how dynamic an industry is and how likely firms are to face the same competitors year after year.
- **Economies of scale** measure how productive smaller firms in an industry are versus larger ones. This helps indicate one possible barrier new firms face when deciding whether to enter an industry. They may have a harder time competing against larger, established firms if they are smaller and less efficient.

Performance indicators

We can also look at indicators of what the outcome of competition has been on firms' performance. These are normally referred to as "performance indicators." We estimated the following three:

- Return on sales measure average **profits** within an industry, and **markups** measure the difference between the price firms charge for goods and the cost of producing them. Profits and markups both provide a measure of the pressure firms face to lower their prices so they can compete against their rivals.

- **Profit elasticity with respect to costs** measures how intensely firms that can innovate or find more efficient ways to produce goods or services apply discipline on their rivals. Profit elasticity is an indicator of competitive intensity between firms.

HOW WE ANALYZED THE DATA

A team led by Dr. Matthew Osborne, Associate Professor of Marketing at the University of Toronto Department of Management, helped us with this project.[8] They analyzed the data Statistics Canada made available to us in the Research Data Centres, and they analyzed the tabulations provided by Statistics Canada.

We also relied on the technical expertise of Statistics Canada's Economic Analysis Directorate of the Analytical Studies and Modelling Branch in designing and interpreting our analysis.[9] Statistics Canada also allowed us to access the datasets we requested through the Research Data Centre, and they produced tabulations of data for us upon request.[10]

The Statistics Canada datasets we used track firms and employees over time.[11] They provide anonymized information about firms, including balance sheets, payroll, employment, etc. They are compiled using information collected from sources that include:

- Statistics Canada
- Canada Revenue Agency
- Innovation, Science and Economic Development Canada
- Employment and Social Development Canada

8 We are grateful to Dr. Osborne and his team of research assistants for their work on this project (Ramin Fourouzandeh, Farhang Shamsoddin and Junhui Yang).

9 We are grateful to Bassirou Gueye and Weimin Wang of Statistics Canada for their work on this project.

10 Dr. Osborne's team estimated economies of scale, markups and profit elasticity with respect to costs directly in the Research Data Centre. The remaining indicators were measured using tabulations of data produced by Statistics Canada for the Bureau. Although the research and analysis are based on data from Statistics Canada, the opinions expressed do not represent the views of Statistics Canada.

11 In the Research data centre we accessed data from files in the Canadian Employer Employee Dynamics Database (CEEDD). The tabulations we received from Statistics Canada were compiled from these files as well as the Longitudinal Employment Analysis Program (LEAP).

NAICS codes

The data used for this project organizes firms by business activity through the North American Industry Classification System (NAICS). NAICS provides common definitions of industry structure in Canada, the United States and Mexico. Each firm is assigned a NAICS code, a series of numbers based on their main production activity.

The most detailed NAICS industry level we could get a useful amount of output for was the 4-digit code.[13] Most of our analysis is done using information at the 4-digit NAICS code level. In some cases, we present findings at the 3-digit NAICS code level as well.

WHAT ARE NAICS CODES?

Firms are given a NAICS code based on their main production activity. NAICS has a hierarchical structure. For example, NAICS codes 2121 (coal mining) and 2122 (metal ore mining) belong to NAICS code 212 (mining and quarrying – except oil and gas). Code 212 in turn belongs to NAICS code 21 (mining, quarrying, and oil and gas extraction).

The longer the NAICS code, the narrower the industry definition is.[12] The narrower the definition is, the more detail it provides about firm activity.

[12] For more details on how NAICS codes are defined and organized, see Statistics Canada's website.

[13] We could not release much information for groupings of firms narrower than the 4-digit NAICS code level in order to ensure that we met Statistics Canada's rigorous confidentiality conditions for use of the data. Therefore, we only sought this information at the 4-digit NAICS level.

Interpreting the data

OUR CONFIDENCE IN OUR RESULTS IS STRONG BECAUSE WE RELIED ON DATA THAT IS HIGHLY REPRESENTATIVE OF THE CANADIAN ECONOMY AND COMPUTED MULTIPLE INDICATORS OF COMPETITION. WE ALSO LOOKED AT THE TRENDS OF ALL THESE INDICATORS ACROSS INDUSTRIES AND OVER MANY YEARS.

This approach ensured we didn't misinterpret more minor changes we might see in the data. The trends we observed can inform us about general changes to competitive intensity from 2000 to 2020 across the economy.[14] Rather than focusing on one indicator or aspect of competition, looking at multiple indicators together helps us better identify how competition has changed overall. Our approach is in line with OECD guidance and international best practice.[15]

Each indicator tells us something specific about competition across industries. But it doesn't give us the full picture. For example, concentration tells us whether a few firms have captured a larger share of production. But it doesn't tell us how easy it is for new firms to enter an industry. It also doesn't reveal whether firms with larger revenue shares might face competition regardless of their size. To get a fuller picture, we rely on multiple indicators of competition.

FACTORS WE CONSIDERED

This is a research project, not an investigation. We are not identifying behaviours that we would review under the *Competition Act*. The goal of this research is to generally inform us about the state of competition in Canada and how it has changed over time.

Below we outline factors we kept in mind when we interpreted our findings. These factors aim to account for the nature of the data we use.[16] They highlight why it is more useful to look at trends across different indicators for the economy as a whole, and not to focus on individual industries. These factors do not affect broader trends as much as more sensitive, highly detailed, granular observations of one industry or year.

[14] Different measures of competition are calculated over different time frames depending on the availability of the data from Statistics Canada.

[15] OECD (2021), *Methodologies to measure market competition, OECD Competition Committee Issues Paper*.

[16] Though we note that, overall, the data we used is rich in information and represents Canadian industry well, its structure and source do impose some limitations on how we can use it to meet our needs.

Industries are not markets

Sometimes, during our investigations, we examine market power or measure changes in competition. We will generally do so based on antitrust markets. An antitrust market is the group of products or services that buyers see as close substitutes within an area where buyers are willing or able to travel to switch between products or services.[17]

The data we use does not group firms into antitrust markets. For this type of project, the best information we have on the types of goods and services a firm produces are NAICS classifications. Compared to an antitrust market, a NAICS industry may be either defined more narrowly or broadly. In these cases, measures of competitive intensity may not accurately reflect the competitive dynamics they are meant to measure for specific industries.[18] This means the findings of this project alone cannot meet our enforcement standards. But they are still informative when looking at overall trends in the Canadian economy.[19]

NAICS codes change over time and firms may shift between NAICS codes

As the economy changes, the activity captured by a NAICS code may need to adjust. Firms may therefore have a different NAICS code from one year to the next as NAICS categories are redefined, even if their own activities have not changed.

Also, while a firm may have activities ranging across multiple NAICS industries, it will only be assigned one code. So a firm may be over-represented in one industry and absent in another where it competes with other firms. Further, if one of its activities becomes more important in one year, that firm may change its NAICS code in that year.

The changes we see in our competition indicators may then reflect changes in NAICS codes or the movement of firms between NAICS codes. They may not reflect changes in the competitive structure of an industry. We focused on general trends rather than on specific industries. In this way, we are able to ensure we do not misrepresent changes in particular industries.

Tax data does not always reflect economic theory

Many of the indicators we calculate are based on economic theory that may not align directly with tax data. This is a common concern. Much of the literature we used in our work accounts for these differences and explores ways to use administrative or accounting data. We are mindful of the limitations and assumptions of each model and indicator.

This data reflects only firms filing taxes in Canada

The data we use compiles only information on firms that operate and file taxes in Canada. It does not capture the difference between products and services bought within Canada and those that are exported. It does not account for products and services bought by Canadians from foreign firms (imports) either. This can affect our findings, as we may not capture industry competition completely because we don't capture the effects of trade. For example, the UK CMA found that concentration may be under- or over-estimated if it doesn't account for imports and exports.[20]

Trade may affect competition in different industries in different ways. We focus on trends across the entire economy to avoid accounting for effects that are limited only to a specific industry.

---

17 See Competition Bureau (2011), *Merger Enforcement Guidelines*; and Competition Bureau (2019), *Abuse of Dominance Enforcement Guidelines* for more on how we define markets at the Bureau.

18 See Werden and Froeb (2018), "Don't panic: A Guide to Claims of Increasing Concentration"; and Rossi-Hansberg E., Sarte P.D., and Trachter, N. (2021), "Diverging Trends in National and Local Concentration."

19 For example, research from the European Commission found that "industries" that were more concentrated saw greater merger and antitrust interventions by the Commission. See European Commission (2021), *Modelling the macroeconomic impact of competition policy: 2021 update and further development*, 29-30.

20 UK CMA (2022), *The State of UK Competition Report April 2022*, 83.

Some estimates were withheld to keep the information confidential

Statistics Canada has conditions in place to avoid revealing information that could identify specific firms. So, at times, some information was not provided to us or we could not withdraw some output from the Research Data Centre. In certain instances, we aggregated output in such a way to ensure that it remains anonymized.

These precautions may affect our findings, especially since information is most likely to be withheld for industries:

- that are most concentrated
- that have the fewest firms
- where one firm is dominant[21]

Our focus on trends across industries should reduce the impact of withheld information on our conclusions.

[21] To learn more on the procedures in place to protect that data by keeping it anonymous and confidential, researchers may consult Statistics Canada's *RDC/FRDC Confidentiality Handbook for Economic Microdata*, provided upon request.

Structural indicators of competition

INDUSTRY STRUCTURE DESCRIBES ELEMENTS SUCH AS:

- **How many firms there are in an industry**
- **what barriers to entry new firms face**
- **how many firms enter and exit**

Elements of an industry's structure influence how firms make decisions and price their products. For example, the number and size of competitors affect the pressure on a firm's prices and its drive to innovate.

Competitive interaction also then changes the industry structure. For example, aggressive competitors may push inefficient firms out of the industry. On the other hand, if there is only a small threat of entry from new firms, existing firms may be able to increase their prices or offer fewer choices to their customers.

Industry structure alone may not provide a complete picture of the environment firms operate within. But it does provide important information on the competitive structure and the incentives that drive firms to compete.

CONCENTRATION

For this project, we measured concentration using the share of revenues that the largest firms earn.[22]

High concentration means that a few firms earn a greater share of the revenues in their industry. Theory tells us that if a market is more concentrated, it is easier for firms to increase their prices and make profits above what we would expect to see in a competitive setting. They can make these larger profits because they face fewer competitors. If there is more concentration, and fewer firms, it is also more likely that some firms can coordinate and increase prices.[23]

We calculated two different measures of concentration:

- **a concentration ratio (CR)**
- **the Herfindahl-Hirschman Index (HHI)**

Concentration Ratio (CR)

The concentration ratio tells us what percentage of all revenue for an industry goes to the largest firms. Specifically, we compute this for the 10 largest firms (CR10).[24]

[22] Along with revenues, we can also measure concentration by looking at the number of employees firms have or their capacity (i.e., how many products they can produce). However, revenues are a commonly used input and the most clearly observable in our dataset.

[23] See Competition Bureau (2011), *Merger Enforcement Guidelines*, para 5.13.

[24] As discussed in Appendix A, we also carried out an analysis of CR3. However, for confidentiality reasons the data available to conduct this analysis was at a higher level of aggregation. This created concerns about the reliability of the CR3 analysis, which is why we chose to focus on the measurement of CR10 and HHI.

The CR10 measure produces a value between 0% and 100%. For example, if the 10 largest firms in an industry each account for 5% of industry revenues, CR10 will be 50%. The larger the share of revenue for these largest firms, the higher the ratio and the more concentrated the industry. However, CR10 does not tell us how shares of revenues are distributed among either the top 10 firms or the rest of the industry.

Herfindahl-Hirschman Index (HHI)

Unlike CR10, HHI helps us understand how shares of revenue in the industry are distributed beyond the largest firms. HHI is the sum of the squared share of industry revenue of each firm in an industry. HHI is measured on a scale between 0 and 10,000.

The HHI increases as fewer, larger firms earn a larger share of the industry revenue. It also increases as revenues are distributed in an industry more unevenly. For example, an industry would have an HHI of 10,000 when it has only one firm. If an industry has more small firms with equal shares of revenue, it will have an HHI closer to 0.

HOW DOES HHI WORK?

Let's consider two industries of 10 firms where CR10 is 100%. Here, we can consider two extreme cases of how firm revenue shares are distributed:

1. Revenue shares within the industry are **evenly distributed** when each firm has a share of 10%. Here, the HHI is 1,000.
2. Revenue shares within the industry are **unevenly distributed** where a single firm has a share of 90% and the remaining 10% is split evenly between the remaining 9 firms. Here, the HHI is 8,111.

An industry where the biggest firms have similar revenue shares may have different dynamics than one with one large player and a fringe of smaller players. By looking at the HHI, we can account for how revenue shares are distributed within an industry. CR10 alone does not capture this aspect of concentration.

Interpreting concentration measures

It is difficult to set a threshold that definitively identifies a highly concentrated industry. When we investigate specific mergers or anticompetitive acts, we rely on market share information. It helps tell us whether mergers or some firm behaviours in a market are more or less likely to raise concerns.[25] We do not use specific HHI thresholds for enforcement. However, the U.S. Department of Justice and Federal Trade Commission's *Horizontal Merger Guidelines* identify thresholds past which mergers are more likely to enhance market power:[26]

- **unconcentrated markets: HHI below 1,500**
- **moderately concentrated markets: HHI between 1,500 and 2,500**
- **highly concentrated markets: HHI above 2,500[27]**

Concentration rose in the most concentrated industries

We find that concentration rose in the most concentrated industries. We are especially interested in looking at how concentration has evolved in industries that are highly concentrated. These are the ones that we would most likely scrutinize in the context of our work to enforce or advocate for fair competition.

[25] See Competition Bureau (2011), *Merger Enforcement Guidelines*; and Competition Bureau (2019), *Abuse of Dominance Enforcement Guidelines*.

[26] We note that the Department of Justice and Federal Trade Commission published draft Merger Guidelines with updated thresholds on July 19, 2023. It is important to note that these thresholds refer to market concentration rather than industry concentration, which is what we measure in this project.

[27] U.S. Department of Justice and the Federal Trade Commission (2010), *Horizontal Merger Guidelines*, 18-19. Likewise, other competition agencies have set market HHI benchmarks or thresholds that may indicate a need for greater scrutiny and a level of HHI describing a "highly concentrated" market. These will vary and not all agencies rely on these concentration thresholds. See, for example, the European Commission (2004), *Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings*; and the Australian Competition and Consumer Commission (2008), *Merger Guidelines*. We refer to these thresholds as a useful reference point, but note that they were intended for use with market concentration rather than industry concentration.

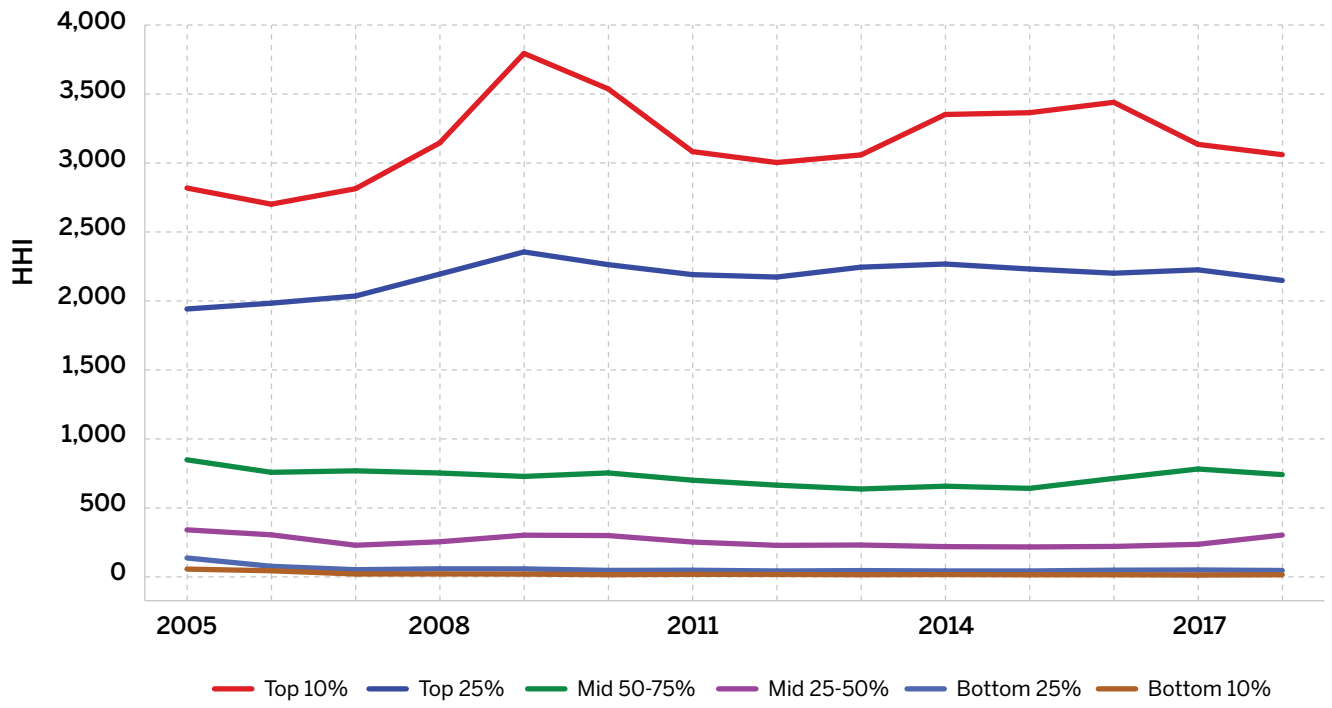
Ranking industries by their average concentration over all years, we can compare how concentration has evolved in both more concentrated industries and less concentrated ones. See Figure 1 below to learn what we found.

Concentration for the top 10% and 25% most concentrated industries rose overall between 2005 and 2018.

- **HHI in the top 10% most concentrated industries rose by 8.6%: It went from 2,818 in 2005 to 3,060 in 2018. We observe variation within that time period.**

- **HHI in the top 25% most concentrated industries rose by 10.7%: It went from 1,942 in 2005 to 2,149 in 2018.**

Figure 1: Average annual HHI from 2005 to 2018 for industries that are grouped by average HHI



We also found that the number of industries with an HHI greater than 2,500 (highly concentrated) rose from 19 in 2005 to 27 in 2018. Out of a little over 300 industries, this rate was approximately one industry every two years. This is based on the number of industries for which no information was withheld to protect confidentiality. Where data was withheld to protect firm confidentiality, we can safely assume that those industries are more concentrated. However, withheld data does not affect the observed upward trend.[28]

We find similar trends when examining CR10. The number of industries with a CR10 over 80% has also risen, to a lesser degree, from 47 in 2005 to 50 in 2018. These are industries where the top 10 largest firms earn 80% or more of all industry revenues.

We do note that average concentration fell in industries with medium or low concentration. In Appendix A you can find more analysis to support the findings described above.

[28] See Appendix A for more information.

RANK STABILITY

Concentration measures alone do not reflect possible changes in which firms make up the top 10 in an industry. We use rank stability to better understand how much change there is in the group of largest firms. This helps us understand how dynamic industries are and whether firms can easily challenge the largest players in their industry (also called "contestability").

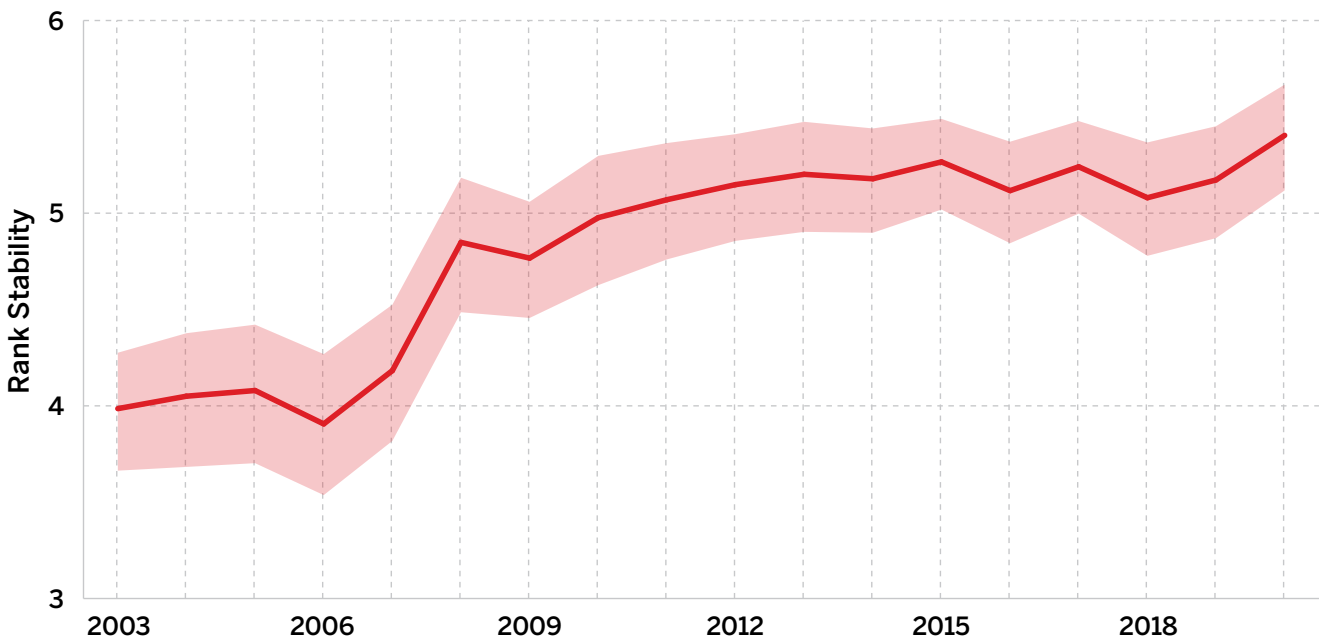
We measure rank stability as the number of firms among the top 10 largest by revenue in an industry that were also in the top 10 for the three prior years. For example, a rank stability of 10 implies that the top 10 firms have remained the same, while a rank stability of 1 means only one firm has remained in the top 10 and the other nine are new to the top 10.

When rank stability is higher, it may tell us that there is less competition. This is because it shows that existing competitors or new firms entering an industry are less likely to push the top firms out of their positions. When rank stability is lower, it tells us that firms are more likely to successfully compete for a larger share of revenues.

Rank stability has risen overall

From 2003 to 2020, rank stability increased across all industries. Figure 2 below presents average rank stability for all industries based on revenue. This increase affects almost all industries. Less than 1% of industries saw their rank stability fall. These account for less than 0.5% of all industry revenues.

Figure 2: Average rank stability from 2003 to 2020 for all industries



Note: The shaded red area indicates a 95% confidence band. This means that if we were to re-sample the population in the same way, we would expect data to fall within the range of values 95% of the time.

The general overall rise in rank stability across the economy could mean that competitive intensity has gone down. Larger firms are more entrenched in their positions. We describe further analysis of our findings on rank stability in Appendix B.

ENTRY, EXIT, SURVIVAL AND INDUSTRY DYNAMISM

Entry and exit rates

The threat that new competitors will enter an industry encourages firms to compete more actively. This is true even when there might be fewer firms in the industry. Entry and exit rates help us understand how dynamic an industry is. An industry is dynamic when new firms can enter it and challenge existing ones.

When new firms can enter an industry, it encourages existing firms to:

- **innovate**
- **charge lower prices**
- **tailor their offers to their customers' demands**
- **offer better-quality products**

If the existing firms choose not to make these kinds of changes, customers can switch to new providers who offer those greater benefits. This dynamism is at the heart of the competitive process. It ensures that firms offering the best value are more successful.

In a competitive and dynamic economy, we also expect to see inefficient firms exiting. They would exit because they can no longer continue to compete against more efficient rivals. However, we note that if smaller, newer firms are mainly the ones that are exiting industries, higher entry or exit may not mean greater competition.

We calculated entry rates from 2001 to 2020 as the number of opening firms in a given year as a percentage of active firms in that year. The exit rate is the number of closing firms in a given year as a percentage of active firms in that year.[29]

Survival rates

Along with entry and exit rates, we calculated the survival rates of firms in industries from 2005 to 2020. This information is another way we can learn how dynamic an industry is.

The survival rate is the percentage of firms that have been active for at least five years as a percentage of the average number of firms operating in those years.

High survival may show that an industry is not very dynamic. In an industry where few firms enter and exit, the survival rate will be high. With a higher survival rate, firms may be better able to understand the behaviour of their competitors. This in turn may relax the rivalry among them. Their rivalry is not as intense because they can learn to predict how their competitors will react and base their strategies on this.

On the other hand, if many firms enter an industry and new firms are the ones exiting most often, the survival rate may be low. Yet this would not necessarily indicate greater competition.

[29] We count an entry when a firm becomes active. More precisely, a firm "enters" in a year if it had employees that year but had no employees in a previous year. We count an exit when a firm becomes inactive. More precisely, a firm exits in a year when they have no employees but did have employees in a previous year. We looked into other measures that tested for persistence of entry and exit (for 3 years previous or after) and found similar results. You can learn more in Appendix C.

Entry and exit rates have declined overall

It is difficult to identify the competitive rate of entry, exit or survival for each industry. It will vary by industry, based on several factors. These include:

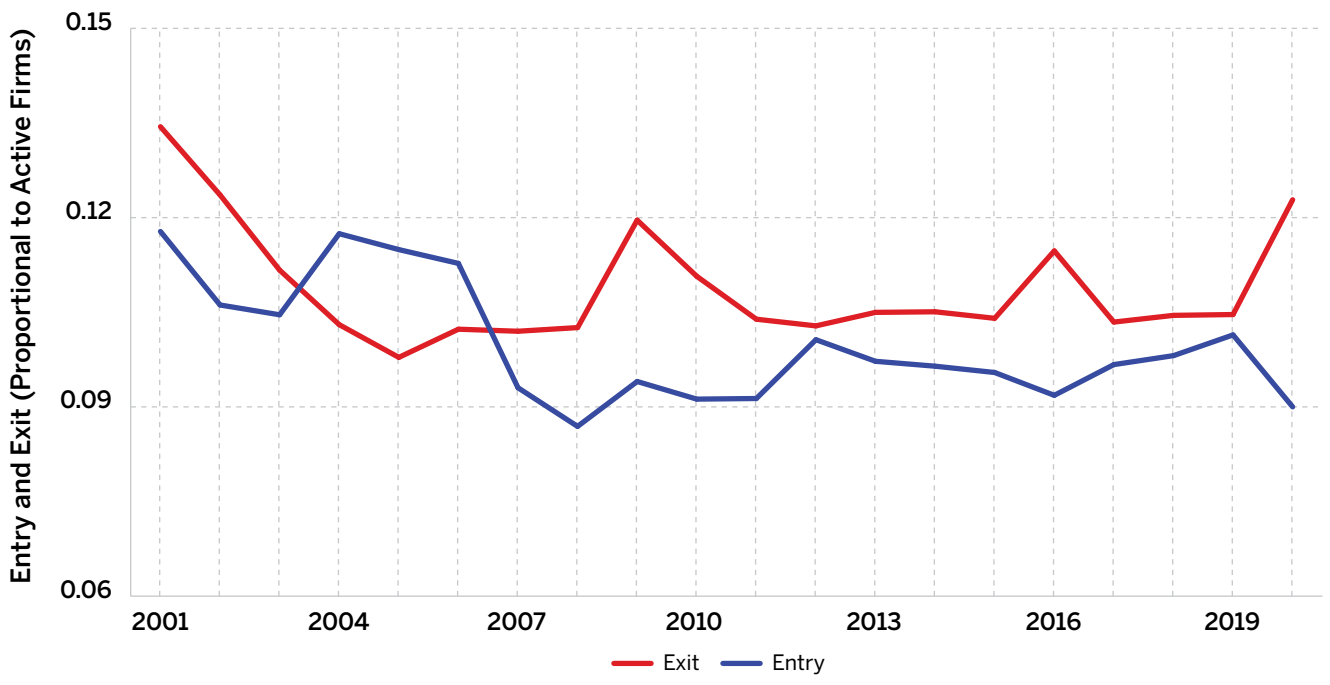
- the types of products or services offered
- the nature of firms' inputs and whether they are costly or hard to come by
- the regulations that apply
- the competition that already exists
- the geographic make-up of where the firm operates

So instead, we focus on the trends in entry, exit and survival rates. They provide more information to help us understand whether the Canadian economy as a whole has become more or less dynamic.

We find that the average entry and exit rates have gone down across the economy between 2001 and 2020 (see Figure 3 below). Entry rates have gone down by 24% (from 11.8% to 9.0%); exit rates, by 8% (from 13.4% to 12.3%).

The decline in entry and exit rates may appear small, but we saw it across industries.[30] It tells us Canadian industries across the economy have become less dynamic from 2001 to 2020.

Figure 3: Average entry and exit rates from 2001 to 2020 for all industries



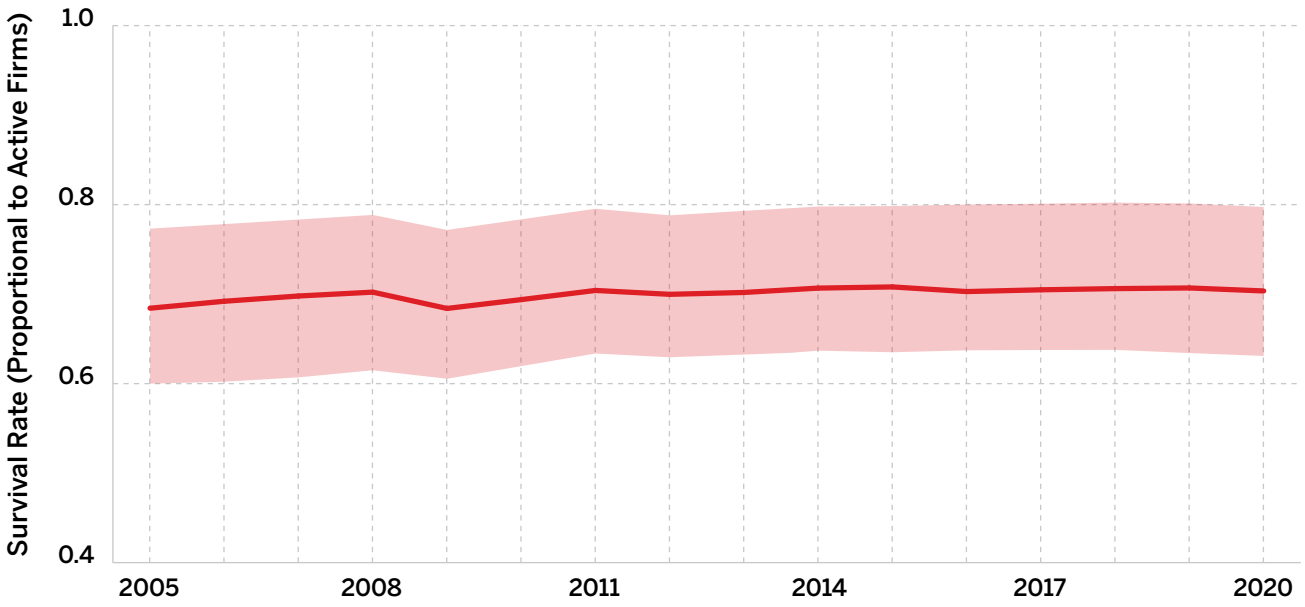
Note: Average of industry rates of entry and exit weighted by industry revenue

[30] Based on all industry revenues, only 7% of industries, accounting for only 6% of all industry revenues, saw entry rates go up. Likewise, only 7% of industries, accounting for 14% of all industry revenues, saw exit rates go up.

Survival rates have risen slightly overall

Survival rates are consistent with what we learned about entry and exit rates: they rose across all industry groups, from an average of 68.4% in 2005 to 70.4% in 2020 (see Figure 4 below). This is a small increase (2%), but it covers a wide range of industries.[31] When we view these rates in combination with falling entry and exit rates, we again see that industries have become less dynamic.

Figure 4: Average survival rate from 2005 to 2020 for all industries



Note: Average of industry survival rate weighted by industry revenue. The shaded red area indicates +/- 1 standard deviation from the mean. This represents the range where approximately 68% of the industry level data lies within any given year.

The declines in entry and exit rates and the increase in survival rates point to a decrease in the overall dynamism of the economy. We describe further analysis of our findings on entry, exit and survival rates in Appendix C.

[31] Based on all industry revenues, 62% of industries, accounting for 59% of all industry revenues, saw a meaningful increase in survival rate. Only 11% of industries, accounting for 10% of all industry revenues, experienced a decline. The rest saw no meaningful change.

BARRIERS TO ENTRY: ECONOMIES OF SCALE

As noted above, if firms feel threatened by new competitors, they are encouraged to compete more actively. At the Bureau, we evaluate barriers to entry and how they affect competition when we review mergers or allegations of monopolistic practices. Along with market shares and concentration, barriers to entry are an important aspect of industry structure and competition. Barriers to entry can take many forms, including:

- **higher unrecoverable costs of entry or expansion**
- **regulations**[32]
- **economies of scale**[33]

Using data, we can estimate economies of scale as barriers to entry. Economies of scale occur when the average cost of producing each unit of a product or service goes down as a firm produces more. With high economies of scale, a firm can likely only enter an industry with success if it does so on a large enough scale to compete profitably against large existing firms whose costs are lower. This means that smaller competitors may be discouraged from entering industries with high economies of scale.

We used the cost disadvantage ratio (CDR) to measure economies of scale

We estimate the cost disadvantage ratio (CDR) as a measure of economies of scale. The CDR compares the value added per worker of smaller firms to the value added per worker of larger firms within an industry.[34]

As the CDR increases above 1 (there is no upper limit), it shows that estimated economies of scale are higher. Specifically, the value added per worker for larger firms is higher than it is for smaller firms. If the CDR is between 0 and 1, it indicates diseconomies of scale. In other words, small firms are more efficient than larger firms. If the CDR equals 1, it indicates no economies of scale. In this case, small firms are as efficient as larger ones.

We expect to find economies of scale in most industries,[35] but we cannot determine the level of CDR that tells us whether barriers to entry will hinder competition. First, the products or services firms produce within industries may vary widely. Second, the model may not account for any differences in the quality of labour.[36] Finally, there are other barriers to entry, unique to each industry, also at play. As a result, it is more informative to examine trends in CDR rather than compare CDR levels across different industries to understand how this potential barrier to entry has changed.

Economies of scale declined overall

We find that economies of scale have gone down on average across all industries from 2001 to 2018. This tells us that larger firms are becoming less efficient compared to smaller ones. In Figure 5 we group average CDR for industries by high to low economies of scale. We see that overall CDR has decreased, particularly in industries where it is highest on average.[37]

[32] We note that Canada's regulatory environment is ranked among the least favourable to product market competition according to the OECD. See: Indicators of Product Market Regulation, OECD.

[33] See Competition Bureau (2011), *Merger Enforcement Guidelines*; and Competition Bureau (2019), *Abuse of Dominance Enforcement Guidelines*.

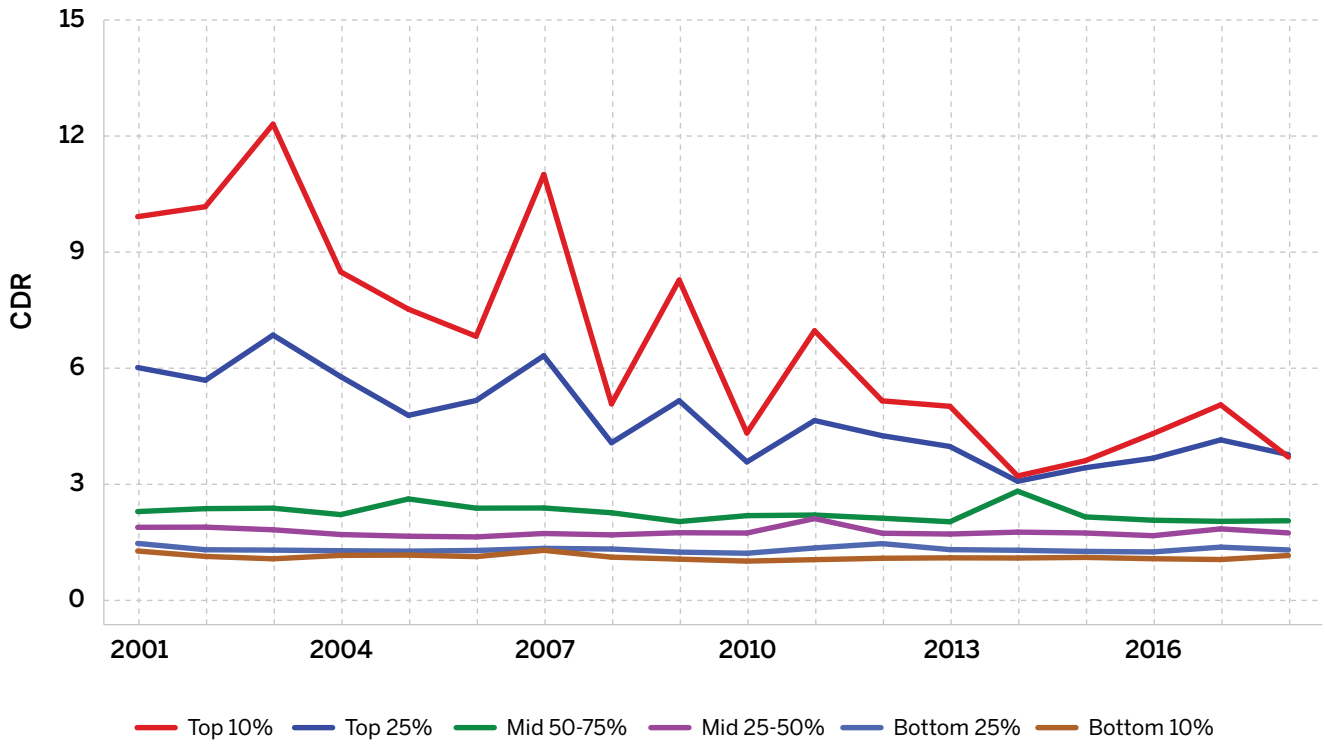
[34] We follow the method proposed by Caves, R.E., Khalilzadeh-Shirazi, J., and Porter, M. (1975), "Scale Economies in Statistical Analyses of Market Power." In their approach, the value added per worker for larger firms is the denominator, and that of smaller firms is the numerator. This approach provides an indicator that gets larger as economies of scale decrease. By inverting this ratio, we get a CDR that moves in the same direction as economies of scale. See the detailed description of this approach in Appendix D.

[35] Many economic models of firm production assume economies of scale, and economies of scale have been remarked upon from the earliest economic writings. Modern economic literature commonly estimates these for a variety of industries.

[36] See Appendix D for a full description of the model.

[37] It is worth noting that CDR has not meaningfully changed in 56% of industries, which account for approximately 46% of all industry revenues.

Figure 5: Average annual CDR from 2001 to 2018 for industries that are grouped by high to low economies of scale



We often expect larger firms to be more efficient than smaller ones due to economies of scale. If the technology of production allows larger firms to operate at a lower average cost, then it may be more efficient to have fewer firms with a larger scale of production in an industry. This means some concentration in industries with high economies of scale may not reflect low competition.

To see whether this was true, we looked at whether we were seeing higher concentration in industries with higher economies of scale. We found no clear correlation between industries with high CDR and those with high concentration. In other words, industries with high economies of scale were not more likely to have high concentration. This suggests that the increases in concentration we observed were not due to larger firms becoming more efficient.

In addition, we expect falling economies of scale to mean declining barriers to entry. As economies of scale decrease, new firms do not need to reach as large a size in order to compete against larger existing firms. The cost advantage of larger firms is smaller where economies of scale are smaller. However, we did not note rising entry rates during the same period (as described above). As a result, we cannot connect the falling economies of scale we observed with rising entry rates as we might expect.

By examining CDR, we see that economies of scale have gone down slightly, but entry rates have not gone up at the same time. See Appendix D for further analysis of our findings on barriers to entry.

Performance indicators

YOU HAVE READ ABOUT HOW WE MEASURED STRUCTURAL INDICATORS LIKE CONCENTRATION, BARRIERS TO ENTRY AND INDUSTRY DYNAMICS. ALL OF THESE INDICATORS HELP US UNDERSTAND THE ENVIRONMENT FIRMS OPERATE WITHIN. THEY CAN SHINE A LIGHT ON OVERALL TRENDS AND CHANGES IN COMPETITION SINCE INDUSTRY STRUCTURE WILL AFFECT FIRMS' CHOICES.

We can learn more about how competition has changed by looking at performance indicators: markups, profits and profit elasticity with respect to costs. These indicators measure the direct outcome of firms' actions.

Higher profits and markups can both be indicators of a less competitive economy. In a competitive industry, firms face pressure to keep their prices low. This in turn means we would not expect firms to achieve substantially higher profits or markups. Likewise, we can look at how cost increases are passed through to consumers, which is reflected in profit elasticity. This helps us understand how much pressure firms face to drive down prices and innovate.

MARKUPS

Markups are defined as the difference between the price a firm charges for a product and its marginal cost. Marginal cost describes the cost of producing one additional unit.[38] A firm with market power can usually charge a price much higher than its marginal cost. In this way, it will enjoy a high markup. When firms face strong competition from rivals, they will usually feel pressure to reduce their price to be closer to their costs. In theory, in a perfectly competitive market, markups are zero. Competition in this market pushes prices down to marginal cost.

Estimating markups is not straightforward

One of the challenges with measuring markups directly is that we do not observe the firm's marginal cost. Marginal costs are not observed and so are not reported in accounting or tax data. Economic literature provides several approaches to estimate markups with accounting data or tax data. We follow two common approaches in this project.[39] Both methods will infer markups by estimating firms' production functions, essentially looking at how firms use labour and capital to produce goods while keeping their costs to a minimum. The methods differ in how they use the data available to account for the productivity of firms. See Appendix E for details on our methodology.[40]

[38] For example, if a firm sells a product at a price of $2.50 with a constant marginal cost of $2 (the cost of producing one additional unit) then its markup would be $0.50. Markups are commonly expressed relative to marginal cost in percentage terms – here it would be $0.50/$2 or 25%.

[39] We follow the approach proposed in Olley, S. and Pakes, A. (1996), "The dynamics of productivity in the telecommunications equipment industry." *Econometrica*, 62(6), 1263-1297; as well as the approach proposed in De Loecker, J. and Warzynski, F. (2012), "Markups and Firm-Level Export Status." *American Economic Review*, 102 (6): 2437-71.

[40] Both approaches result in similar trends. We report what we observed following the De Loecker and Warzynski (2012) approach in this report for conciseness, but all results can be consulted in Appendix E.

Markups are a good indicator of market power. Yet, they may not precisely indicate competition on their own. Firms may be able to achieve higher markups, even when they compete intensely, if they make changes such as:

- developing new and innovative products
- differentiating their product in some way
- providing consumers with a variety of products
- competing on factors beyond price
- lowering their costs and operating more efficiently[41]

These are all examples of potentially competitive actions. An increase in markups could also reflect an increase in fixed costs, such as more investment in research and development. Firms may increase prices to recoup these fixed costs, but their marginal costs would remain the same, so we would see higher markups. It is still useful to look at trends in markups over time. This is because changes in markups can signal changing competitive dynamics within industries.

It is also most helpful to look at trends in markups rather than comparing levels between industries. This is because markups may be different across industries based on industry-specific factors. For example, are they research-intensive or technology-intensive sectors? Or are they industries with high fixed cost? Given the methods we use to estimate markups, it may be most helpful to look at trends.[42]

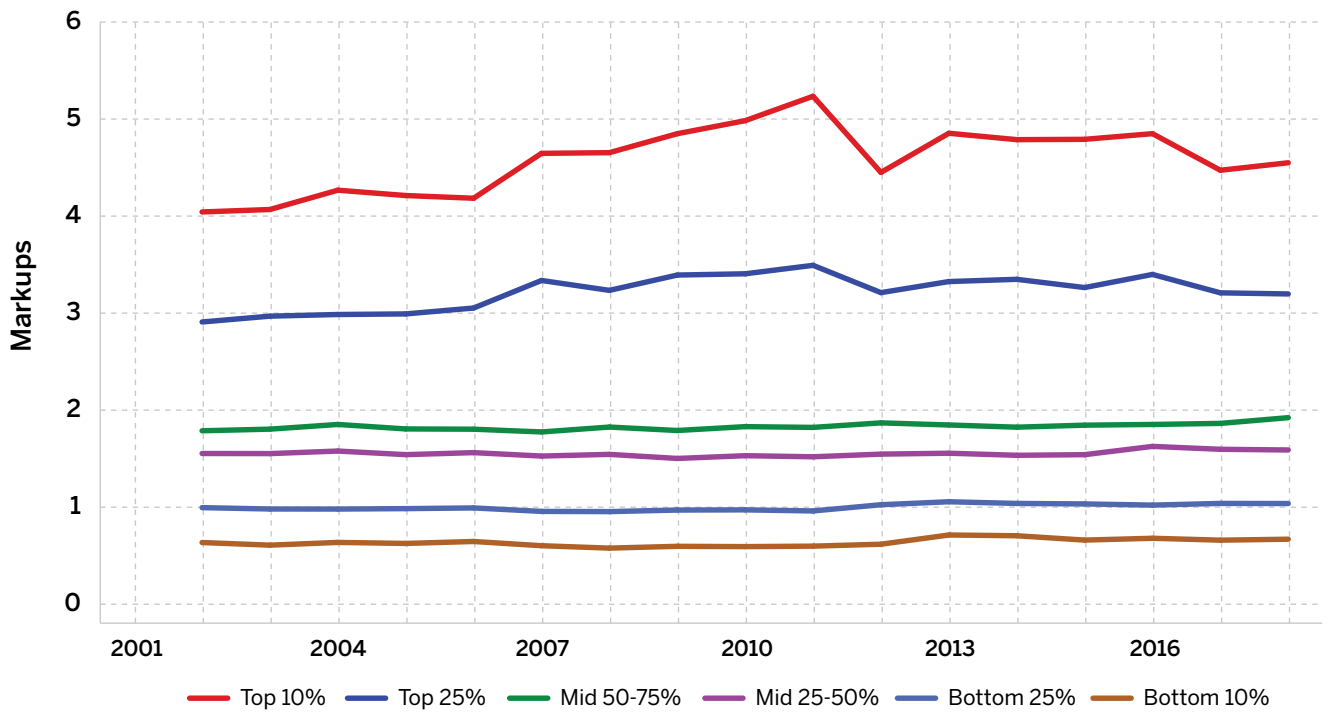
[41] See, for example:
- OECD (2021), *Methodologies to measure market competition, OECD Competition Committee Issues Paper*.
- Autor, D. et al. (2020), "The fall of the labor share and the rise of superstar firms." *The Quarterly Journal of Economics*, 135(2), 645-709.

[42] See Appendix E for more information. See also:
- Hambur, J. (2021), "Product market power and its implications for the Australian economy." (No. 2021-03). Treasury Working Paper.
- Bond, S., Hashemi, A., Kaplan, G., and Zoch, P. (2021), "Some unpleasant markup arithmetic: Production function elasticities and their estimation from production data." *Journal of Monetary Economics*, 121, 1-14.

Markups have risen overall and more so in higher markup industries

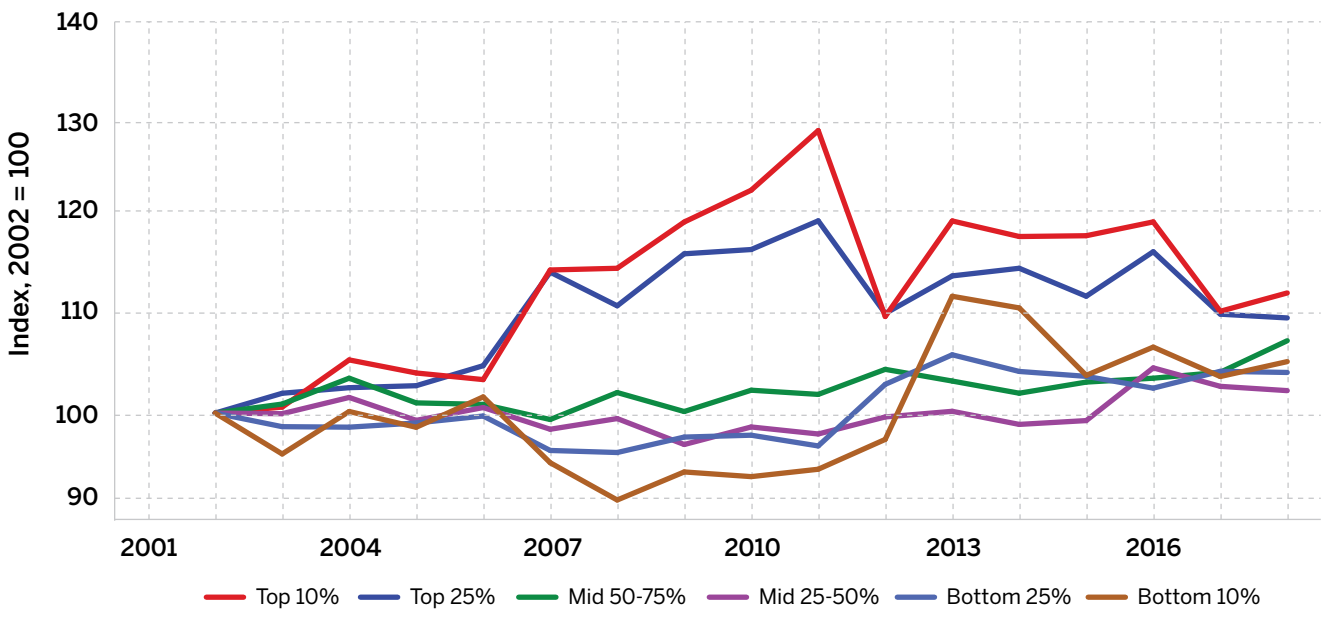
We observe a small overall increase of 6.7% in the average markup across all industries between 2002 and 2018. However, this increase is steeper in industries with the highest estimated markups, where it rises by 12.5%. These increases appear in Figure 6 below. Here, we show how markups have evolved for groups of industries with higher and lower average markups.

Figure 6: Average annual markup from 2002 to 2018 for industries that are grouped by average markup



To better illustrate this rising trend across industries, we set the starting point of each group tracked above to 100. This allows us to track how markups have changed for industries with high and low markups on average (Figure 7 below).

Figure 7: Indexed trend in average markup from 2002 to 2018 for industries that are grouped by average markup



While we observe a divergence in markups between the top and bottom industries during our time period, the trend across all groups shows increased markups overall.

As noted above, several different factors could put pressure on markups to increase. Nonetheless, this generalized increase in markups could indicate a decline in the intensity of competition firms face. It is also consistent with trends observed in our measure of profits, which gives us added confidence in the trends we observed.[43]

[43] This is especially important in light of research on the most appropriate calculation of markups. See Appendix E for more information. See also:
- Doraszelski, U. and Jaumandreu, J. (2021), "Reexamining the De Loecker & Warzynski (2012) Method for Estimating Markups." CEPR Discussion Paper No. DP16027.
- Bond, S., Hashemi, A., Kaplan, G., and Zoch, P. (2021), "Some unpleasant markup arithmetic: Production function elasticities and their estimation from production data." *Journal of Monetary Economics*, 121, 1-14.

PROFITS

When firms have to compete aggressively against their rivals, they face pressure to keep their prices low. So we don't expect them to earn substantially higher profits.

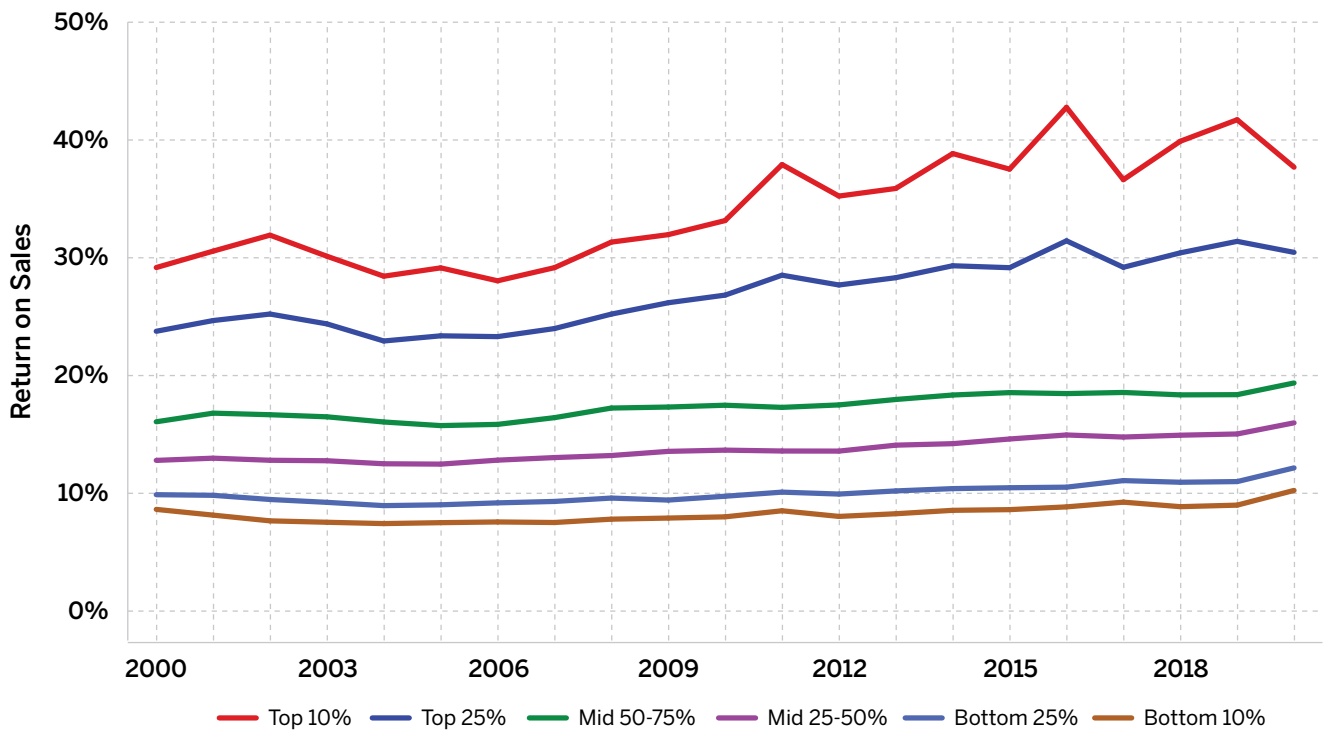
We measured profits using return on sales (ROS). ROS is defined as operating profits[44] divided by revenue. Operating profits are earnings from operations before interest and taxes (EBIT). For a detailed description of how we calculated EBIT using our dataset, see Appendix F.

ROS does not provide a standard for identifying a level of profits that is competitive or above what a firm would make under optimal competition. Competitive ROS will be different for each industry since it will depend on factors like fixed costs, how firms use labour and capital and in what proportion, and so on. And just as we described above for markups, in a competitive setting, a firm may still earn high profits in some conditions. For example, if it innovates or provides a variety of products, it may be able to earn higher profits. As such, our findings are more informative if we examine trends in ROS over time. Then we can understand how competitive pressure on profits may have changed over time.

Profits have risen overall and more so in higher-profit industries

We found that ROS has increased for most industries and on average overall. We also saw that the industries with the highest profits have seen a slightly faster increase compared to the overall average (see Figure 8 below). The top 10% of industries with highest ROS had an increase in ROS from 29.2% in 2000 to 37.7% in 2020 (an increase of 8.5%). Overall, average ROS increased from 15.7% in 2000 to 19.5% in 2020 (an increase of 3.8%).

Figure 8: Average annual ROS from 2000 to 2020 for industries that are grouped by average ROS



[44] Operating profits do not include most fixed costs, like research and development and investments in productive assets (e.g., machinery).

Similar to markups, other factors could be putting upward pressure on ROS. However, the increase in ROS across industries could mean that firms face declining competitive pressure to lower prices or keep them low, which can improve profitability.

PROFIT ELASTICITY WITH RESPECT TO COSTS

We can also think of competition as a continuous, ongoing process. Firms continue to challenge each other and to look for ways to outcompete their rivals by finding more efficient ways to produce goods and services.

We assume that, in a competitive environment, firms are pushed to innovate and find new ways to produce at a lower cost. As a result, one or a few firms may earn higher profits for a time while their competitors catch up.

An input to production is anything that goes into producing goods and services. It includes materials, labour and equipment. If input costs increase in an industry, and firms do not face any pressure from competitors, they will simply pass this on to customers by charging a higher price. However, when some firms have a larger profit margin because they are more efficient, they can continue to put pressure on their rivals by not raising their price, since they absorb the cost increase in their profit margin. This means those more efficient firms will limit how much of the cost increase can be passed on to customers. As a result, profits for firms in this industry will go down more than they would in industries where firms face less pressure to compete and keep prices low.

Profit elasticity with respect to costs, also called the Boone indicator, measures the size of a change in profit that occurs when a firm's marginal cost increases.[45] Since marginal costs can't be observed directly, we inferred them by looking at average variable cost.[46]

This indicator can better measure competition in industries where there are one or a few larger firms, but they are large because they are more efficient. It fills a gap left by our measures of concentration and other measures that only look at the outcome of competition, like markups.

The Boone indicator takes a value between negative infinity ($-\infty$) and one (1). In more competitive industries, we expect the Boone indicator to approach negative infinity. This is because an increase in cost will mean a larger decrease in profits. As we note above, this happens because more efficient competitors can impose discipline on others within an industry. As it increases towards 1, the Boone indicator shows weaker competitive intensity.

Once again, we focused on the trends we observed in profit elasticity rather than comparing elasticity between industries. The level of the Boone indicator was affected by several factors according to the industry and the data we used. So, we got more helpful information if we looked at the change across industries.

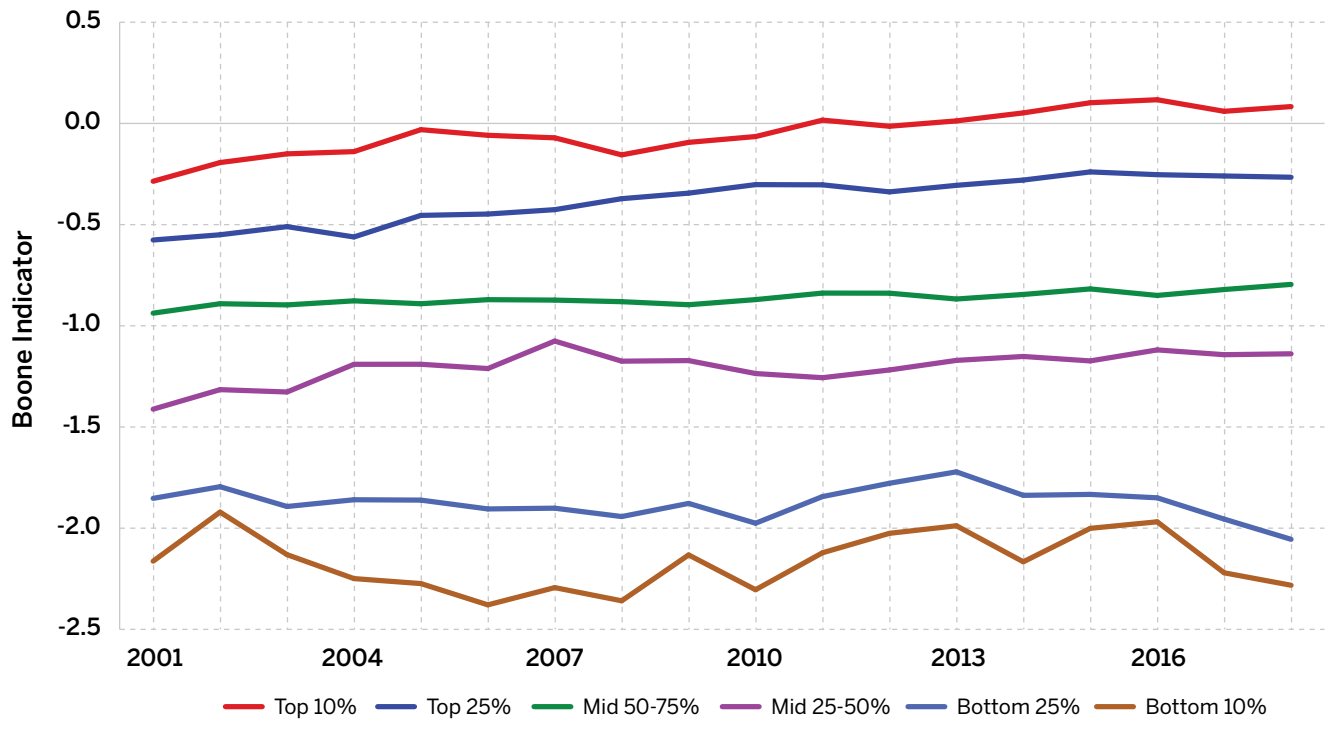
[45] Boone, J. (2008), "A New Way to Measure Market Competition," The Economic Journal, 118(531), 1245-1261.

[46] We follow the approach in Griffith, R., Boone, J., and Harrison, R., (2005), "Measuring Competition," Advanced Institute of Management Research Paper No. 022. We measured average variable cost as the cost of goods sold divided by total sales. You can read more about our methodology in Appendix G.

Profit elasticity has risen overall

We found an 11% increase in the Boone indicator on average across all industries. This increase is larger (128%) for the top 10% of industries with the highest average Boone indicator. Industries where the Boone indicator is lowest saw a small decline, indicating a rise in competitive intensity. However, the overall trend is on the rise, as you can see in Figure 9. Here we plot the trends in the Boone indicator from 2001 to 2018 for industries grouped from highest to lowest on average.

Figure 9: Average annual Boone indicator from 2001 to 2018 for industries that are grouped by average Boone indicator



The overall increase in the Boone indicator across industries could indicate that competitive intensity is falling within industries. When costs rise, firms are then less likely to face pressure to maintain low prices. Instead, they can pass on the cost increase to their customers. This is consistent with the overall increase in markups and profits that we also observed over this time period and points to a decline in competitive intensity overall. See Appendix G for more details on our analysis and findings.

Conclusion

WE EXAMINED MULTIPLE COMMONLY USED INDICATORS OF COMPETITION. EACH TELLS US SOMETHING SPECIFIC ABOUT COMPETITION. IT EITHER TELLS US ABOUT THE ENVIRONMENT IN WHICH FIRMS COMPETE, OR ABOUT THE OUTCOME OF THE COMPETITIVE PROCESS ON FIRM PERFORMANCE.

As described in the sections above, we need to be cautious when we interpret these indicators. Yet, by looking at multiple indicators together, we find a consistent and clear decline in competitive intensity in Canada between 2000 and 2020. To summarize our key conclusions:

- **Concentration has increased in the most concentrated industries, and a greater number of industries are becoming highly concentrated.**
- **Rank stability has gone up across industries. This means the largest firms in industries face less of a challenge from smaller firms.**
- **Entry and exit rates have gone down across industries, while the firm survival rate has gone up. This indicates that industries are becoming less dynamic and existing firms face less pressure from potential new ones.**
- **Economies of scale have gone down slightly, but entry rates have not gone up with them.**
- **Profits and markups are increasing overall, and this is happening faster in industries where profits and markups are already high.**
- **Profit elasticity is increasing, which indicates that the competitive process is becoming less dynamic.**

These findings help us measure how competitive intensity has evolved in Canada. This is important information that we can use to understand how competition policy in Canada has performed. Our findings also provide important context for our work at the Bureau to enforce the *Competition Act* and advocate for regulations that reduce barriers to competition in the Canadian economy. More generally, this work highlights why it is important to modernize Canada's competition infrastructure and recentre the role of competition in our economy.

The Bureau will continue to explore ways that we can build on and refine our findings by expanding on the knowledge and expertise we have gathered from this research.

Appendix A: Concentration

A CONCENTRATED MARKET IS ONE WHERE A FEW FIRMS ACCOUNT FOR A LARGE SHARE OF TOTAL REVENUES. IF A MARKET IS MORE CONCENTRATED, IT MAY BE EASIER FOR A FIRM TO INCREASE ITS PRICE ABOVE A LEVEL WE WOULD EXPECT TO SEE IN A COMPETITIVE MARKET. THE LIKELIHOOD THAT SOME FIRMS MAY BE ABLE TO INCREASE PRICES BY COORDINATING THEIR ACTIONS ALSO INCREASES AS THE LEVEL OF CONCENTRATION IN A MARKET RISES AND AS THE NUMBER OF FIRMS DECLINES.[1]

Changes in concentration measures can inform us about changes in market structure. While we do not define a specific level of concentration that may trigger enforcement action, we generally find that a merger is less likely to reduce competition substantially when market shares or concentration measures are low.[2]

We calculated three different measures of concentration. The CR3 and the CR10 concentration ratios and the Herfindahl-Hirschman Index (HHI).

METHODOLOGY: CONCENTRATION RATIOS

The concentration ratio (CR) is defined as the sum of the market shares of the top N firms in an industry. In a given industry, the CR10 measures the share of the top 10 firms whereas the CR3 measures the share of the top 3. A higher concentration ratio implies that the largest firms account for a larger share of the industry. CR10 and CR3 can range from close to 0% in the case of many tiny firms, to 100% in the case where the largest 10 (or 3) firms account for all industry revenue.

Concentration ratios were provided to us in custom tabulations by Statistics Canada using the National Accounts Longitudinal Microdata File (NALMF), T1 Financial Declaration File (T1FD), and T1 Business Declaration File (T1BD) datasets[3] from 2005 to 2018. They are calculated for each 4-digit NAICS industry and aggregated as revenue-weighted averages of component 4-digit NAICS codes for higher-level NAICS industries (2- and 3-digit NAICS industries). The NALMF datasets contain all incorporated businesses, while the T1FD and T1BD contains all unincorporated businesses, who have filed or were declared on a tax return.

We used the following steps to calculate CR3 and CR10:

1. In the NALMF dataset, several observations are missing the NAICS industry code. We fill missing NAICS codes in a year with the value from a prior or subsequent year where available. If the NAICS code is lacking for a firm throughout the entire dataset, the firm is excluded from our analysis.

2. For any incorporated firm and each year, we calculate its revenue using the variables farm_total_revenue[4] and total_revenue from NALMF, and for any unincorporated firm, the revenue is calculated using variables L8299[5] and L9659[6] from the T1FD and T1BD dataset. We then calculate the total revenue of a 4-digit NAICS industry by summing up the revenue of all firms in the industry.

1 See Competition Bureau (2011), *Merger Enforcement Guidelines*, para 5.13

2 See Competition Bureau (2011), *Merger Enforcement Guidelines* para 5.8-5.9, and Competition Bureau (2019), *Abuse of Dominance Enforcement Guidelines*, para 33-34

3 Both the NALMF and the T1FD and T1BD datasets are components of the Canadian Employer-Employee Dynamics Database (CEEDD).

4 Firm tax filings are a primary source of the data in the NALMF. Revenue is calculated as $farm\_total\_revenue + total\_revenue$. Statistics Canada breaks down total revenues for firms into farm and non-farm revenue.

5 Total revenue (non-farming)

6 Total farm revenue

3. The CR3 and CR10 at the 4-digit NAICS is then calculated as the sum of the revenues for the 3 largest firms for CR3, or 10 largest firms for CR10, and dividing it by the total revenue for the 4-digit NAICS industry.

4. The concentration ratio for 2- and 3-digit NAICS industries is calculated as the revenue-weighted averages of concentration ratios of the underlying 4-digit NAICS industries.

METHODOLOGY: HERFINDAHL-HIRSCHMAN INDEX (HHI)

The HHI for an industry is defined as the sum of the squared revenue share of each firm in the industry. A higher HHI value indicates that fewer firms account for a greater share of revenue and that revenue is more unevenly distributed between firms in an industry (i.e., more concentrated within fewer firms). The HHI will range from close to 0 in the case of many tiny firms, to 10,000 in the case where a single firm accounts for all industry revenue.

The HHI was provided to us in custom cross-tabulations by Statistics Canada using the NALMF and T1FD and T1BD, covering the years 2005 to 2018 for each 4-digit NAICS code (unless data was withheld for a particular NAICS code-year pair due to confidentiality concerns).

Similar to the concentration ratios, we follow steps 1 and 2 (see the section on Concentration Ratios above) to compute revenues for firms and 4-digit NAICS industries. We then divide each firm's revenue by total industry revenue to obtain the revenue share for each firm in a 4-digit NAICS industry.

The HHI is then calculated by summing the squared revenue share of each active firm in a 4-digit NAICS industry. The HHI for 2- and 3-digit NAICS industries is calculated as the revenue-weighted averages of HHI of the underlying 4-digit NAICS industries.

CONFIDENTIALITY

For the CR3, Statistics Canada only released revenue-weighted averages (of 4-digit NAICS industries) at the 3- and 2-digit NAICS code levels to protect the confidentiality of individual firms.

Further, Statistics Canada did not release CR10, CR3, and HHI measures for certain NAICS industries in certain years. This was done when the number of firms in a NAICS industry in a particular year was too low, or where one or a few firms were over-represented in the output. This is important in the context of concentration measures since more concentrated industries are more likely to be the subject of redactions.

DETAILED FINDINGS

Concentrated industries have become more concentrated (HHI)

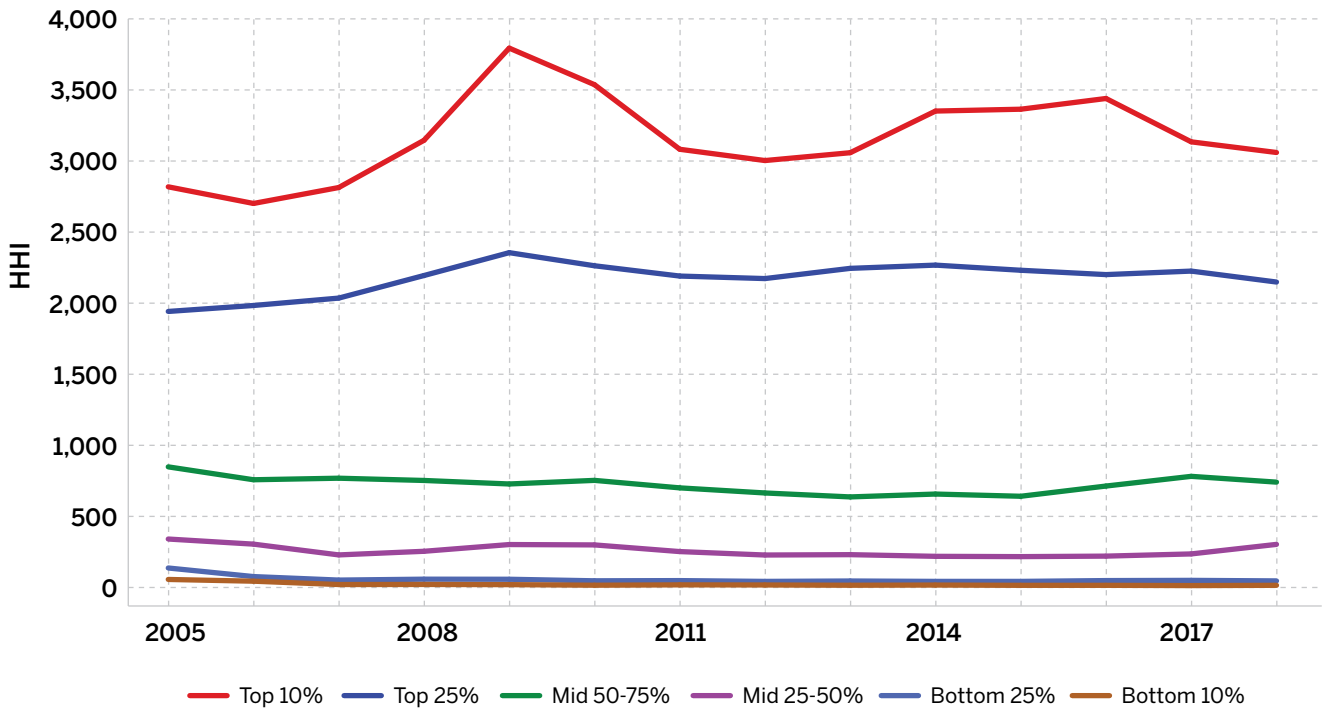
By grouping industries by their mean concentration over the entire period from 2005 to 2018, we can track and compare the change in concentration for those industries that are most concentrated with those industries that are less concentrated. Figure A1 shows the change in HHI for industries grouped by their mean HHI over the whole sample. We group industries into 4 quartiles (top 25%, middle 50% to 75%, middle 25% to 50%, and bottom 25%) as well as the top and bottom 10%.

We are especially interested in looking at how concentration has evolved in industries that are highly concentrated. These are the ones that we would most likely scrutinize in the context of our work to enforce or advocate for competition.[7]

[7] Research from the European Commission found that industries that were more concentrated saw greater merger and antitrust interventions by the Commission See European Commission (2021), *Modelling the macroeconomic impact of competition policy*: 2021 update and further development, 29-30.

We see an overall increase in concentration for the most concentrated industries, namely the top quarter of industries, ranked by concentration, and within that group, for the top 10% of industries.[8]

Figure A1: Average annual HHI from 2005 to 2018 for industries that are grouped by average HHI



More specifically, the HHI for the most concentrated group of industries (Top 10%) increased from 2,818 to 3,060 (8.6%) from 2005 to 2018, and the HHI for the Top 25% increased from 1,942 to 2,149 (10.7%) over this period. By comparison, the average HHI of all industries decreased from 800 to 790 (-1.3%). This overall decline is driven by decreasing concentration in less concentrated industries, as seen in Table A1.

Table A1: Change in average HHI from 2005 to 2018 for industries in different distributional groups

	HHI in 2005	HHI in 2018	Change in HHI
Top 10%	2,818	3,060	+242
Top 25%	1,942	2,149	+207
Mid 50-75%	848	741	-107
Mid 25-50%	341	303	-38
Bottom 25%	137	46	-91
Bottom 10%	56	15	-41

[8] Some firms in the NALMF may have common ownership. We also calculated HHI measures taking this into account. We found similar trends in HHIs though the level of concentration increased when we took common ownership into account. This was particularly true for the most concentrated industries. As a result, the concentration results presented here can be considered conservative.

In order to further verify that concentration has risen for industries that were, on average, the most concentrated, we assessed the change in concentration from 2005 to 2018 for industries that could be described as highly concentrated (HHI greater than 2,500), moderately concentrated (HHI between 1,500 and 2,500) and non-concentrated (HHI less than 1,500).[9]

We found that, for highly concentrated industries, 9 (out of 26) further increased in concentration, while 2 decreased, 13 showed no meaningful change in concentration, and for 2 industries output was withheld or missing and we could not measure a trend. Likewise for moderately concentrated industries, 8 (out of 27) increased in concentration, while 5 decreased, and 14 showed no meaningful change. Meanwhile for non-concentrated industries, almost twice as many industries showed a decrease rather than an increase. This is detailed below in Table A2.

Table A2: Significance of average HHI trend for industries with different levels of average concentration

	HHI over 2500	HHI 1500 to 2500	HHI below 1500	All Industries
Increase in HHI	9	8	42	59
Decrease in HHI	2	5	81	88
No meaningful change	13	14	137	164
Could not measure trend[10]	2	0	1	3

More industries have become highly concentrated

We find that the number of concentrated industries has increased from 2005 to 2018. Below, in Table A3, we track the number of industries (4-digit NAICS) that are highly concentrated (HHI greater than 2,500), moderately concentrated (HHI between 1,500 and 2,500) and unconcentrated industries (HHI less than 1,500).[11] We find there is an increase in the number of industries with HHI greater than 2,500.[12]

Table A3: Number of 4-digit NAICS industries with HHI above 2500, between 1500 and 2500, or below 1500

	HHI over 2500	HHI 1500 to 2500	HHI below 1500	Industries with no data released due to confidentiality
Number of Industries (2005)	19	27	259	8
Number of Industries (2018)	27	25	254	7
Change in Number of Industries	8	-2	-5	0

[9] These thresholds, described in our report, are based on thresholds in the United States' Department of Justice and Federal Trade Commission (2010), *Horizontal Merger Guidelines*. These are meant to identify *markets* where mergers are more likely to warrant further scrutiny as they are more likely to enhance market power. We note that recent draft Merger Guidelines (United States' Department of Justice and Federal Trade Commission (2023), Merger Guidelines) have been released which introduce a lower threshold of 1,800 to define highly concentrated markets. Other jurisdictions identify thresholds of 2000 for a highly concentrated market, and yet others, including Canada, do not establish specific thresholds of HHI but may consider concentration or market share information.

[10] One way to assess the evolution of the measure over time is to examine the trend coefficients estimated from a regression of the 4-digit NAICS concentration measures, $(y_t^{(i)})$, on a constant term and time trend for each NAICS as in the equation below, where $\alpha^{(i)}$ and $\beta^{(i)}$ are computed for each 4-digit NAICS (i) when sufficient data is available (at least two years of data for each industry).

$$y_t^{(i)} = \alpha^{(i)} + \beta^{(i)} \times t + \epsilon_t^{(i)}$$

An industry's time trend was meaningful if it was statistically significant at the 5% level.

[11] These are thresholds used by the United States antitrust agencies for the purpose of identifying mergers that are likely to enhance market power. Note that these thresholds are designed for the analysis of market concentration, while we are measuring industry concentration. Source: FTC (2010), *Horizontal Merger Guidelines*. 18-19.

[12] Using a HHI threshold of 2,000 showed a similar increase.

Comparing HHI to CR10 and CR3

We focus our analysis on concentration primarily on HHI as it is the most descriptive measure of concentration. While CR10 and CR3 are also informative measures of concentration, they do not provide the same detail as HHI. HHI provides insight on the distribution of shares in an industry, while CR10 and CR3 only provide information on the combined share of the 10 or 3 largest firms.

For example, a hypothetical industry with a CR10 of 100% could have widely different HHIs. HHI would be 1,000 in an industry where the top 10 firms each have a 10% share. However, HHI would be 8,111 in an industry where one firm has a share of 90% while the remaining 10% of industry revenues are split equally between the remaining nine firms.

Below in Figures A2 and A3 we plot the joint distribution of CR10 and HHIs. We can see that the industries where we find higher values of the CR10 can yield a wider range of possible HHIs.

Figure A2: Joint distribution of HHI and CR10 at the 4-digit NAICS level

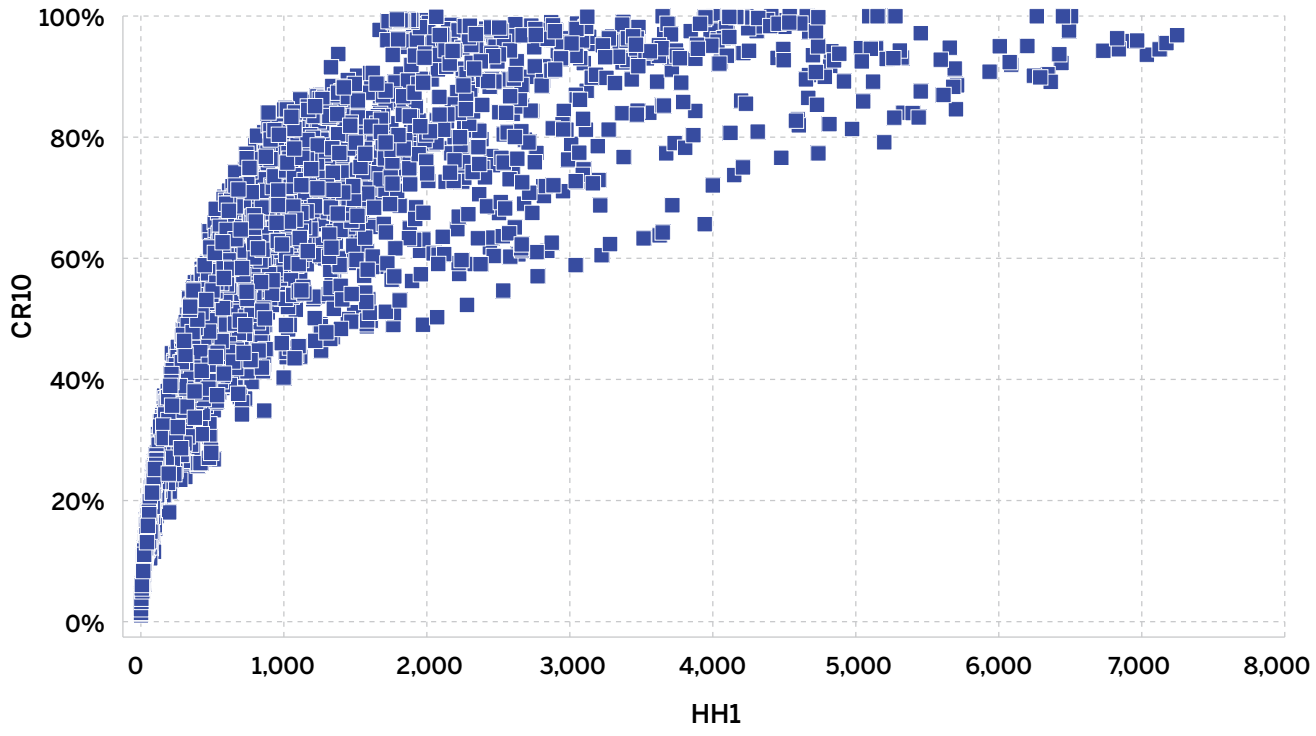
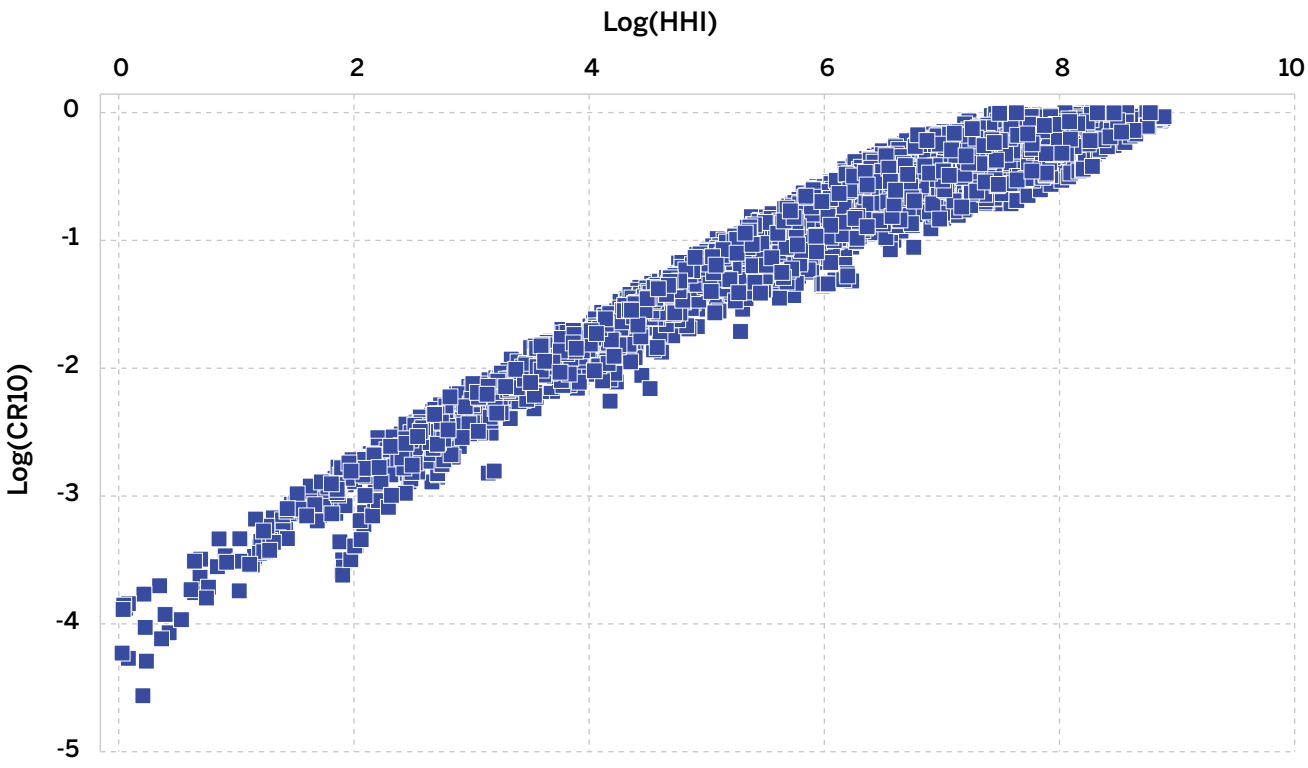


Figure A3: Joint distribution of the natural logarithm of HHI and CR10 at the 4-digit NAICS level



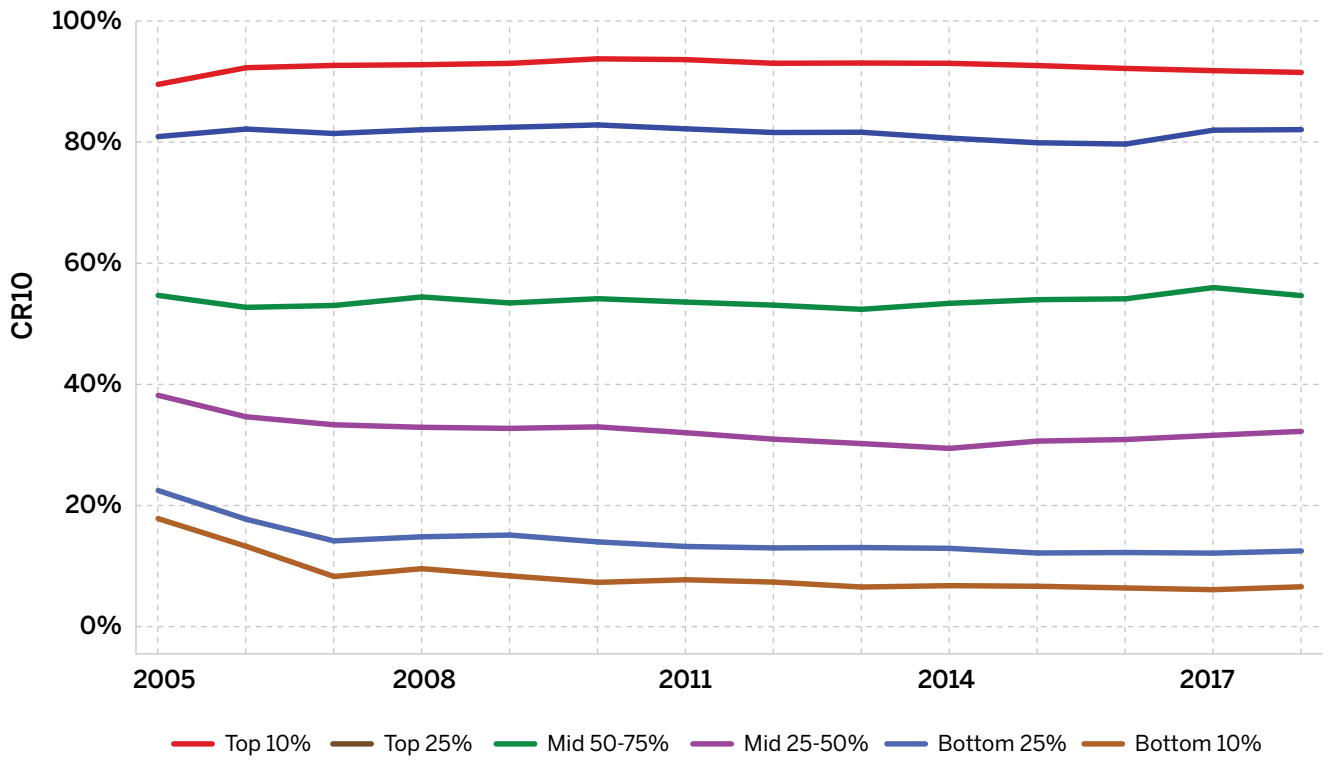
We expect concentration ratios to be correlated with HHI, and we do find that CR10 and HHI are strongly correlated.[13] The correlation between the CR10 and HHI is 0.784, and the correlation between the logarithm of CR10 and the logarithm of HHI is 0.928. Further, we find that 61% of industries that are in the top 10% by HHI are also in the top 10% by CR10. Comparisons of the HHI with the CR3 are less informative because the output we received for industry CR3 was aggregated up to the 3-digit NAICS level as a weighted average of 4-digit NAICS CR3s for confidentiality reasons.

HHI and CR10 present similar trends

Below we plot trends in CR10 across the distribution of industries just like we did for HHI above. We find a similar increase in the concentration of the most concentrated industries, although it is smaller compared to the increase in HHI. This difference in magnitude is not unexpected given the wide variance in HHI we observe in the most concentrated industries by CR10. HHI is more sensitive to the distribution of revenue shares and will therefore capture greater variation in industry composition.

[13] The CR10 and the HHI have a different functional dependence on market shares and we do not expect a linear relationship to exist between them.

Figure A4: Average annual CR10 from 2005 to 2018 for industries that are grouped by average CR10



The CR10 for the most concentrated group of industries (Top 10%) increased from 90% to 92% (+2.2%) from 2005 to 2018, and the CR10 for the Top 25% increased from 81% to 82% (+1.4%) over this period. By comparison, the average CR10 across all industries dropped from 49% to 45% from 2005 to 2018 (-8%). Once again, we find that this decline is driven by a decrease in concentration of less concentrated industries. These changes are detailed in Table A4 below.

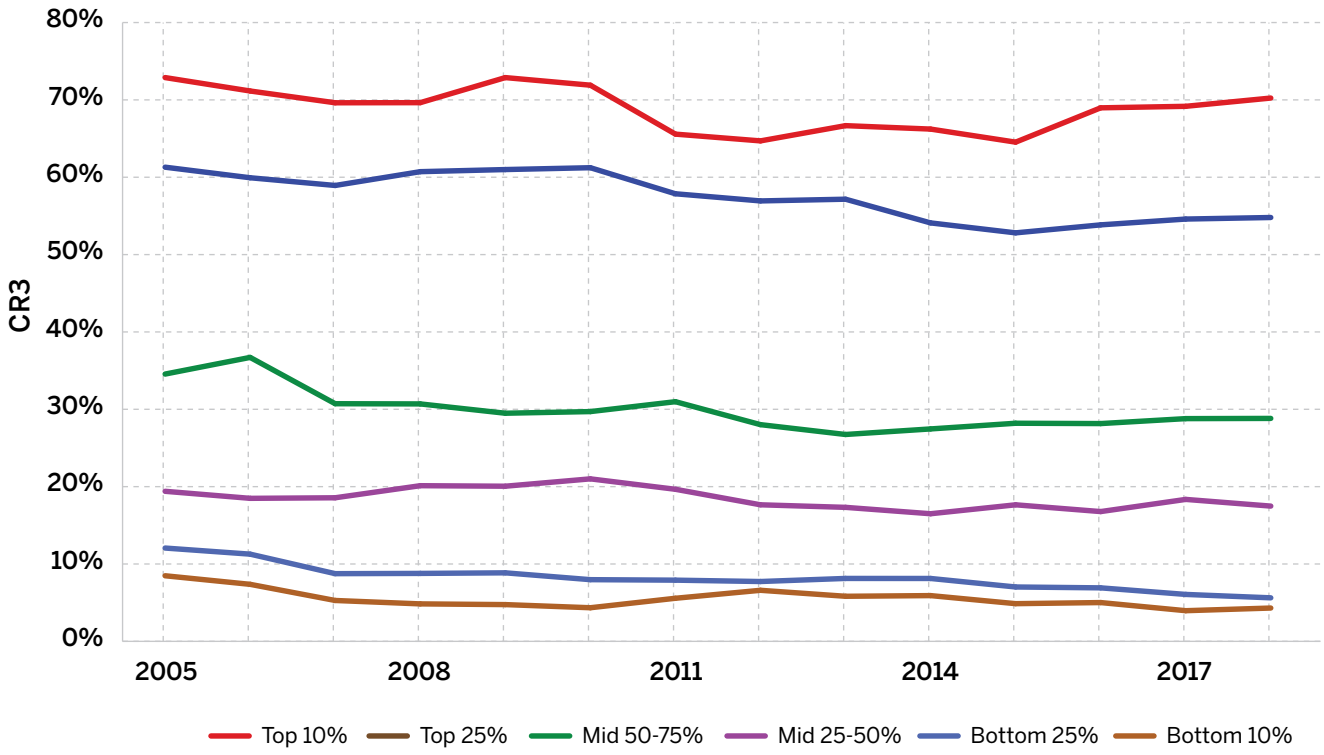
Table A4: Change in CR10 from 2005 to 2018 for industries in different distributional groups

Group	CR10 in 2005	CR10 in 2018	Change in CR10 (Percentage Points)
Top 10%	90%	92%	+2
Top 25%	81%	82%	+1
Mid 50-75%	55%	55%	0
Mid 25-50%	38%	32%	-6
Bottom 25%	22%	12%	-10
Bottom 10%	18%	7%	-11

Trends in CR3

Trends in CR3 do not reflect the trends observed for HHI and CR10. We saw CR3 decline for industries where it was highest as well as for all industries on average. This is reflected in Figure A5 below, where we plot the evolution of CR3 by grouping industries by their average CR3 over all years.

Figure A5: Average annual CR3 from 2005 to 2018 for industries that are grouped by average CR3



The CR3 for the most concentrated group of industries (Top 10%) at the 3-digit NAICS level decreased from 73% to 70% (-3.6%) from 2005 to 2018, and the CR3 for the Top 25% at the 3-digit NAICS level decreased from 61% to 55% (-10.61%) over this period.

However, due to confidentiality, we received CR3 tabulations as weighted means of underlying 4-digit NAICS CR3s for each 3-digit NAICS code. It is important to note that HHI and CR10 at the 4-digit NAICS code level vary greatly within each 3-digit NAICS code. As such, reporting CR3 at the 3-digit NAICS level may mask trends and levels at the more disaggregated 4-digit NAICS level. For example, the most concentrated 3-digit NAICS codes by CR10 have CR10s of 92% and 89% but within these, the underlying 4-digit NAICS codes CR10 values differ greatly. They range from 59% to 98% and from 39% to 99%.

As such, trends observed at the 4-digit NAICS level may not be the same as those observed at a higher level of aggregation, like the 2- or 3-digit NAICS level.

We demonstrate that our findings are robust across various measures of concentration. HHI and CR10 both point to increasing concentration among industries that are most concentrated (in the top 10% and 25%). Although CR3 seems to suggest that concentration is decreasing among the most concentrated industries, the data was quite aggregated for confidentiality reasons and the results are less reliable.

Appendix B: Rank Stability

RANK STABILITY MEASURES THE NUMBER OF FIRMS THAT REMAINED AMONG THE TEN LARGEST FIRMS IN AN INDUSTRY OVER THE PAST THREE YEARS. THIS HELPS US UNDERSTAND HOW DYNAMIC INDUSTRIES ARE AND WHETHER FIRMS CAN EASILY CHALLENGE THE LARGEST PLAYERS IN THEIR INDUSTRY (ALSO CALLED "CONTESTABILITY"). WE OBTAINED THE AVERAGE RANK STABILITY OF 4-DIGIT NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE INDUSTRIES WITHIN EACH 3-DIGIT NAICS CODE INDUSTRY FOR THE PERIOD FROM 2003 TO 2020.

METHODOLOGY

Rank Stability was provided to us in custom cross-tabulations by Statistics Canada using the National Accounts Longitudinal Microdata File (NALMF) dataset at the ultimate parent ID level. We calculate rank stability measures using two criteria: revenue and variable profits.[1] To construct our dataset, we implement the following data cleaning procedure:

1. In the NALMF dataset, several observations are missing the NAICS industry code. We fill missing NAICS codes in a year with the value from a prior or subsequent year, where available. If the NAICS code is lacking for a firm throughout the entire dataset, the firm is excluded from our analysis.

2. We combine firms that have different enterprise IDs but the same ultimate parent ID. In doing so, we sum over their related variables (such as total revenue and variable profit) so that we end up having one observation for each ultimate parent ID and NAICS pair for each year.[2]

3. Below we show how to derive the rank stability for industry-year (*j*, *t*) based on the revenue criterion. Rank stability based on variable profit is derived similarly. First, we merge data for year *t* with data for year $t - 3$ based on the enterprise ID. Then, for each 4-digit NAICS code, we identify the top ten firms by revenue in year *t* and also the top ten firms in year $t - 3$. Rank stability is the number of firms belonging to both groups.

4. In order to protect the confidentiality of firms in this data, Statistics Canada did not provide output at the 4-digit NAICS code. Rather, we obtained average rank stability for 4-digit NAICS codes within 2- and 3-digit NAICS codes.

[1] For each firm, revenue is calculated as $farm\_total\_revenue + total\_revenue$ and variable profits are calculated as $farm\_total\_revenue + total\_revenue - total\_cost\_of\_sales$. Statistics Canada breaks down total revenue for firms into farm and non-farm revenue.

[2] In some cases, there may be more than a single ultimate parent ID and NAICS pair in a given year. This would reflect a scenario where two firms with different NAICS share an ultimate parent ID.

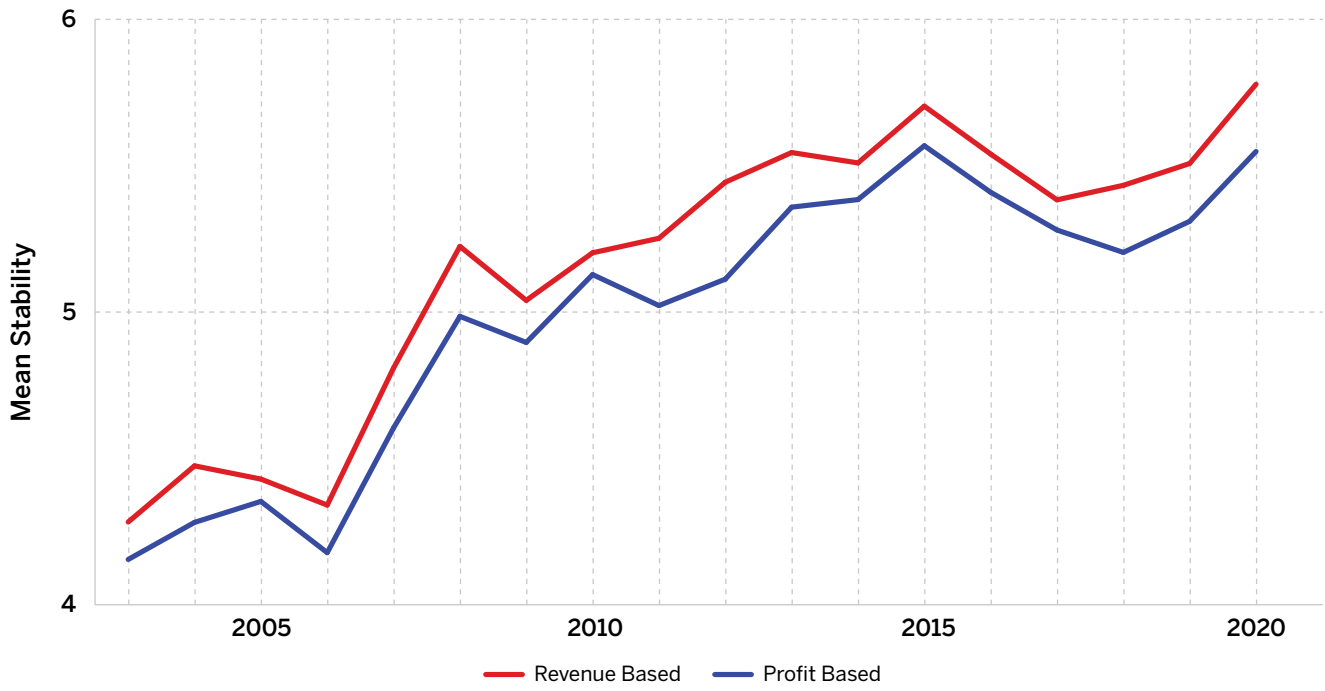
FINDINGS

We find a general increase in rank stability across the economy, indicating that the largest firms in an industry are less likely to be replaced, facing less of a challenge to their top position.

Profit-based and revenue-based rank stability display similar trends and levels

In our main report, we focus on revenue-based rank stability as it relates most closely to our measurements of industry concentration, which is calculated based on revenue shares. However, we also obtained tabulations of rank stability based on profits. In Figure B1 below we plot average rank stability based on both profits and revenue. Both indicators show a similar trend.

Figure B1: Average profit-based and revenue-based rank stability from 2003 to 2020 for all industries



Calculating the industry level time trend for profit-based and revenue-based rank stability yielded similar results. The percentage of industries that saw a meaningful[3] increase or decrease in rank stability is very similar, as shown in Tables B1 and B2.

Table B1: Significance of revenue-based rank stability trend for all industries (4-digit NAICS)

	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in rank stability	31	32%	46%
Decrease in rank stability	1	1%	0%
No meaningful change	44	45%	28%
Could not measure trend	22	22%	21%

Table B2: Significance of profit-based rank stability trend for all industries (4-digit NAICS)

	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in rank stability	33	34%	49%
Decrease in rank stability	0	0%	0%
No meaningful change	43	44%	25%
Could not measure trend	22	22%	21%

When we consider industry specific time trends, we observe that industries representing over 45% of all revenues, were increasing in rank stability between 2003 and 2020 for both measures. Less than 1% of industries saw their rank stability fall. These account for less than 0.5% of all industry revenues.

Rank stability has increased across the distribution of industries

To identify how rank stability has changed across the economy, we grouped industries and plotted the evolution of rank stability for the industries with the highest rank stability on average across all years to those with the lowest rank stability. Figure B2 and Table B3 present the trends for revenue-based rank stability for each group.[5] We find that the increase in rank-stability is widespread across industries regardless of the rank stability in 2003. In fact, industries with lower rank stability at the beginning of the period saw a more rapid rise in rank stability.

[3] One way to assess the evolution of the measure over time is to examine the trend coefficients estimated from a regression of the 3-digit NAICS measure, in this case rank stability, on a constant term for each NAICS (fixed effects) and time trend as in the equation below, where $\alpha^{(i)}$ and $\beta^{(i)}$ are computed for each 3-digit NAICS (i) when sufficient data is available (at least two years of data for each industry).

$$y_t^{(i)} = \alpha^{(i)} + \beta^{(i)} \times t + \epsilon_t^{(i)}$$

An industry's time trend was meaningful if it was statistically significant at the 5% level.

[4] We list the number of industries with redacted output. Statistics Canada did not release output for certain industries in some years in order to protect the confidentiality of firms in the data. Data is withheld when there are too few firms in an industry to maintain confidentiality, or one or a few firms are dominant in the output. As such it is reasonable to assume these industries would fall within the highly-concentrated group in years with redacted data.

[5] We omit these figures and tables for profit-based average rank stability by group since they are quantitatively similar both in terms of levels and trends.

Figure B2: Average revenue-based rank stability from 2003 to 2020 for industries that are grouped by average revenue-based rank stability[6]

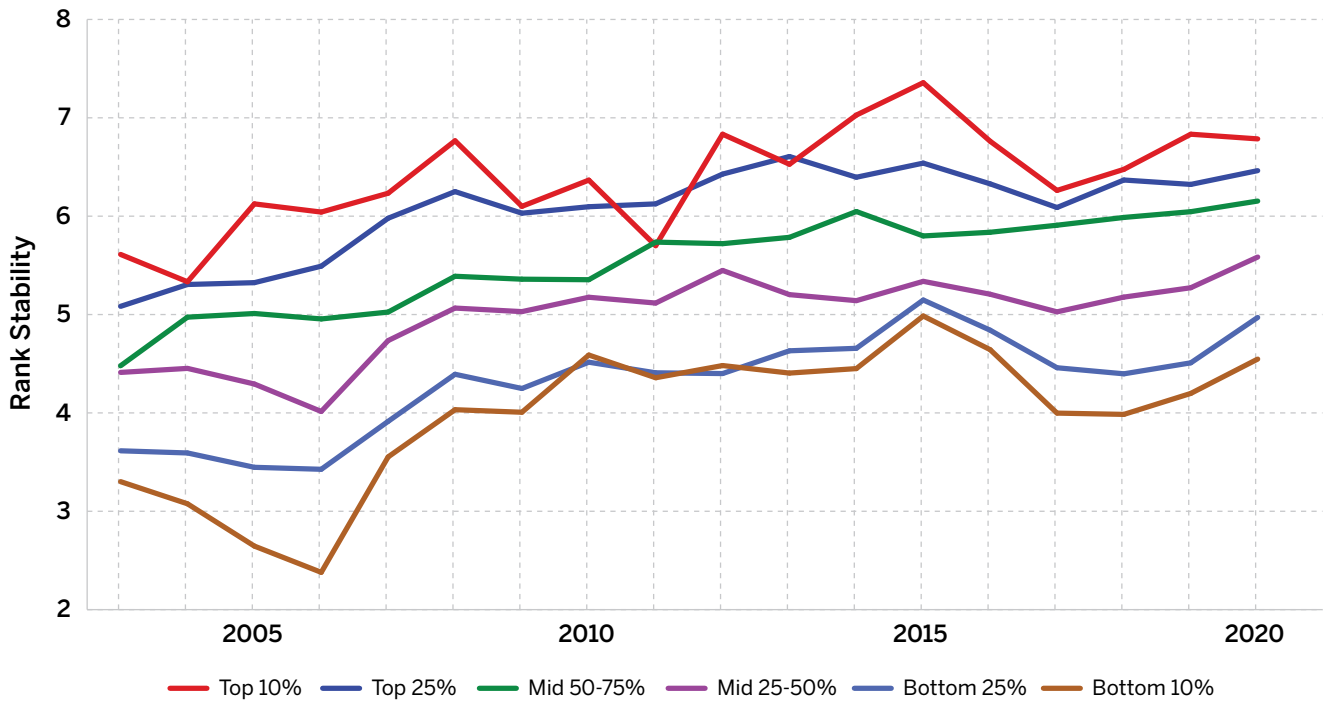


Table B3: Change in revenue-based rank stability from 2003 to 2020 for industries in different distributional groups

Group	Rank Stability in 2003	Rank Stability in 2020	Change in Rank Stability
Top 10%	5.61	6.79	+1.17
Top 25%	5.08	6.46	+1.38
Mid 50-75%	4.48	6.15	+1.67
Mid 25-50%	4.41	5.58	+1.17
Bottom 25%	3.61	4.97	+1.36
Bottom 10%	3.30	4.55	+1.25

We find that rank stability is increasing across all industry groups and these findings hold for both the profit- and revenue-based rank stability.

[6] Lines for the Top 10% and Top 25% intersect throughout the period studied. This is due to the fact that industry distributional groups are fixed over time. As a result, in some cases, the lines cross one another when two groups have relatively similar averages. The same occurs for the Bottom 10% and Bottom 25%.

Appendix C: Entry, Exit, and Survival Rates

ENTRY (EXIT) RATES FOR A GIVEN YEAR ARE CALCULATED AS THE RATIO OF NEW ENTRANTS (EXITS) TO ACTIVE FIRMS. HEALTHY ENTRY AND EXIT IN A MARKET MAY SIGNAL THAT MORE EFFICIENT FIRMS ARE ENTERING AND REPLACING LESS EFFICIENT INCUMBENTS. THIS TURNOVER MAY LEAD TO INCREASED LEVELS OF INNOVATION AND HIGHER COMPETITIVE INTENSITY. ALTHOUGH ENTRY AND EXIT RATES ARE USEFUL INDICATORS, IT IS IMPORTANT TO CONSIDER THEM ALONG WITH OTHER INDICATORS. FOR EXAMPLE, IF SMALLER, NEWER FIRMS ARE MAINLY THE ONES THAT ARE EXITING INDUSTRIES, HIGHER ENTRY OR EXIT MAY NOT MEAN GREATER COMPETITION.

METHODOLOGY

Entry and Exit Rates

Entry and exit information is provided to us in custom cross-tabulations by Statistics Canada using the Longitudinal Employment Analysis Program (LEAP) dataset. We calculate entry and exit rates for each 4-digit North American Industry Classification System (NAICS) industry.

We focus on active firms, that is, those firms with positive average labour units (ALU). The ALU is defined as the average employment for a firm if it paid its workers the average annual earnings (AAE) of a typical worker in that given province, enterprise size, and 4-digit NAICS industry.

We define the following variables:

- **Entry:** the number of active firms in period t that did not exist or have an ALU of zero in period t−1
- **Exit:** the number of active firms in period t that did not exist or have an ALU of zero in period $t + 1$

As a robustness check, we also compute longer-term measures of entry and exit:

- **Entry (long-term):** the number of active firms in period t that did not exist or have an ALU of zero in period $t - 1$, $t - 2$, and $t - 3$
- **Exit (long-term):** the number of active firms in period t that did not exist or have an ALU of zero in period $t + 1$, $t + 2$, and $t + 3$

Rates are calculated by taking the relevant count and dividing by the number of active firms in each industry for each year.

Survival Rates

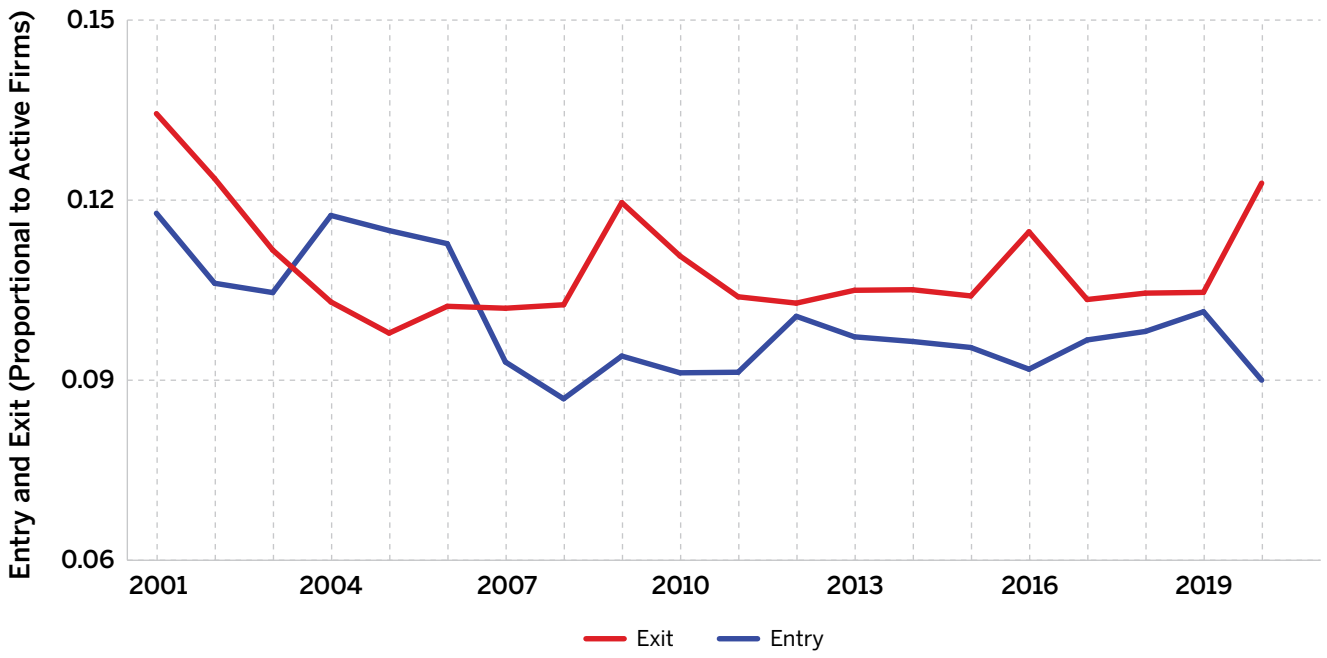
Survival rates were provided to us in custom cross-tabulations by Statistics Canada using the LEAP data set. First, we keep active firms with a positive ALU. The survival rate is then calculated as the number of firms that have been active during the past five years (including the current year), divided by the number of active firms averaged over these years.

DETAILED FINDINGS

Entry and exit rates have declined overall

We look at revenue-weighted average entry and exit rates between 2001 and 2020 and observe a decline in entry and exit rates. See Figure C1.

Figure C1: Average entry and exit rates from 2001 to 2020 for all industries*



*Average of industry rates of entry and exit weighted by industry revenue

More specifically, we find that the revenue-weighted average entry and exit rates have gone down across the economy between 2001 and 2020. Entry rates have gone down by 24% (from 11.8% to 9.0%) and exit rates decreased by 8% between 2001 and 2020 (from 13.4% to 12.3%).[1] See Table C1.

Table C1: Change in entry and exit rates from 2001 to 2020 for all industries (4-digit NAICS)

Variable	Rate in 2001	Rate in 2020	Change in Rate (Percentage Points)
Entry	11.8%	9.0%	-2.8
Exit	13.4%	12.3%	-1.0

[1] If we look at the overall change from 2001 to 2019 we observe entry rates decreasing from 11.8% to 10.1% (change of -1.6%) and exit rates decreasing from 13.4% to 10.4% (change of -3.0%).

To verify that entry and exit rates have decreased in general, we assessed the industry level time-trend in entry and exit rates from 2001 to 2020 in Table C2 and Table C3. We found that 37% of industries (47.5% revenue share) saw a meaningful[2] decline in the entry rate and 20.7% of industries (27.1% revenue share) saw a meaningful decline in the exit rate.

Table C2: Significance of entry rate trend for all industries (4-digit NAICS)

	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in entry rate	20	5.9%	6.3%
Decrease in entry rate	125	37.0%	47.5%
No meaningful change	149	44.1%	38.6%
Could not measure trend[3]	44	13.0%	7.6%

Table C3: Significance of exit rate trend for all industries (4-digit NAICS)

	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in exit rate	22	6.5%	14.4%
Decrease in exit rate	70	20.7%	27.1%
No meaningful change	205	60.7%	52.0%
Could not measure trend	41	12.1%	6.5%

As a robustness check, we also consider long-term exit and entry rates. We find that long-term entry and exit rates are strongly correlated with the short-term entry and exit rates. In addition, the overall change in entry and exit rates over the entire sample period is consistent.

Table C4: Change in long-term entry and exit rates from 2001 to 2020 for all industries (4-digit NAICS)

Variable	Change in Rate (Percentage Points)	Pearson Correlation with Short-Term Entry/Exit
Entry (long-term)	-4.0%	0.97
Exit (long-term)	-1.2%	0.87

Our report focuses on reporting entry and exit. This method recorded firms who became active after being inactive in the previous year (entry) and firms who became inactive after being active in the previous year (exit). We present these measures as we have the greatest data available.

[2] One way to assess the evolution of the measures over time is to examine the trend coefficients estimated from a regression of the 4-digit NAICS measure, in this case entry and exit rates, on a constant term for each NAICS (fixed effects) and time trend as in the equation below, where $\alpha^{(i)}$ and $\beta^{(i)}$ are computed for each 4-digit NAICS (i) when sufficient data is available (at least two years of data for each industry).

$$y_t^{(i)} = \alpha^{(i)} + \beta^{(i)} \times t + \epsilon_t^{(i)}$$

An industry's time trend was meaningful if it was statistically significant at the 5% level.

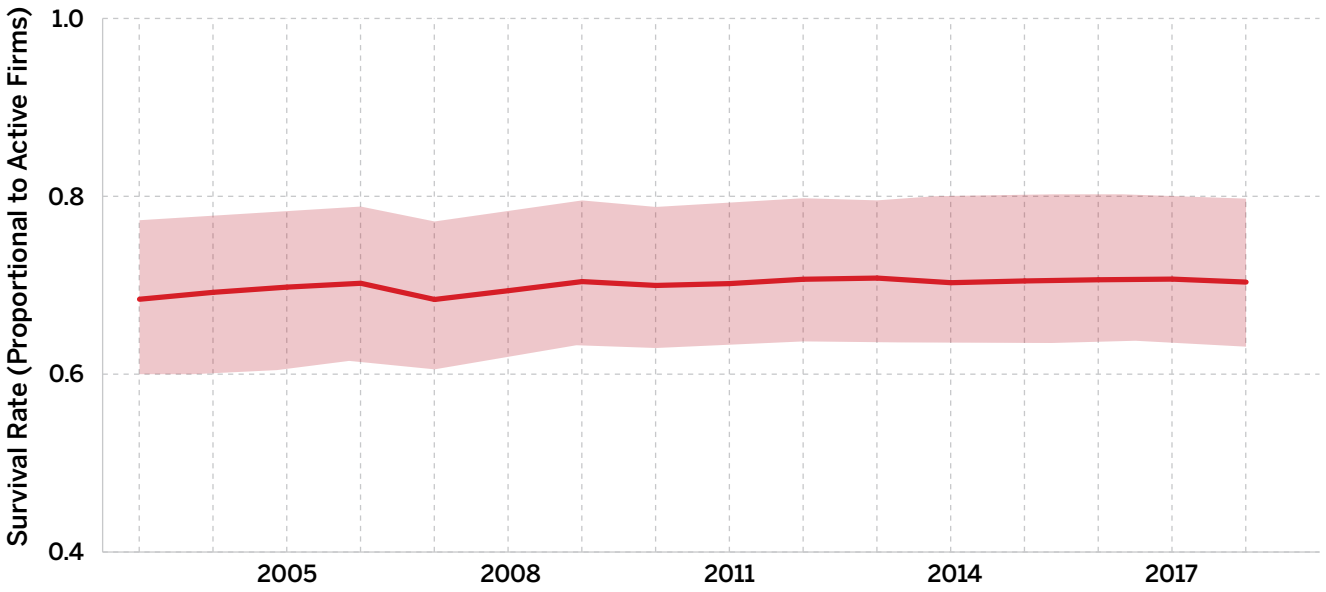
[3] We list the number of industries with redacted output. Statistics Canada did not release output for certain industries in some years in order to protect the confidentiality of firms in the data. Data is withheld when there are too few firms in an industry to maintain confidentiality, or one or a few firms are dominant in the output. As such it is reasonable to assume these industries would fall within the highly-concentrated group in years with redacted data.

We also assess an alternative long-term measure of entry and exit. This method recorded firms who became active after being inactive[4] for 3 previous years (long-term entry) and where active firms became and remained inactive for 3 subsequent years (long-term exit).[5] A significant amount of this data at the 4-digit NAICS level are withheld for confidentiality. We find that the trends are similar where data was available for both methods of calculating entry and exit. This confirms our observation of reduced industry dynamism.

Survival rates have risen slightly overall

We look at revenue-weighted survival rates between 2005 and 2020. We see a modest increase in survival rates between 2001 and 2020. See Figure C2.

Figure C2: Average survival rate from 2005 to 2020 for all industries*



*Average of industry survival rate weighted by industry revenue. The shaded red area indicates +/- 1 standard deviation from the mean. This represents the range where approximately 68% of the industry level data lies within any given year.

[4] Or who did not exist in the data.

[5] This allows us to account for industry dynamics beyond short term entry and exit.

More specifically, we find that the revenue-weighted survival rate between 2005 and 2020 has increased by 2.9% (from 68.4% to 70.4%). See Table C5.

Table C5: Change in survival rate from 2005 to 2020 for all industries (4-digit NAICS)

Survival Rate in 2005	Survival Rate in 2020	Change in Survival Rate (Percentage Points)
68.4%	70.4%	+2.0

Table C6: Significance of survival rate trend for all industries (4-digit NAICS)

	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in survival rate	195	57.7%	58.9%
Decrease in survival rate	35	10.4%	9.7%
No meaningful change	84	24.9%	25.0%
Could not measure trend[3]	24	7.1%	6.3%

To verify that survival rates have increased in general, we assessed the industry level time-trend in survival rates from 2005 to 2020 in Table C6. We found that 57.7% of industries (58.9% revenue share) saw a meaningful increase in the survival rate.

Appendix D: Cost Disadvantage Ratio (CDR)

COMPETITION WITHIN A MARKET FUNCTIONS WELL WHEN INCUMBENTS ARE CONTINUALLY CONTESTED BY POTENTIAL NEW ENTRANTS. A PRECONDITION FOR THIS IS THE ABILITY FOR AN ENTRANT TO ENTER A MARKET AND TO DO SO AT SUFFICIENT SCALE. BARRIERS TO ENTRY MAY RESTRICT POTENTIAL COMPETITORS FROM GAINING ACCESS TO A MARKET THUS GIVING INCUMBENTS THE FLEXIBILITY TO RAISE PRICES ABOVE COST. BARRIERS TO ENTRY CAN INCLUDE THINGS LIKE REGULATION, AND THE PRESENCE OF ECONOMIES OF SCALE.

The presence of economies of scale can give a cost advantage to the incumbent. If incumbents are operating at the minimum efficient scale, they are able to spread fixed costs over a larger amount of output thus lowering their per-unit costs.[1] However, a new firm may be producing at a higher per-unit cost relative to incumbents and therefore discouraged from entering industries with high economies of scale. This difference in per-unit costs can be measured by the cost disadvantage ratio (CDR).

To measure the CDR, we would ideally have variations in average unit costs. However, under certain circumstances, value-added per worker provides an inverse measure of variations in unit costs.[2,3] Caves et al. (1975) suggest computing the CDR as the ratio of the value added per worker in the smallest 50% of firms to the value added per worker in the largest 50% of firms.[4]

METHODOLOGY

The CDR measures the economies of scale in an industry by comparing the efficiency of larger firms to their smaller rivals. We use the National Accounts Longitudinal Microdata File (NALMF) dataset to estimate the cost-disadvantage ratio from 2001 to 2018 for each 3-digit North American Industry Classification System (NAICS) industry.[5] To account for common ownership, we use the ultimate parent ID as our unit of observation instead of the enterprise ID. To construct our dataset, we implement the following data cleaning procedure:

1. In the NALMF dataset, several observations are missing the NAICS industry code. We fill these missing NAICS codes in a year with the value from a prior or subsequent year, where available. If the NAICS code is missing for a firm throughout the entire period, the firm is excluded from our analysis.

2. We combine firms that have different enterprise ID but the same ultimate parent ID. In doing so, we sum over their related variables (including sales, value-added, and labour force) so that we end up having one observation for each ultimate parent ID and NAICS pair for each year.

3. We only keep active firms. We define an active firm as any firm that has strictly positive sales of goods and services and has an average annual labour force greater than 1.[6] We drop any firms with missing variables for average annual labour or sales of goods and services.

---

1 Porter, M. E. (2008), "The five competitive forces that shape strategy." *Harvard business review*, *86*(1), 78.

2 Caves, R. E., Khalilzadeh-Shirazi, J., & Porter, M. E. (1975), "Scale economies in statistical analyses of market power." *The Review of Economics and Statistics*, 133-140.

3 Some of these specific circumstances include: firms produce homogenous products (or have similar production functions), capital/labour proportions are constant across firms, and wage rates and labour quality must not vary with scale.

4 See also Dunning, J. H. (1973), "The determinants of international production." *Oxford economic papers*, *25*(3), 289-336.

5 We compute the CDR at the 3-digit NAICS level since CDR at the 4-digit NAICS was not released by Statistics Canada for certain industry-year pairs.

6 We use variable PD7_AvgEmp_12 (average employees reported from PD7s) as the measure of average labour of each firm. Average labour above 1 in a given year allows us to avoid extreme values of $ValueAddedPerWorker_{it}$ as a result of near zero employment costs. PD7 data come from a monthly tax form which allows us to capture changes in numbers of employees or payroll throughout the year.

4. To construct our indicator variable, the firms for each year and 3-digit NAICS code are first sorted based on their sales. We then divide the firms into two groups: a group of smaller firms in terms of sales of goods and services that make up 50% of the total industry sales (indicated by variable ($I_{it_{below\ 50\%}} = 1$), and a group of larger firms that covers the other 50% of the total industry sales (indicated by variable ($I_{it_{above\ 50\%}} = 1$)).

5. To maintain the confidentiality of individual firms, if the number of large firms (those with $I_{it_{above\ 50\%}}$=1) is less than 10, we place the largest 10 firms into the group of larger firms.

6. The dependent variable of our regression equation is calculated as the value added per worker using the sum of T4 payroll and capital income (value_added_WW) and dividing by the mean of monthly employment submissions (PD7_AvgEmp_12) from the NALMF dataset.

7. Following Caves et al. (1975) we estimate the CDR by running the following regression

$$\text{ValueAddedPerWorker}_{it} = \sum_{j} \left(\beta_{1jt} I_{it_{above\ 50\%}} \times j_{it} + \beta_{2jt} I_{it_{below\ 50\%}} \times j_{it}\right) + \epsilon_{it}$$

where i indexes firms, j indexes NAICS codes, and t indexes years. In this regression, j_{it} is an indicator for whether firm i is operating in industry j in year t. $I_{it_{above\ 50\%}}$ ($I_{it_{below\ 50\%}}$) is a metric that determines if firm i is part of the set of large (small) firms based on its sales, which represent half[7] of the total market share in industry j.

8. CDR is then calculated as

$$\widehat{CDR_{jt}} = \frac{\widehat{\beta_{2jt}}}{\widehat{\beta_{1jt}}}$$

which is intuitively the average value added per worker for smaller firms divided by the average value added per worker for larger firms. Assuming larger firms are more cost-efficient, it is expected that this ratio will be less than 1.

9. We use the delta method to estimate the standard error of CDR. Specifically, let $\widehat{\beta_1}, \widehat{\beta_2}, \widehat{v_1}, \widehat{v_2}$ be the estimated coefficients and their variance. The estimated variance of $\widehat{CDR} = \frac{\widehat{\beta_2}}{\widehat{\beta_1}}$ is then calculated as:[8]

$$\widehat{\text{var}(CDR)} = \left(\frac{1}{\widehat{\beta_1}}\right)^2 \widehat{v_2} + \left(\frac{-\widehat{\beta_2}}{(\widehat{\beta_1})^2}\right)^2 \widehat{v_1}$$

DETAILED FINDINGS

For the remainder of this section we report the reciprocal of the CDR ($\frac{1}{CDR}$). We have done the same in the main report. This adjustment makes the CDR increasing in the degree of economies of scale. Values appearing at the upper end of the distribution represent industries with large economies of scale whereas industries at the lower end of the distribution have small economies of scale.

[7] In order to maintain the confidentiality of specific firm information, we have modified this definition slightly in some cases, by taking the top 10 firms when fewer than 10 firms make up more than 50% of industry share.

[8] The covariance term in delta method equals zero, due to the fact that the regressors are dummies and add up to one.

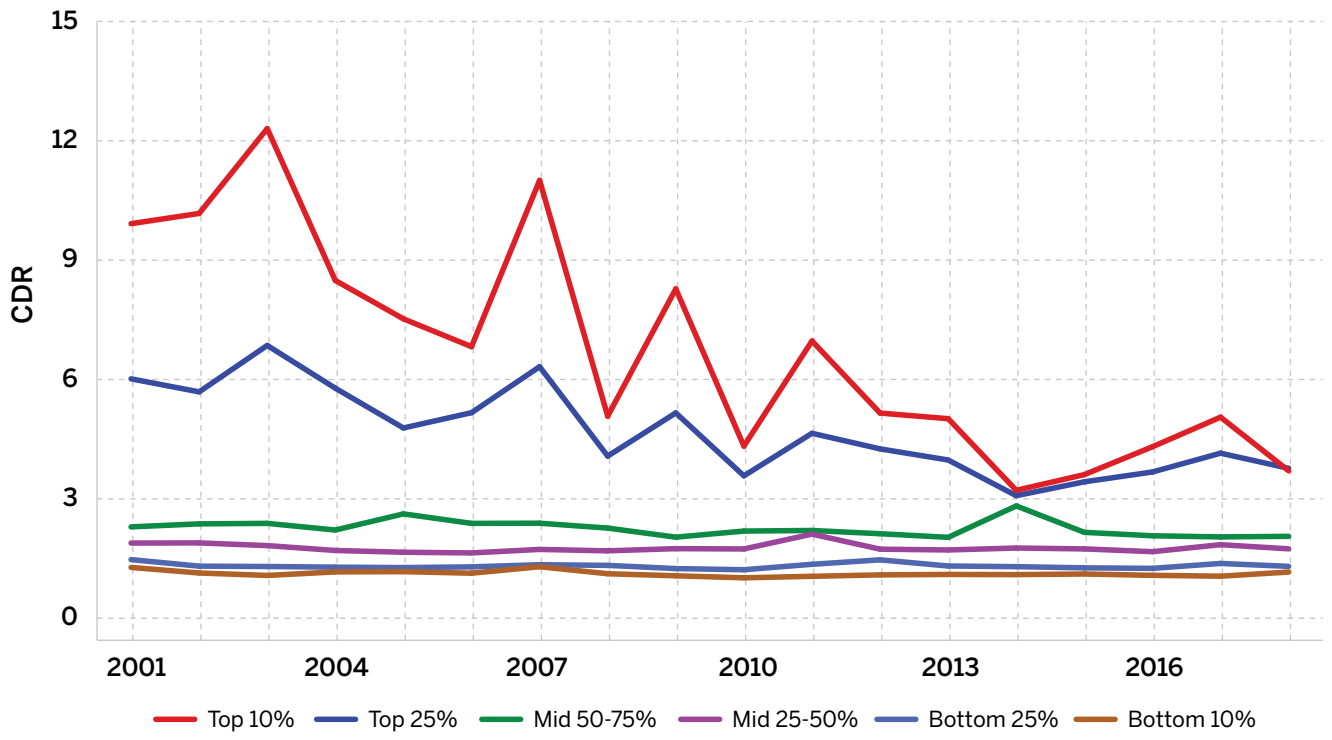
Economies of scale declined overall

By grouping industries by their mean reciprocal CDR over the entire period from 2001 to 2018, we can track and compare the change in reciprocal CDR for those industries that have higher economies of scale with those industries that have lower economies of scale. Figure D1 shows the change in reciprocal CDR for industries grouped by their mean reciprocal CDR over the whole sample. We group industries into four quartiles (top 25%, middle 50% to 75%, middle 25% to 50%, and bottom 25%) as well as the top and bottom 10%.

We are especially interested in assessing how reciprocal CDR has evolved in industries that have large economies of scale. These are likely the industries with high barriers to entry.

We observe an overall decrease in the reciprocal CDR for industries with high economies of scale, namely the top quarter of industries, ranked by concentration, and within that group, for the top 10% of industries.

Figure D1: Average annual reciprocal CDR from 2001 to 2018 for industries that are grouped by high to low economies of scale



More specifically, the reciprocal CDR for the groups of industries with highest economies of scale (Top 10%) decreased from 9.92 to 3.70 (-62.64%) from 2001 to 2018, and for the Top 25% decreased from 6.02 to 3.77 (-37.38%) over this period. This suggests that the cost advantage larger firms possess relative to smaller firms due to economies of scale in these industries is shrinking. As economies of scale decrease, new firms do not need to reach as large a size in order to compete against larger existing firms. That may signal lower barriers to entry and an improved competitive position for potential entrants. However, we did not see corresponding rising entry rates during this period.

Table D1: Change in reciprocal CDR from 2001 to 2018 for industries in different distributional groups (3-digit NAICS)

Group	Reciprocal CDR in 2001	Reciprocal CDR in 2018	Change in Reciprocal CDR
Top 10%	9.92	3.70	-6.21
Top 25%	6.02	3.77	-2.25
Mid 50-75%	2.30	2.06	-0.24
Mid 25-50%	1.89	1.74	-0.15
Bottom 25%	1.47	1.30	-0.17
Bottom 10%	1.28	1.16	-0.12

To further verify that the reciprocal CDR has decreased in general, we assessed the industry level time-trend in reciprocal CDR from 2001 to 2018.[9] We found that 21% of industries (22% revenue share) saw a meaningful decline in the reciprocal CDR between 2001 and 2018.

Table D2: Significance of reciprocal CDR trend for all industries (3-digit NAICS)

Trend Direction	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in reciprocal CDR	16	15.2%	14.0%
Decrease in reciprocal CDR	22	21.0%	22.1%
No meaningful change	59	56.2%	45.5%
Could not measure trend[10]	8	7.6%	18.4%

Although only 21.0% of industries have a decreasing trend coefficient, we see that the overall decrease is largely driven by industries in the top 25%.

Efficiency is not driving concentration

Of the top 10% most concentrated industries by HHI, none exhibit meaningful increases in reciprocal CDR over time. As a result, we conclude that the most concentrated industries are not becoming more concentrated due to increases in relative efficiency from the largest firms.

[9] One way to assess the evolution of the measure over time is to examine the trend coefficients estimated from a regression of the 3-digit NAICS CDR measures, $(y_t^{(i)})$, on a constant term and time trend for each NAICS as in the equation below, where $\alpha^{(i)}$ and $\beta^{(i)}$ are computed for each 3-digit NAICS (i) when sufficient data is available (at least two years of data for each industry).

$$y_t^{(i)} = \alpha^{(i)} + \beta^{(i)} \times t + \epsilon_t^{(i)}$$

An industry's time trend was meaningful if it was statistically significant at the 5% level.

[10] Statistics Canada did not release output for certain industries in some years in order to protect the confidentiality of firms in the data. Data is withheld when there are too few firms in an industry to maintain confidentiality, or one or a few firms are dominant in the output. As such it is reasonable to assume these industries would fall within the highly-concentrated group in years with redacted data.

Appendix E: Markups

FIRMS SET PRICES THAT INCORPORATE THEIR COSTS AND REFLECT COMPETITIVE PRESSURE FROM RIVAL FIRMS.

In the absence of competitive pressure, firms may have market power and the ability to raise prices. Price-cost markups are a direct measure of market power and can identify industries where competition is lacking. Although markups are a standard tool for assessing market power, they do not provide a complete picture when considered independently from other measures. For example, price-cost markups may not reflect things like non-price competition and capacity constraints.

Methodology

We use the National Accounts Longitudinal Microdata File (NALMF) dataset to estimate firm-level markups from 2002 to 2018. To construct our dataset we applied certain data cleaning processes.

First, in the NALMF dataset, several observations are missing the North American Industry Classification System (NAICS) industry code. We fill missing NAICS in a year with the value from a prior or subsequent year, where available. If the NAICS code is missing for a firm throughout the entire dataset, the firm is excluded from our analysis. Second, we only keep firms with strictly positive and non-missing revenues.

We also incorporate GDP deflators using sector-year specific GDP and real GDP sourced from Statistics Canada.[1] For each sector and each year, sector GDP divided by sector real GDP yields the deflator.

Next, we construct the key variables used in the markup calculations. Specifically, the wage bill is proxied by total payroll for the firm, revenue is proxied by the variable total sales of goods and services,[2] employment is proxied by the mean of all monthly employment submissions, the capital stock is proxied by the sum of total tangible capital assets and the total accumulated amortization on tangible capital assets, overhead expenditure is proxied by total operating expenses, and investment is proxied by the sum of net investment in buildings and net investment in machinery and equipment. We only keep active firms in our analysis.[3]

We calculate the market share of each firm in its 4-digit NAICS in each year. (This corresponds to the variable z in the model below, i.e., an output market factor that generates variation in factor demand across firms). We then merge in the GDP deflators at the 4-digit sector-year level to deflate all nominal values to real values. We follow De Loecker et al. (2020) and only use GDP deflators rather than different deflators for different variables such as revenue and investment.

Next, we only keep firms with a strictly positive wage bill[4] and take the logarithm of revenue, capital stock, and employment, dropping observations with missing values for any of the logged variables. In other words, only observations with strictly positive revenue, capital stock, and employment are retained. We further take the logarithm of overhead expenditure and investment, but we do not drop observations with missing logged overhead expenditure and/or investment. We will drop them only when we implement the two-step or one-step approach, because the overhead expenditure (investment) variable will be used only in the two-step (one-step) approach.

[2] Compared to other variables in the data that can proxy revenue (such as total_revenue), sales of goods and services more directly corresponds to the notion of $price \times quantity$.

[3] The specific variables used are in order that they appear in the text: T4_Payroll, sales_goods_and_services, PD7_AvgEmp_12, total_tangible_assets, tot_acum_amort_tangible_assets, total_operating_expenses, investment_BLDG, investment_ME, and the BusinessStatusCode.

[4] In our data, there are no firms with negative or zero wage bill.

Three further remarks are helpful. First, the calculation of market shares is performed at the beginning before dropping observations with missing logged variables as market share should be computed using all available data. Dropping observations would have the effect of overestimating firm-level market shares. Second, we only keep observations with at least one employee.[5] Third, the wage bill will only be used to calculate a variable representing a share, so there is no need to take its logarithm.

Next, we proceed to the markup calculations. We follow two approaches to computing markups: the De Loecker and Warzynski (2012)[6] two-step approach and the Olley and Pakes (1996)[7] one-step approach. These two approaches compute the numerator of the estimated markups calculation.

Estimating Output Elasticity of the Variable Input: De Loecker and Warzynski (2012) Two-step Approach (DLW)

At the beginning of the two-step approach, we drop observations with missing log overhead expenditure (but we disregard log investment). Our coding for this approach follows mostly the replication code for the original De Loecker-Warzynski paper, with two small deviations due to specific features of our data.

1. We calculate the per capita wage bill of each firm in each year, which is wage bill divided by employment. Then, in each 4-digit NAICS, we drop outlier observations with per capita wage bill in the top or bottom 2%.[8] Dropping these outlier firms with extreme values of per capita wage bill likely excludes firms with many non-producing employees (e.g., managers) or an outsize proportion of part-time workers. This is consistent with the intention of our measure of employment capturing the adjustable part of firms' workforce.

2. We use the coefficients from an OLS regression as the starting values for the GMM estimation to facilitate convergence.

De Loecker et al. (2020)[9] show the markup (price over marginal cost) of a firm in a year is:

$$\mu_{it} = \theta_{it}^{v} \frac{P_{it}Q_{it}}{P_{it}^{V}V_{it}},$$

where V_{it} is the number of units of a variable input (e.g., labour), P_{it}^{V} is the price of input V_{it}, $P_{it}Q_{it}$ is revenue, and θ_{it}^{v} is the output elasticity of the variable input. θ_{it}^{v} must be obtained by estimating a production function. The variable input is something the firm can adjust easily, which, in the case of De Loecker et al. (2020), is the cost of goods sold or employment.

We restrict θ_{it}^{v} to be the same through time for firms within a 4-digit NAICS (hence we add subscript *s* to represents a 4-digit NAICS and drop subscript *t*) but allow it to vary flexibly across sectors. A firm's production function can be represented as

$$y_{it} = \theta_{s}^{v} v_{it} + \theta_{s}^{k} k_{it} + \theta_{s}^{x} x_{it} + \omega_{it} + \epsilon_{it},$$

where lower-case variables mean logged quantities (e.g., $y_{it} = \ln(Y_{it})$), ω_{it} captures unobserved productivity shocks and ϵ_{it} captures measurement errors. y_{it} is revenue, v_{it} is employment, k_{it} is capital stock, and x_{it} is overhead expenditure. The standard approach to dealing with endogeneity (i.e., input choices may be functions of innovations in the productivity shock) is to use a control function. We let the productivity shock be a flexible function of states and controls

5 In the data, employment can be smaller than one, likely due to firms only hiring on a part-time basis.

6 De Loecker, J. and Warzynski, F. (2012), "Markups and Firm-Level Export Status." *American Economic Review*, 102 (6): 2437-71.

7 Olley, S. and Pakes, A. (1996), "The dynamics of productivity in the telecommunications equipment industry." *Econometrica,* 62(6), 1263-1297.

8 This cleaning is not needed for most sectors, but without it, for some sectors the markup calculation would result in non-convergence of the objective function, and/or negative output elasticity.

9 De Loecker, J., Eeckhout, J., and Unger, G. (2020), "The Rise of Market Power and the Macroeconomic Implications." *The Quarterly Journal of Economics,* 135(2) 561-644.

$$\omega_{it} = h_t(d_{it}, k_{it}, z_{it}),$$

where d_{it} is a static choice of the firm (either cost of goods sold as in Olley and Pakes or investment as in Ackerberg et al. (2015))[10] and z_{it} are controls which capture shifts in output and input markets. DLW is a two-step approach where we consider $d_{it} = v_{it}$, leading us to a nonparametric production function

$$y_{it} = \phi_t(v_{it}, k_{it}, z_{it}, x_{it}) + \epsilon_{it}.$$

We assume that the productivity shock evolves according to a first-order Markov process, i.e., $\omega_{it} = g(\omega_{it-1}) + \xi_{it}$. We first estimate the function ϕ_t, and recover productivity as $\omega_{it} = \phi_t - \theta_s^v v_{it} - \theta_s^k k_{it} - \theta_s^x x_{it}$. The structural parameters θ (θ_s^v , θ_s^k and θ_s^x) can be estimated using the following moment conditions:

$$E\left(\xi_{it}(\theta)\begin{bmatrix} v_{it-1} \\ k_{it} \\ x_{it} \end{bmatrix}\right) = 0$$

Estimating Output Elasticity of the Variable Input: Olley and Pakes (1996) One-step Approach (OP)

The Olley-Pakes one-step approach is straightforward and can be implemented using a single regression. To note: at the beginning of this approach, we drop observations with missing log investment (but we disregard log overhead expenditure).

Olley and Pakes (1996) use investment as control and assume that investment decisions do not affect the productivity shock. Ackerberg et al. (2015) show that this can be estimated in a single step using nonlinear least squares:

$$y_{it} = \theta_{st}^v v_{it} + \theta_{st}^x x_{it} + \phi_t(i_{it}, k_{it}, z_{it}) + \epsilon_{it}.$$

Note that in the one-step approach, due to its simplicity, we can allow the output elasticity to vary by year as well. We let z_{it} be market share and ϕ_t be a set of polynomial basis functions.

Computing Markups

The various inputs into the markup calculations are computed as follows:

1. For both methods we compute the firm-specific input share of labour relative to total revenues $\left(\frac{P_{it}Q_{it}}{P_{it}^V V_{it}}\right)$.

2. In the DLW methodology, we compute θ_s^v for each 4-digit NAICS industry. This parameter does not vary over time. The same parameter is assigned to each firm within the 4-digit NAICS industry.

3. In the OP methodology, we compute θ_{st}^v for each 4-digit NAICS industry and time period. The parameter is assigned to each firm within a given s and t pair.

4. Markups are computed as follows:

$$\hat{\mu}_{it} = \widehat{\theta_{it}^v} \frac{P_{it}Q_{it}}{P_{it}^V V_{it}}$$

LIMITATIONS

Since marginal cost is not observable in tax data, we rely on the DLW and OP approaches to estimate markups using an estimated production function. Although these methodologies allow us to calculate markup without marginal cost, there are a number of potential limitations.

[10] Ackerberg et al. (2015), "Identification Properties of Recent Production Function Estimators." *Econometrica*, 83(6), 2411-2451.

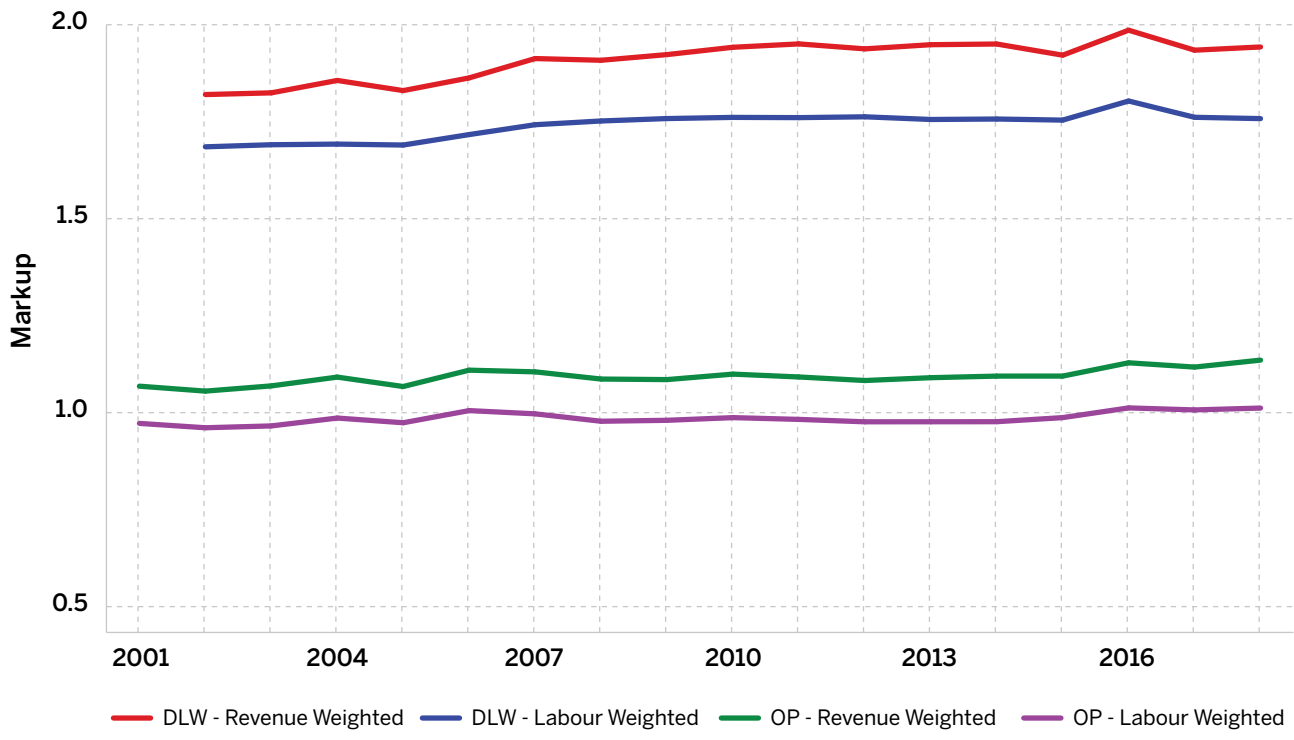
Doraszelski and Jaumandreu (2021)[11] criticize the approach of De Loecker and Warzynski (2012) for measuring markups from production function data. They point out that the DLW method is not robust to differences in demand across firms or time unless they are observed by the econometrician. Another paper by Bond et al. (2021)[12] explores identification and estimation challenges with computing markups using the ratio estimator. In terms of identification, the ratio estimator does not reflect markups if revenue elasticity is used instead of output elasticity or if the inputs used are neither fully fixed nor fully flexible. Furthermore, even when observing quantity and prices, it can also be challenging to estimate output elasticity when firms face different demand schedules and non-linear productivity dynamics.

Despite these limitations, researchers have pointed out that as long as the true and estimated production functions do not change over time—a standard assumption in the literature—changes or trends in markups are identified and can be consistently estimated. It can be shown that percentage change in estimated markups reflect the percentage change in true markups. It therefore makes most sense to consider percentage changes in estimated markups.[13]

Trends in markups are robust to the estimation model used

In Figure E1 and E2 we present the markups from the OP and DLW methodologies using both revenue and labour weights. The most important thing to note is that the choice of weighting scheme does not impact the trends and variation within the data. For the DLW and OP approach, the revenue- and labour-weighted series exhibit similar co-movements. The primary difference between the OP and DLW approach is that their respective levels differ meaningfully, which has been documented in the literature.[14] However, for our purposes, we are mostly focused on the evolution of markups over time and the choice of the weighting scheme and the underlying methodology does not meaningfully impact our conclusions.

Figure E1: Average annual markup from 2001 to 2018 by methodology and by weighting procedure



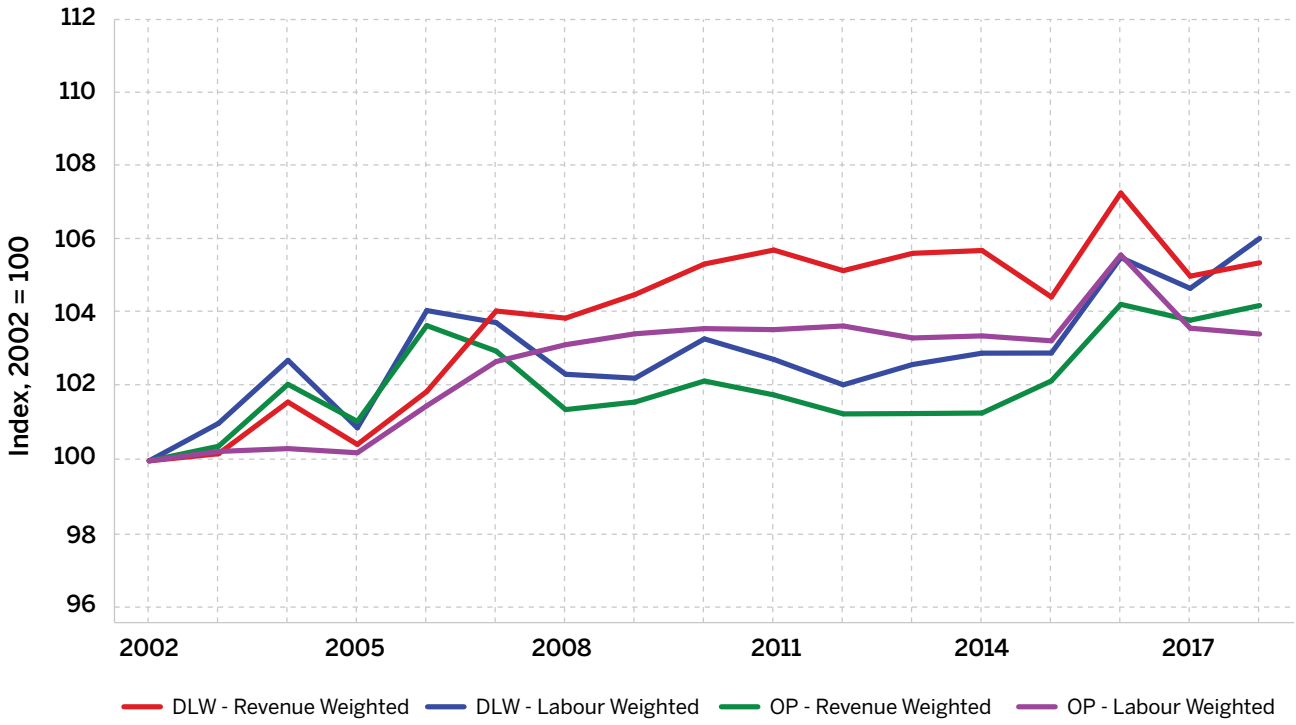
[11] See Doraszelski, U. and Jaumandreu, J. (2021), "Reexamining the De Loecker & Warzynski (2012) Method for Estimating Markups." CEPR Discussion Paper No. DP16027

[12] Bond, S., Hashemi, A., Kaplan, G., & Zoch, P. (2021),"Some unpleasant markup arithmetic: Production function elasticities and their estimation from production data." *Journal of Monetary Economics*, 121, 1-14.

[13] See Hambur, J. (2021), "Product market power and its implications for the Australian economy" *Treasury Working Paper*, 30-31.

[14] Ibid.

Figure E2: Indexed trend in average markup from 2002 to 2018 by methodology and by weighting procedure (Index, 2002 = 100)



The evolution of markups is robust to various methods of classifying groups

We find that markups are increasing across the distribution of industries, and increasing faster in industries with high markups. We assign 4-digit NAICS industries into groups by their mean markup over the whole sample. We group industries into four quartiles (top 25%, middle 50% to 75%, middle 25% to 50%, and bottom 25%) as well as the top and bottom 10%. In Figure E3, we present average revenue-weighted markups by groups using the DLW approach. Indexing to 100 in 2002 helps us compare the evolution of average markups over time without focusing on the level. As stated earlier, the evolution of markups is very similar regardless of the methodology or weighting scheme used.

Figure E3: Indexed trend in average markup from 2002 to 2018 for industries that are grouped by average markup

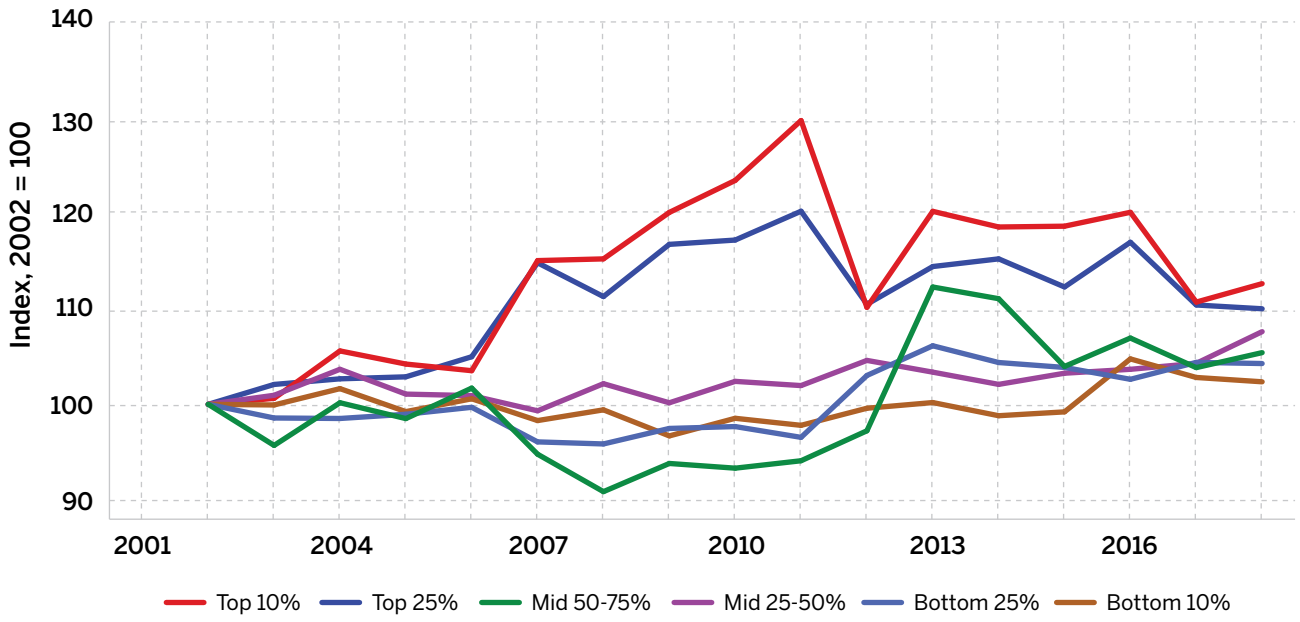


Table E1: Change in markup from 2002 to 2018 for industries in different distributional groups

Group	DLW Indexed Markup in 2002 (2002 = 100)	DLW Indexed Markup in 2018 (2002 = 100)	Change in Indexed Markup (Percent)
Top 10%	100	112.5	12.5%
Top 25%	100	109.9	9.9%
Mid 50-75%	100	107.6	7.6%
Mid 25-50%	100	102.3	2.3%
Bottom 25%	100	104.2	4.2%
Bottom 10%	100	105.4	5.4%

Another way to assess the evolution of markups over time is by looking at the 4-digit NAICS specific trend coefficients.

Table E2: Significance of markup trend for all industries (4-digit NAICS)

	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in markup	55	16.3%	8.2%
Decrease in markup	25	7.4%	13.3%
No meaningful change	183	54.1%	50.4%
Could not measure trend [15]	75	22.2%	28.1%

We find that a large share of industries have seen no meaningful[16] increase. For another group of industries, we did not have enough observations (markups for a particular year for this industry) to conclude whether markups were increasing or decreasing.[17]

Nonetheless, we see a small increase in markups overall and markups have been increasing in more industries than decreasing. We have additional confidence in this trend given that it is consistent with trends that we observed in our measure of profits.

[15] Statistics Canada did not release output for certain industries in some years in order to protect the confidentiality of firms in the data. Data is withheld when there are too few firms in an industry to maintain confidentiality, or one or a few firms are dominant in the output. As such it is reasonable to assume these industries would fall within the highly-concentrated group in years with redacted data.

[16] One way to assess the evolution of the measure over time is to examine the trend coefficients estimated from a regression of the 4-digit NAICS markup measures, $(y_t^{(i)})$, on a constant term and time trend for each NAICS as in the equation below, where $\alpha^{(i)}$ and $\beta^{(i)}$ are computed for each 4-digit NAICS (i) when sufficient data is available (at least two years of data for each industry).

$$y_t^{(i)} = \alpha^{(i)} + \beta^{(i)} \times t + \epsilon_t^{(i)}$$

An industry's time trend was meaningful if it was statistically significant at the 5% level.

[17] Missing observations were the result of Statistics Canada vetting that redacted certain outputs for some 4-digit NAICS codes with only a few firms or if a single firm was over-represented in the output.

Appendix F: Profits

WHEN FIRMS HAVE TO COMPETE AGGRESSIVELY AGAINST THEIR RIVALS, THEY FACE PRESSURE TO KEEP THEIR PRICES LOW. SO WE DON'T EXPECT THEM TO EARN SUBSTANTIALLY HIGHER PROFITS. LOOKING AT TRENDS IN PROFITS CAN GIVE US SOME INSIGHT INTO THE PRESSURES FIRMS FACE TO KEEP THEIR PRICES, AND THEREFORE THEIR PROFITS, LOWER IN ORDER TO COMPETE AGAINST THEIR RIVALS.

Profit information was provided to us in custom tabulations by Statistics Canada. The return on sales (ROS) is defined as a firm's operating profits divided by its revenue. Operating profits are earnings from operations before interest and taxes (EBIT).[1]

Statistics Canada provided tabulations of profit indicators for the years 2000 to 2020 using the National Accounts Longitudinal Microdata File (NALMF) dataset as well as the General Index of Financial Information (GIFI).[2]

METHODOLOGY: RETURN ON SALES (ROS)

To construct our dataset, we applied certain data cleaning procedures.

1. First, in the NALMF dataset, several observations are missing the North American Industry Classification System (NAICS) industry code. We fill missing NAICS codes in a year with the value from a prior or subsequent year, where available. If the NAICS code is missing for a firm throughout the entire dataset, the firm is excluded from our analysis. Second, we only keep firms with strictly positive revenues.

2. The ROS was calculated for each firm at the enterprise ID level, and we drop the top and bottom 1% of firms as outliers. For each industry, we take the simple means and the means by percentiles of revenue (as defined below) throughout the distribution of firm size as shown below.

3. For each industry-year, we categorize firms into six groups by revenue:[3] top 10%, top 25%, top 50%, bottom 50%, bottom 25%, and bottom 10%. For each industry-year-group, we calculate the average ROS as the firm-level average operating profits ($capital\ cost + profit$) divided by revenues.[4]

[1] We also assessed an alternative measure of profits, the return on capital employed (ROCE). However, results based on the ROCE were volatile, exhibited some economically unreasonable values, and lacked interpretability.

[2] See Statistics Canada's website for further information on the GIFI.

[3] Revenue is calculated as the sum of farm_total_revenue and total_revenue. Statistics Canada breaks down total revenues for firms into farm and non-farm revenue.

[4] Capital cost has been defined as the sum of the following lines of the General Index of Financial Information (GIFI): L8404, L8405, L8410, L8411, L8412, L8435, L8436, L8437, L8438, L8439, L8440, L8441, L8456, L8457, L8459, L8460, L8522, L8570, L8571, L8590, L8610, L8611, L8650, L8670, L8711, L8712, L8713, L8714, L8760, L8761, L8762, L8764, L8790, L9180, L9277, L9278, L9282, L9283, L9286. Profit has been defined as the sum of L8089, L8100, L8101, L8102, L8103, L8120, L8121, L8140, L8141, L8142, L8160, L8161, L8162, L8163, L8164, L8165, L8239, L8240, L8241, L8243, L8244, L8245, L8246, minus L8518, L9367.

CONFIDENTIALITY

We received output for ROS at the 4-digit, 3-digit, and 2-digit NAICS levels for the distributional groups specified above. Statistics Canada did not provide some output for certain industries in certain years in order to protect the confidentiality of firms in the data.

INTERPRETATION CONSIDERATIONS

The ROS is an indicator of how much profit is made after paying for the variable cost of production. However, due to the cost reporting used to build the underlying dataset we rely on, some fixed costs may be systematically misclassified as variable and affect our numerator, which could affect comparability between industries or between firms within an industry if they differ in their cost structure.[5]

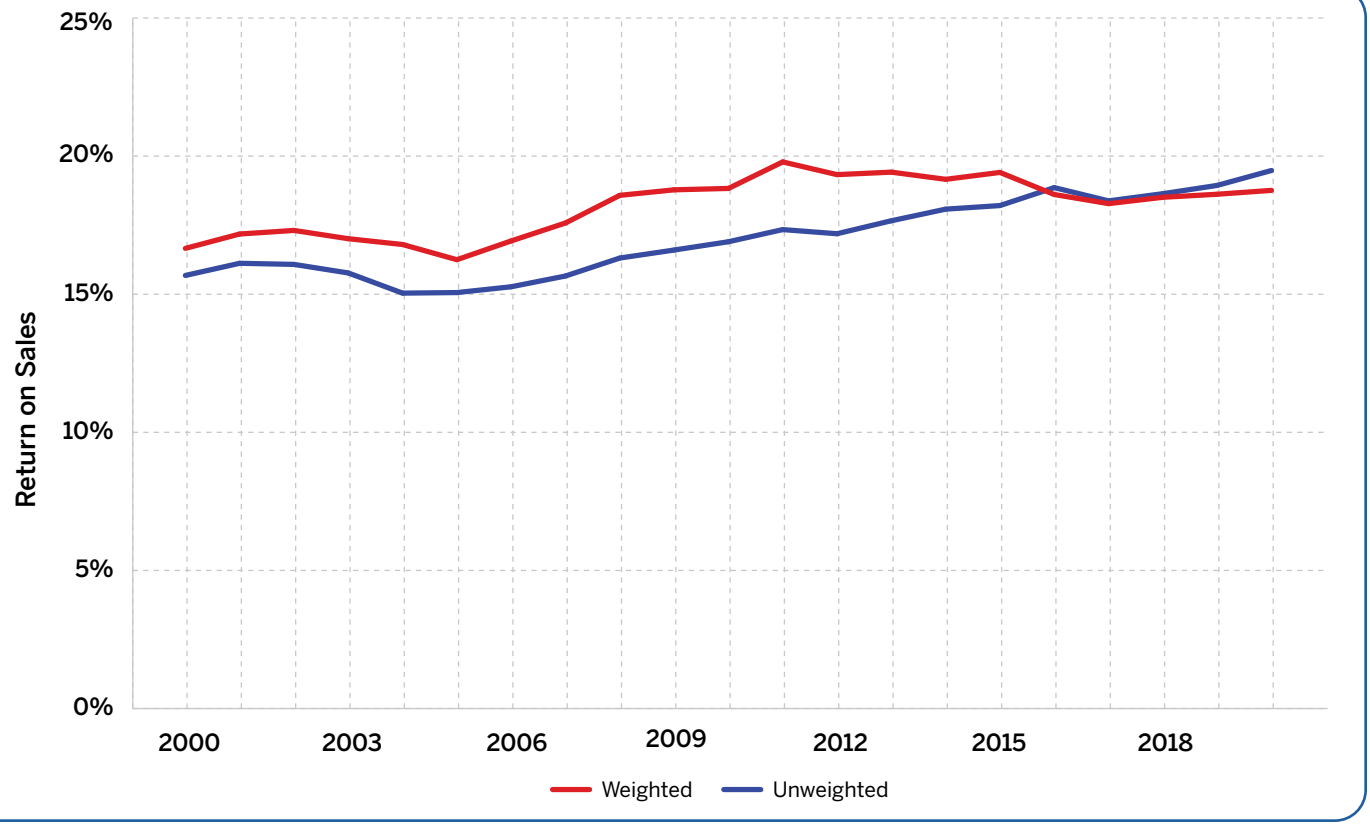
Consequently, it may be more informative to consider trends in profits, especially in combination with trends in markups.

DETAILED FINDINGS

Industries are becoming more profitable on average

On average, ROS increased for all industries over this time period. The revenue-weighted average (weighting ROS for each industry by its share of all industry revenues) shows an increase in ROS of more than 12.5% or 2 percentage points, while the unweighted average shows an increase in ROS of more than 24% or nearly 4 percentage points. This can be seen in Figure F1.

Figure F1: Average revenue-weighted and unweighted returns on sales from 2000 to 2020 for all industries



[5] Consider two industries which have different ratios of variable to fixed costs of production. For the industry with higher fixed costs, variable cost margins would generally be higher than for the industry with lower fixed costs, and vice versa.

Most Industries are becoming more profitable

To further investigate this increase in profits and see whether it occurs in most industries, we assessed the change in profits from 2000 to 2020 for each industry.

We find that the rise in profits is widespread. 68% of industries, representing 74% of total industry revenues exhibit a meaningful[6] increase in mean ROS. Meanwhile, only 3% of industries, accounting for 11% of total industry revenues, have seen a meaningful decrease in ROS.

Table F1: Significance of ROS trend for all industries (4-digit NAICS)

Trend Direction	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in profits	228	67.5%	74.1%
Decrease in profits	10	3.0%	10.5%
No meaningful change	79	23.4%	13.7%
Could not measure trend[7]	21	6.2%	1.7%

Industries with the highest ROS have become more profitable

By grouping industries into 4 quartiles (top 25%, middle 50% to 75%, middle 25% to 50%, and bottom 25%) as well the top and bottom 10% based on their average ROS over the period, we can see in Figure F2 that the most profitable industries have been getting more profitable over the last 20 years.

[6] One way to assess the evolution of the measure over time is to examine the trend coefficients estimated from a regression of the 4-digit NAICS ROS measures in each year t for each industry i, $(y_t^{(i)})$, on a constant term for each NAICS (fixed effects) and time trend as in the equation below, where $\alpha^{(i)}$ and $\beta^{(i)}$ are computed for each 4-digit NAICS (i) when sufficient data is available (at least two years of data for each industry).

$$y_t^{(i)} = \alpha^{(i)} + \beta^{(i)} \times t + \epsilon_t^{(i)}$$

An industry's time trend was meaningful if it was statistically significant at the 5% level.

[7] We list the number of industries with redacted output. Statistics Canada did not release output for certain industries in some years in order to protect the confidentiality of firms in the data. Data is withheld when there are too few firms in an industry to maintain confidentiality, or one or a few firms are dominant in the output. As such it is reasonable to assume these industries would fall within the highly-concentrated group in years with redacted data.

Figure F2: Average annual ROS from 2000 to 2020 for industries that are grouped by average ROS

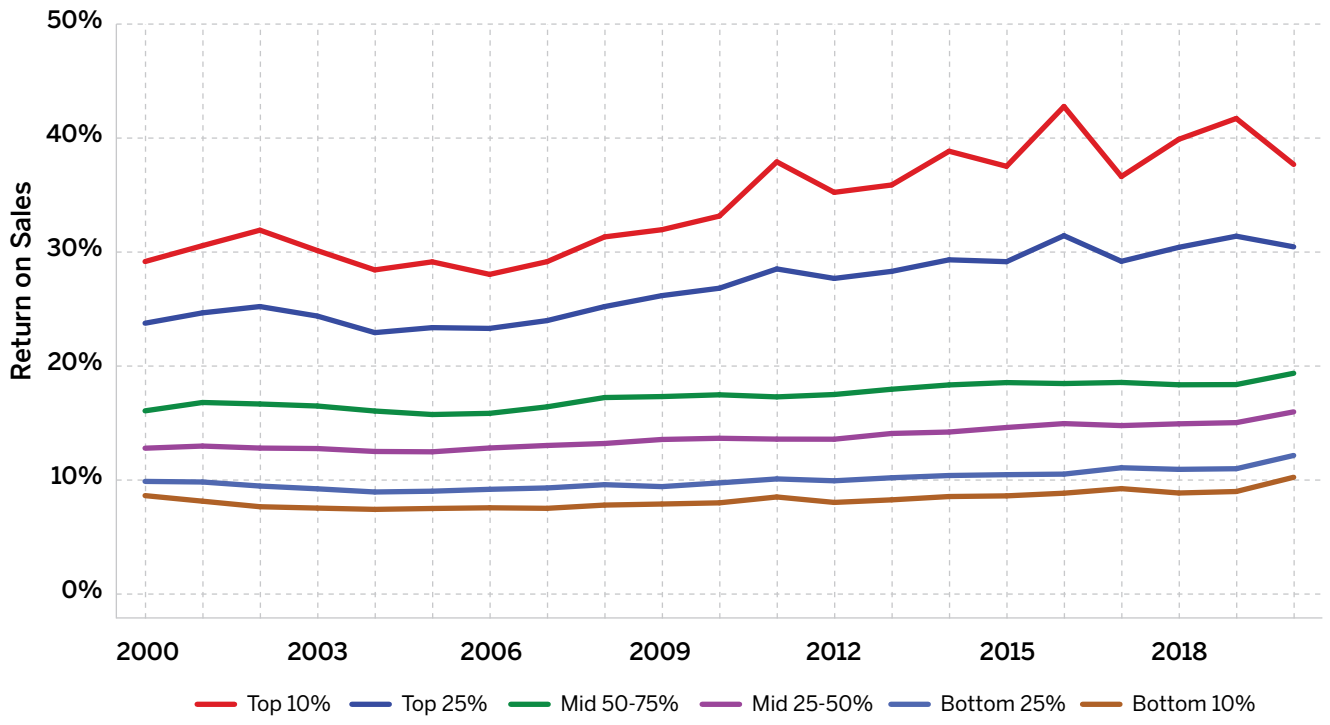


Table F2: Change in ROS from 2000 to 2020 for industries in different distributional groups

Group	ROS in 2000	ROS in 2020	Change in ROS (Percentage Points)
Top 10%	29.2%	37.7%	+8.5
Top 25%	23.8%	30.5%	+6.7
Mid 50-75%	16.1%	19.4%	+3.3
Mid 25-50%	12.8%	16.0%	+3.2
Bottom 25%	9.9%	12.1%	+2.2
Bottom 10%	8.6%	10.2%	+1.6

ROS increased across all distribution groups. The increase was greatest for the top 10% of industries with the highest profits with an increase of 8.5 percentage points (29% growth) and top 25% of industries with the highest profits with an increase of 6.7 percentage points (28% growth).

Appendix G: Boone Indicator

THE BOONE INDICATOR IS A MEASURE FOR EVALUATING THE LEVEL OF COMPETITION IN A MARKET. THE INDICATOR MEASURES THE SENSITIVITY OF A FIRM'S PROFIT TO CHANGES IN ITS MARGINAL COSTS. THE MAIN INTUITION BEHIND THE BOONE INDICATOR IS THAT IN A MORE COMPETITIVE MARKET, INEFFICIENT FIRMS WITH HIGHER COSTS ARE LESS ABLE TO PROFITABLY PASS COST INCREASES ON TO CONSUMERS DUE TO COMPETITIVE PRESSURE FROM MORE EFFICIENT RIVALS. IN A MARKET WITH GREATER MARKET POWER, FIRMS ARE MORE LIKELY TO PASS COST INCREASES ON TO CONSUMERS THROUGH HIGHER PRICES.

METHODOLOGY: BOONE INDICATOR

Following Boone, Griffith, and Harrison (2005),[1] we use the National Accounts Longitudinal Microdata File (NALMF) dataset for 2001 to 2018 and estimate the Boone indicator using the following regression equation:

$$\ln(\pi_{it}) = \alpha_{jt} + \beta_{jt} AVC_{it} + \epsilon_{it}$$

where i indexes firms, j indexes North American Industry Classification System (NAICS) codes, t indexes years, π_{it} is variable profit, and AVC_{it} is the average variable cost. The Boone indicator is β_{jt}, which we estimate for each year and 3-digit NAICS pair.

To account for common ownership, we present results using the ultimate parent ID as our unit of observation instead of the enterprise ID. To construct our dataset, we implement the following data cleaning procedure:

1. In the NALMF dataset, several observations are missing the NAICS industry code. We fill the missing NAICS code in a year with the available value from a prior or subsequent year, where available. If the NAICS code for a firm is missing throughout the entire dataset, the firm is excluded from our analysis.

2. We combine firms that have different enterprise ID but the same ultimate parent ID. In doing so, we sum over their related variables (such as sales, cost of sales, etc.) so that we end up having one observation for each ultimate parent ID and NAICS pair for each year.[2]

3. We only keep active firms with positive sales.

4. After sorting firms based on their market share, we keep firms until 99% of total sales in year *t* and market *j* are covered. This allows us to remove the smallest firms whose behavior could potentially skew our analysis.

In theory, the Boone indicator captures how firm efficiency correlates with variable profits and is ideally calculated using marginal cost as the independent variable in the regression (instead of average variable cost as in our specification). However, since marginal costs are not directly observable, we follow Boone, Griffith, and Harrison (2005)[3] and use average variable cost as a proxy for marginal costs. We calculate our proxy as the cost of goods sold (COGS) divided by total sales. Variable profits are then calculated as total sales minus COGS.

[1] Griffith, R., Boone, J., and Harrison, R., (2005), "Measuring Competition," Advanced Institute of Management Research Paper No. 022

[2] In some cases, there may be more than a single ultimate parent ID and NAICS pair in a given year. This would reflect a scenario where two firms with different NAICS share an ultimate parent ID.

[3] Ibid.

CONFIDENTIALITY

We were able to obtain and review the Boone indicator for 3-digit and 2-digit NAICS industries for release from the Statistics Canada Research Data Centre. However, we could not obtain the output for the Boone indicator at the 4-digit level due to concerns about the confidentiality of firms in the dataset.

DETAILED FINDINGS

Profit elasticity has risen overall

By grouping industries by their mean Boone indicator over the entire period from 2001 to 2018, we can track and compare the change in the Boone indicator for industries. The Boone indicator takes a value between negative infinity ($-\infty$) and 1. In more competitive industries, we expect the Boone indicator to approach negative infinity. As it increases towards 1, the Boone indicator shows weaker competitive intensity.

Figure G1 shows the change in the Boone indicator for industries grouped by their mean Boone indicator over the whole sample. We group industries into 4 quartiles (top 25%, middle 50% to 75%, middle 25% to 50%, and bottom 25%) and two additional groupings for the top and bottom 10%.

We are especially interested in looking at how the Boone indicator has evolved in industries that have a lower degree of competitive intensity. In Figure G1 we can observe an overall increase in the Boone indicator for the industries that already have higher Boone indicator values (and therefore, the lowest competitive intensity). In Table G1, we see that this is true for the top 75% of industries, ranked by the Boone indicator, and within that group, the increase is highest for the top 25% and top 10% of industries.

Figure G1: Average annual Boone indicator from 2001 to 2018 for industries that are grouped by average Boone indicator

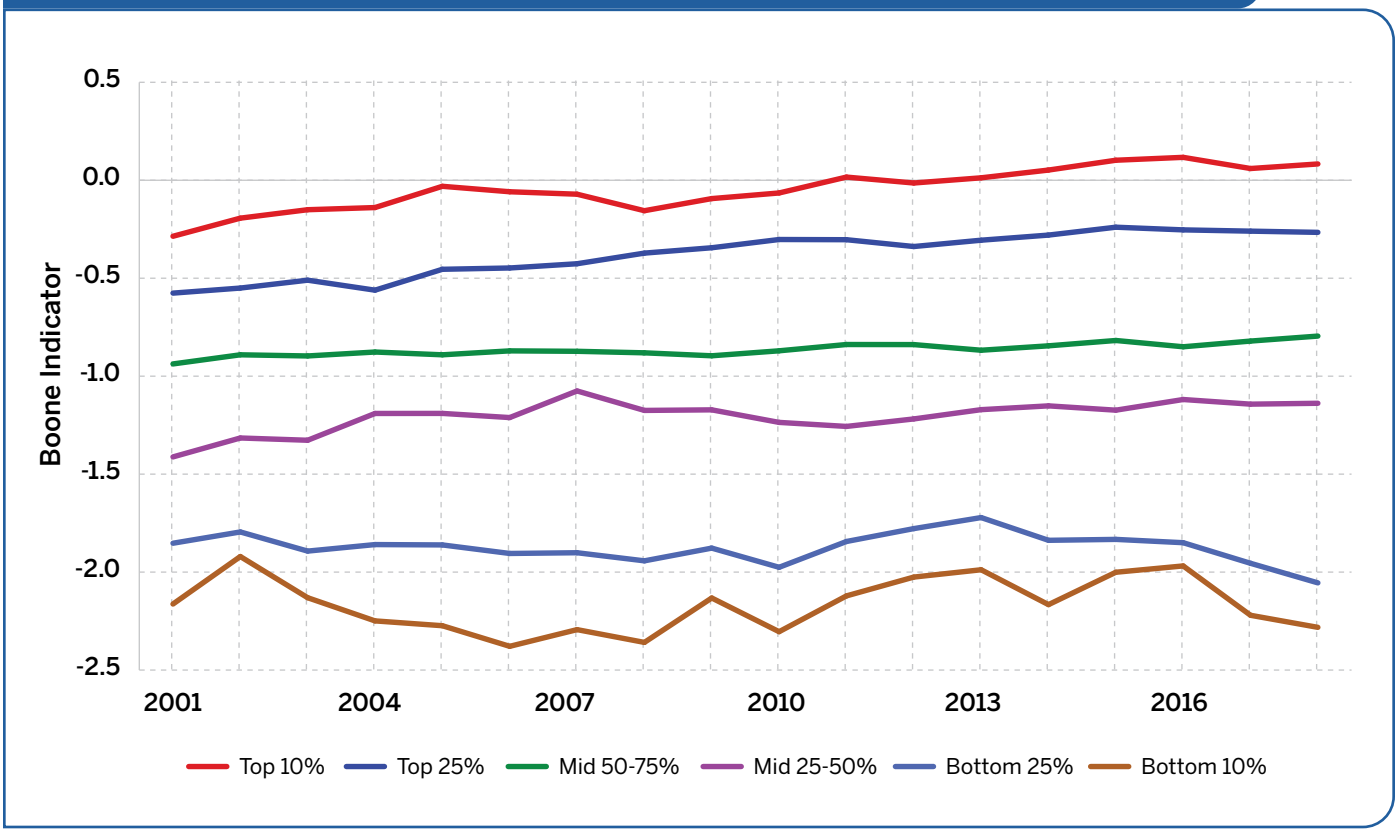


Table G1: Change in Boone indicator from 2001 to 2018 for industries in different distributional groups (3-digit NAICS)

Group	Boone Indicator in 2001	Boone Indicator in 2018	Change in Boone Indicator (Percent)
Top 10%	-0.29	0.08	127.6%
Top 25%	-0.58	-0.27	53.4%
Mid 50-75%	-0.94	-0.80	14.9%
Mid 25-50%	-1.41	-1.14	19.1%
Bottom 25%	-1.85	-2.05	-10.8%
Bottom 10%	-2.16	-2.28	-5.6%

To further verify that the Boone indicator has increased in general, we assessed the industry level time-trend in the Boone indicator from 2001 to 2018[4]. We found that 41% of industries (33% revenue share) saw a meaningful increase in the Boone indicator between 2001 and 2018.

Table G2: Significance of Boone indicator trend for all industries (3-digit NAICS)

Trend Direction	Number of Industries	Percentage of Industries	Share of All Industry Revenues
Increase in Boone indicator	43	41.0%	33.3%
Decrease in Boone indicator	22	21.0%	24.7%
No meaningful change	27	25.7%	22.2%
Could not measure trend[5]	13	12.4%	19.8%

Although only 41% of industries have an increasing trend coefficient, we see that the overall increase is largely driven by industries in the top 25%.

A potential caveat with our calculation of the Boone indicator is that yearly efficiency gains may not immediately translate into profits (for example due to firms re-investing in innovation), and thus the trend in the Boone indicator may not reflect changes in competition right away. In other words, the Boone indicator should be assessed over a longer period to better reflect the underlying trends in competition. As a robustness check, we also run different models in which we pool yearly data into 3-year and 5-year periods and calculate the Boone indicator based on these extended intervals instead of a single year only. The results remain qualitatively the same, supporting our results that the Boone indicator has increased over time and suggesting a decline in competitive intensity.

[4] One way to assess the evolution of the measure over time is to examine the trend coefficients estimated from a regression of the 3-digit NAICS measure, in this case Boone indicator ($y_t^{(i)}$), on a constant term for each NAICS (fixed effects) and time trend as in the equation below, where $\alpha^{(i)}$ and $\beta^{(i)}$ are computed for each 3-digit NAICS (i) when sufficient data is available (at least two years of data for each industry).

$$y_t^{(i)} = \alpha^{(i)} + \beta^{(i)} \times t + \epsilon_t^{(i)}$$

An industry's time trend was meaningful if it was statistically significant at the 5% level.

[5] We list the number of industries with redacted output. Statistics Canada did not release output for certain industries in some years in order to protect the confidentiality of firms in the data. Data is withheld when there are too few firms in an industry to maintain confidentiality, or one or a few firms are dominant in the output. As such it is reasonable to assume these industries would fall within the highly-concentrated group in years with redacted data.