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Methodologies to Measure Market Competition – Note by New Zealand

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

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New Zealand

1. Abstract

1.   This paper contributes to the Competition Committee's Hearing on *"Methodologies to Measure Market Competition"* in June 2021. It focuses on work done by the New Zealand Commerce Commission (NZCC) to measure market competition and apply the results of that measurement.

2.   The NZCC is New Zealand's competition agency, mandated by the Commerce Act 1986 to protect and enhance competition across New Zealand markets and to directly regulate some infrastructure sectors. The NZCC's functions have expanded in recent years, including into market studies and a broader role in the development of policy. To support these and related functions, the NZCC has initiated research into how the level of competition in a market can be assessed quantitatively.

3.   The NZCC's analysis builds on a 2019 study by the researchers Richard Fabling and David C. Maré, in which they computed several competition indicators in order to investigate the link between competition and productivity.[1] These included margin indicators (profit elasticity and price-cost margin) and structural indicators (HHI and concentration ratio).

4.   In 2020, the NZCC gained access to the most granular industry-level estimates of margin indicators used in that study. The NZCC analysed these indicators to glean insights into the state of competition in New Zealand markets and into the quality and consistency of the competition indicators themselves. This paper presents an overview of the NZCC's analysis, a discussion of the data and method challenges faced, and potential applications of this type of analysis to the NZCC's future workstreams.

2. Background and data

5.   New Zealand's economy is small and remote, both of which affect the intensity of competition in its markets. New Zealand's two closest significant trading partners, Australia and China,[2] are roughly 2,000km and 9,000km away respectively.[3] Remoteness makes exporting more challenging and reduces potential for import competition to constrain domestic producers. Regarding size, in 2019 New Zealand's Gross Domestic Product (GDP) was US$223.7 billion, placing it between Finland and Slovakia at 30th out of 37 OECD countries.[4] The combination of these factors means many markets are

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[1] Maré, D. C., & Fabling, R. (2019). *Competition and productivity: Do commonly used metrics suggest a relationship?* Motu Economic and Public Policy Research Trust.

[2] According to the Reserve Bank of New Zealand's trade-weighted index, New Zealand's top five trading partners are China, Australia, the United States, the Euro Area, and Japan. See https://www.rbnz.govt.nz/statistics/b10.

[3] The distance from Auckland to Sydney is 2,156km; from Auckland to Guangzhou is 9,268km. These distances are comparable to the distances from Paris to Istanbul (2,255km) and to Los Angeles (9,085km) respectively.

[4] OECD (2021). *Gross domestic product (GDP) (indicator)*. DOI: 10.1787/dc2f7aec-en. (Accessed on 16 April 2021).

relatively concentrated and the protection and promotion of competition is correspondingly more critical. This motivates the NZCC to take a particular interest in quantitative competition indicators.

6.   The New Zealand economy also has low productivity and productivity growth. Despite high levels of labour utilisation, labour productivity in New Zealand is 40% lower than the average of the top half of the OECD; this deficit has increased from 34% in 1996.[5] Fabling and Maré's 2019 study was motivated in part by the hypothesis that New Zealand's low productivity could stem in part from a lack of competition.

7.   The NZCC's interest in their study lies in the competition indicators used. They were computed using (confidential) firm-level data on output, intermediate consumption, labour costs, and total labour input. The margin indicators are detailed further in the following section.

1.   The firm-level data, spanning the time period 2001–2016, was sourced from Statistics New Zealand's Longitudinal Business Database (LBD). The confidentiality requirements associated with this database restricted how the data could be used.

2.   To compute industry-level indicators, the researchers grouped firms according to industry classifications. The main classifications they used were a modified 318-industry version of ANZSIC[6] Level 4 and a 'productivity dataset' grouping firms into 39 'production function' industries. The NZCC followed these same classifications in its analysis.

3. Competition indicators

8.   Although the original analysis calculated structural indicators such as the HHI, the NZCC only has margin indicators available at this time for the fully granular 318 industry groups. The NZCC is therefore working with the following indicators.

9.   <u>Price-cost margin (PCM)</u>, also known as a Lerner index, represents the difference between a firm's price and marginal cost as a fraction of price.

1.   This reflects the margins being made on each unit sold as a percentage of price charged. Economic theory suggests market power allows firms to price above marginal cost; a lower PCM implies lower margins, indicating a more competitive industry.

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[5] Nolan, P., R., Pomeroy and G. Zheng. (2019). *Productivity by the numbers: 2019*. New Zealand Productivity Commission. Available from www.productivity.govt.nz

[6] ANZSIC is the Australian and New Zealand Standard Industrial Classification system. It is a four-tier system, where Level 1 describes the highest-level industries and Level 4 describes the lowest-level industries. For example, "Poultry Processing" (L4) is part of "Meat and Meat Product Manufacturing" (L3), which is part of "Food Product Manufacturing" (L2), which is part of "Manufacturing (L1). The researchers pooled some Level 4 industries with few observations into higher-level groups to create the 'modified' 318-industry version of the Level 4 classification.

2. Marginal costs are difficult to calculate using accounting data. Therefore, for the purposes of calculating this indicator (and profit elasticity), Fabling and Maré used a firm's variable costs as a proxy for its marginal costs.[7]

3. The industry-level PCMs were calculated using two methods: one involved averaging the PCMs of all firms in the industry (average PCM), and the other weighted this average by the firms' outputs (aggregate PCM). The average PCM calculation excluded all firms whose total variable costs were more than double their total revenue, as these would be small firms with large negative profits and would skew the industry average.[8]

10.   Profit elasticity (PE), also known as the Boone indicator, represents how a firm's profits respond to changes in its unit costs.

1. This is expected to be a negative figure, ie, an increase in costs leads to a decrease in profits. An industry with a smaller (more negative) overall PE is supposedly more competitive than an industry with a larger (less negative) PE, because its firms' profits are more heavily affected by a given change in costs, indicating tighter margins.[9]

2. Fabling and Maré used two specifications to compute industry-level profit elasticities: one using a simple OLS regression (PE-OLS), and one including firm fixed effects (PE-FE). They noted the PE-FE indicator might be a more robust indicator for industries where the boundaries of the industry classification do not reflect the extent of the competitive constraint on its firms. They also suggested that PCM shares this robustness feature.

11.   At this point the NZCC has no strong preference between PCM and PE as indicators of competition. It is aware of the fact that PCM estimates are not robust to collusion.[10] It also notes that, in its data, both of these indicators are estimated across all firms classified in an industry. This somewhat undermines the merits of the PE indicator. For these reasons the NZCC considers each indicator as being equally valid in what follows.

4. Analysis and results

12.   The NZCC was provided with industry-level data for three of the four margin indicators (PE-OLS, PE-FE, and average PCM[11]), disaggregated into the 318-industry 'modified ANZSIC L4' dataset. Although the total span of the data was 16 years (2001-

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[7] Here, total variable costs were approximated as a firm's intermediate consumption plus labour costs. The methods used to impute labour costs for working proprietors necessarily excluded firms consisting only of a working proprietor, ie, sole traders, from the analysis altogether.

[8] This exclusion did not need to be made when calculating aggregate PCM, as the influence of these small firms on the industry average would be modulated by the output-weighting.

[9] In theory, PE should always be negative; however, the PE of some industries has been recorded as positive. A positive PE (an increase in costs is associated with an increase in profit) might in fact indicate there is no causal relationship between cost changes and profit changes, suggesting a high build-up of market power.

[10] Corts, K. (1999), Conduct parameters and the measurement of market power, Journal of Econometrics, 88, pp. 227-250.

[11] Hereafter, we refer to average PCM as 'PCM' as there is no need to differentiate it from aggregate PCM.

2016) the NZCC only has two observations in the time dimension: Period 1 (2001–2008) and Period 2 (2009–2016). This is because the original researchers used multiple years in their regression analysis to estimate the PE indicators.

13.   The NZCC started by ranking each industry from 1 (most competitive) to 318 (least competitive) for each of the three indicators and each of the two time periods. It then applied a weighted[12] average to these rankings to determine which industries were ranked as less competitive across all three indicators.

14.   The major[13] industries ranked as least competitive in Period 1 (2001–2008) were *Legal Services*; *Accommodation*; and *Dairy Cattle Farming*. In Period 2 (2009–2016), they were *Auxiliary Insurance Services*; *Legal Services*; and *Accommodation*.

15.   Following on from this, the NZCC was able to compute each industry's change in rank from Period 1 to Period 2 and apply a weighted average to these "rank changes" to determine which industries' competition indicators had grown (become less competitive) by the most, relative to others. The major industries with the greatest fall in relative competitive rank were: *Sheep-Beef Cattle Farming*; *Supermarket and Grocery Stores*; and *Apple and Pear Growing*.

16.   The NZCC also aggregated the 318 industries into 64 ANZSIC Level 2 industries, and into the 39 'production function' industries used by Fabling and Maré (which the NZCC called Level 1.5 industries).[14] Working with fewer industries allowed the NZCC to create more readable visualisations and pick up on macro-level industry trends.

17.   For example, the NZCC found there are three Level 1.5 industries which all three competition indicators agree were more competitive in Period 2 than Period 1 but were still in the bottom half of industries overall in both periods. These are *Auxiliary Finance and Insurance Services*; *Rental and Hiring Services (except Real Estate)*; and *Professional, Scientific and Technical Services*. This result can be read off Figures 2, 3, and 4; all in the Appendix. The industry key can be found in Table 1.

18.   To delve further into the consistency of the indicators, the NZCC normalised each one by transforming them onto a scale of 0–100.[15] This allowed direct comparison between the indicators. Figure 1 in the Appendix depicts how each of these normalised indicators changes between Period 1 and Period 2 for the 39 Level 1.5 industries.

19.   For most industries, all three indicators move in the same direction, but for some this is not the case. For example, for industry #28 (*Rail, Water, Air and Other Transport*), the PCM indicator implies competition has increased, while the PE-OLS and PE-FE indicators imply competition has decreased. Moreover, the magnitudes of these changes are sizeable and vary between indicators. This calls into question the consistency of the indicators.

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[12] We primarily used weights of 20% for PE-OLS, 30% for PE-FE, and 50% for PCM. This achieves an overall effect of weighting profit elasticity at 50%, and price-cost margin at 50%. PE-FE was given a stronger weight than PE-OLS because of its increased robustness, as described in [10.2].

[13] We defined 'major' as having at least 5,000 employees.

[14] The Level 1.5 industries are not part of the ANZSIC system but Fabling and Maré provided a mapping that allowed us to carry out this aggregation.

[15] This normalisation involved setting the tenth-lowest value of each indicator equal to 0, and the tenth-highest value equal to 100. (Using the tenth-lowest and tenth-highest as boundary values instead of the minimum and maximum was done to eliminate outliers.) All the other values were then placed between 0 and 100 according to their relationship to the boundary values.

5. Challenges and limitations

5.1. Methodological limitations

20. As noted above, the three indicators for which the NZCC has granular data (PE-OLS, PE-FE, and PCM) do not always tell a consistent story. Setting aside PE-OLS—which is expected to be less robust—the latter two indicators moved in opposite directions between the two periods in 123 out of 318 Level 4 industries and 12 out of 39 Level 1.5 industries.

   1. This could reflect industry margins becoming wider but more sensitive to changes in variable costs, or narrower but less sensitive. While there may be plausible explanations for this, it is a less intuitive outcome, and it is surprising that it would occur in 30-40% of industries.

   2. This raises the question of which indicator to place greater weight on should inconsistencies arise. Profit elasticity is a less established method, but it may be better placed to account for varying cost structures and levels of efficiency within an industry. However, it may also be less useful for comparisons between different industries.[16]

21. There are also more general issues with relying on margin indicators to assess competition.

   1. As it is necessary to use a proxy such as average costs or variable costs to estimate a firm's marginal costs, computing a margin indicator in practice requires assumptions that can detach the result from its theoretical counterpart.

   2. A firm's margins are not always reflective of its market power. Some industries carry high fixed costs or require a large sunk investment to enter. Even if these industries are relatively competitive, firms may need to earn large margins to justify operating at all.

22. Structural indicators such as HHI have similar issues. For example, even share of output may not accurately reflect market shares if competition does not occur for each unit of output.[17] Secondly, a relatively concentrated market may still be competitive depending on factors such as contestability, firm churn,[18] and/or the degree of import constraint. Conversely, firms in an unconcentrated market may have market power if they establish product differentiation and/or gain protection via high switching costs.

23. Going forward, the NZCC intends to consider structural indicators in conjunction with margin indicators with a view to mitigating the deficiencies of both. A key next step for future analysis is to obtain granular HHI or concentration ratio data.

24. The NZCC must also consider the substantial differences between industries, classified by systems such as ANZSIC, and competition law markets. Even within the highly disaggregated fourth tier of ANZSIC, industries are typically defined in a

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[16] Gardiner, A. (2017). *What we know and don't know about competition in New Zealand.* Ministry of Business, Innovation and Employment.

[17] This may be the case if firms compete for customer contracts which involve multiple units of output.

[18] Firm churn is the rate at which firms enter and leave the market. If the conditions of a concentrated market allow new, more efficient firms to enter and push out less efficient ones, the market could still be considered competitive.

generalised manner that omit crucial aspects of market definition (eg, geographic boundaries) from consideration. This creates issues for both margin and structural indicators.

1. For example, PCM might reflect no change in margins for an industry that is comprised of several smaller markets, when in fact margins have grown in some markets but shrunk in others (and these changes cancel out). If these smaller markets are concentrated but similarly sized, HHI may also indicate that the overall industry is relatively unconcentrated.

2. In both cases, as a consequence of imprecise industry classifications, these indicators may fail to identify markets in which competition may be low or have decreased. This risk can be mitigated by favouring indicators that are more robust to this issue (eg, PE-FE over PE-OLS), but the risk of error remains unless we can obtain data for more suitably defined markets.

5.2. Data limitations

25. Confidentiality constraints pose a major obstacle to obtaining useful indicators from firm-level data. The NZCC will need to invest in navigating these issues if it is to gain greater insight into competition though this channel. Consideration of both margin and structural indicators is necessary to ensure a balanced assessment of competition. And, paradoxically, the industries for which data is likely to be most restricted (ie, those with a small number of firms) may be the ones of most interest.[19]

26. The NZCC will also need to gain access to much more up-to-date information if it is to realistically apply competition indicator analysis to market screening of the type outlined below.

27. There are also sample size issues to contend with: a trade-off must be made between industry aggregation and time aggregation to satisfy the minimum number of observations required to compute the indicators.[20] For the NZCC's dataset, annual data was pooled into eight-year time periods to enable analysis of ANZSIC Level 4 industries. This reduces market definition issues but sacrifices a lot of detail on the time dimension.

1. This issue would presumably be compounded if the analysis were applied to competition law markets, which would likely be smaller than ANZSIC Level 4 industries.

2. However, the minimum observations requirement could be relaxed for some indicators, eg, PCM (which does not involve statistical regression). It may also be possible to use techniques such as rolling regressions when calculating the PE indicators to satisfy this requirement while retaining information about time trends.

6. Future applications

28. At this point, the NZCC has started on a long journey towards empirical analysis of industry-level competition. This is a proactive approach looking around at the whole

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[19] This point was made by Fabling and Maré in their *Competition and Productivity* paper.

[20] Fabling and Maré aggregated industries that had fewer than 200 observations in an 'industry-time period' into higher-level industry groups.

economy and attempting to identify future trouble spots. However, it is also difficult, including for the reasons outlined above.

29.   The NZCC is hopeful that the deeper insights that it anticipates from further efforts in this direction will help with the identification of sectors where weak competition is holding back significant economic progress. This will likely require the NZCC to also understand the forward and backward linkages between relevant sectors/markets.
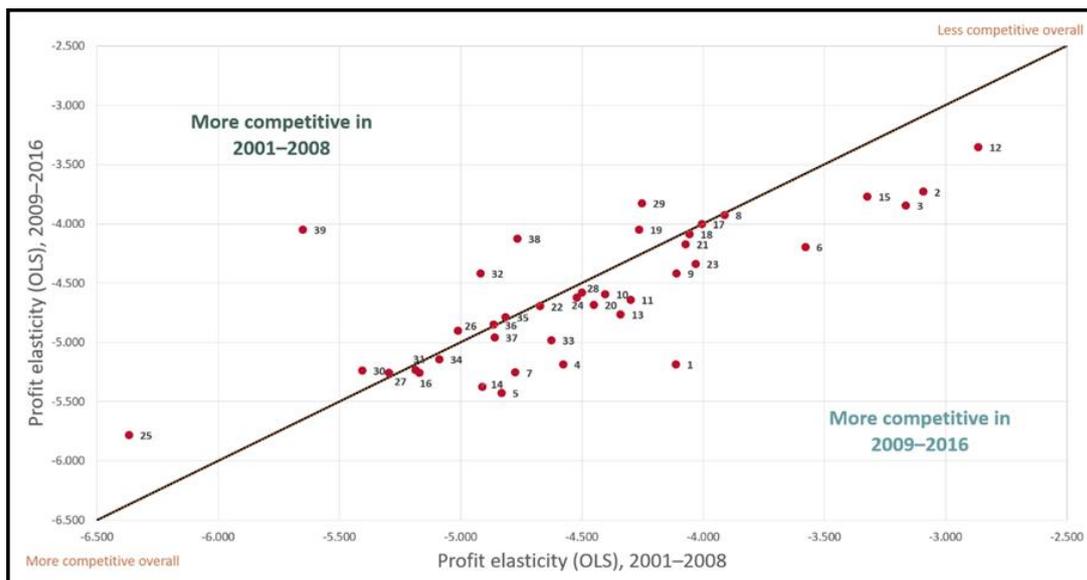
Appendix

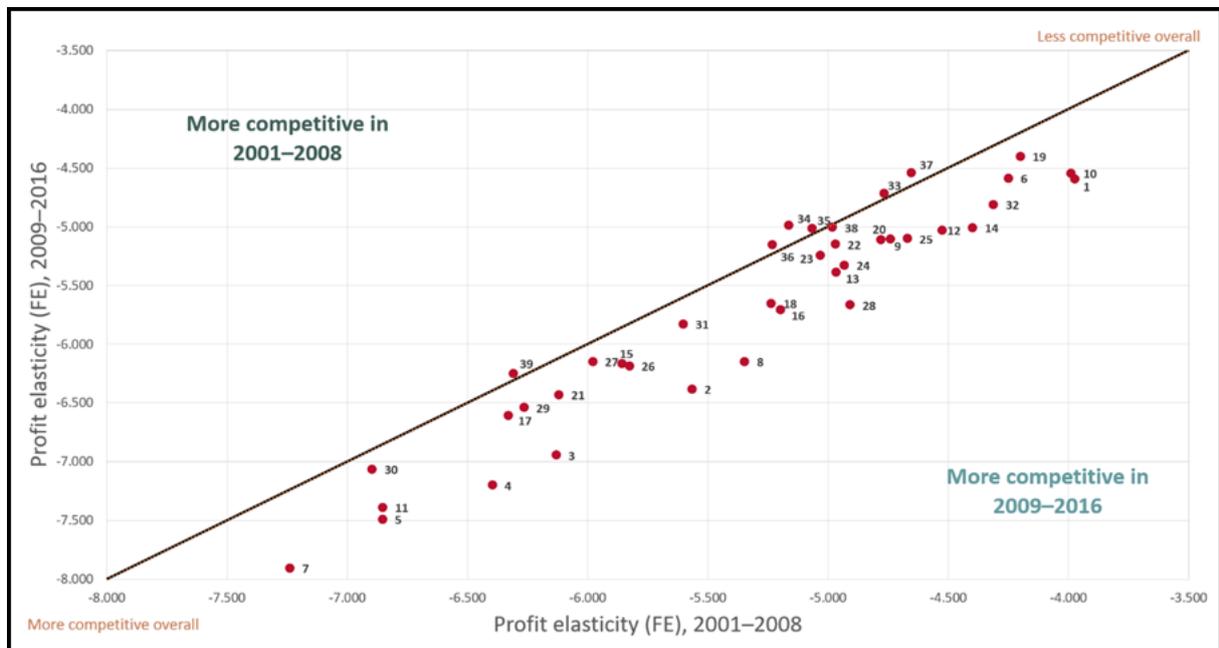## Figure 1. Changes in normalised competition indicators by Level 1.5 industry
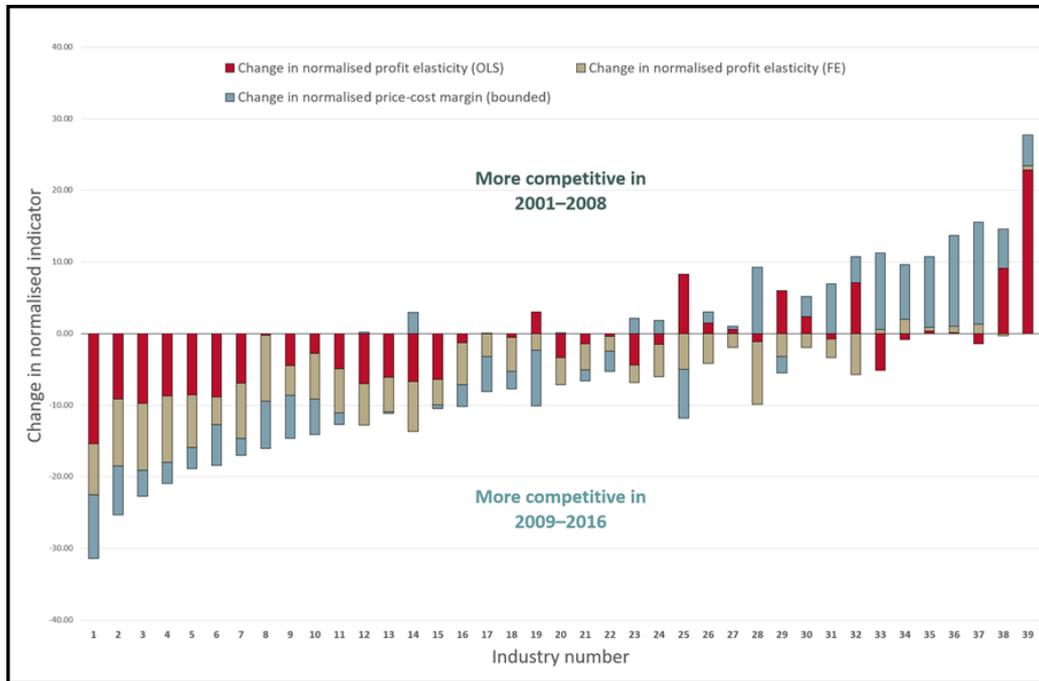
Note: The key to match the industry numbers with Level 1.5 industry names can be found in Table 1**Error! Reference source not found.**, also in the appendix.

Figure 2. Profit elasticity (OLS) for Level 1.5 industries, compared between Period 1 (2001–2008) and Period 2 (2009–2016)
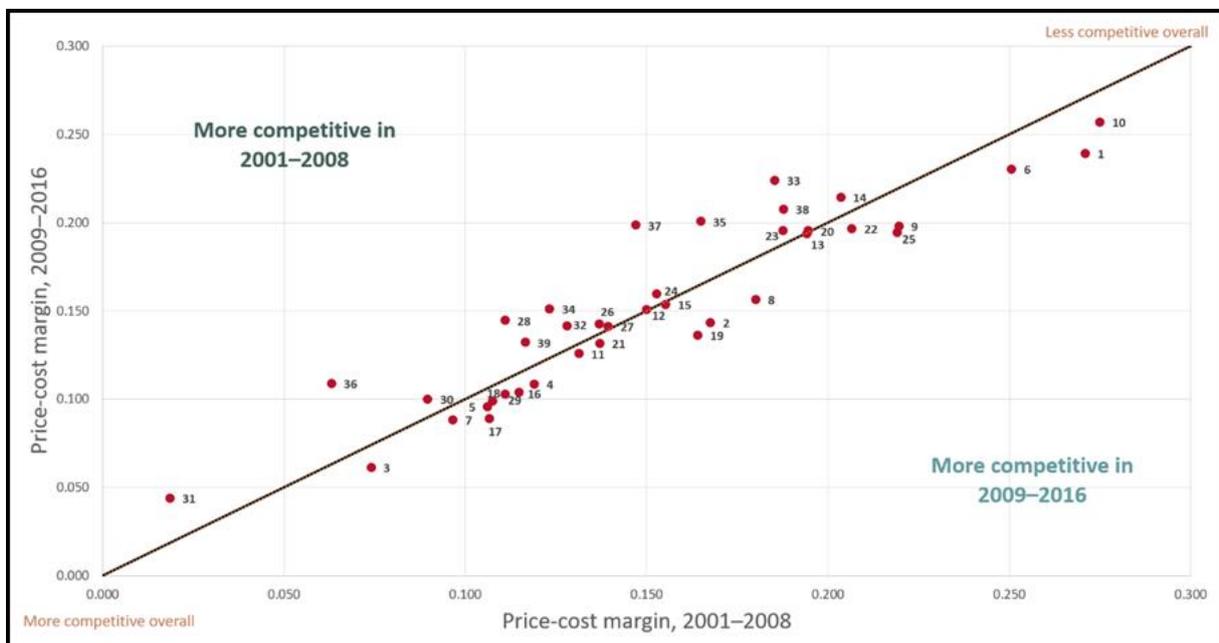

Note: The key to match the industry numbers with Level 1.5 industry names can be found in Table 1, also in the appendix.

Figure 3. Profit elasticity (fixed effects) for Level 1.5 industries, compared between Period 1 (2001–2008) and Period 2 (2009–2016)

Note: The key to match the industry numbers with Level 1.5 industry names can be found in Table 1, also in the appendix.

Figure 4. Price-cost margin for Level 1.5 industries, compared between Period 1 (2001–2008) and Period 2 (2009–2016)

Note: The key to match the industry numbers with Level 1.5 industry names can be found in Table 1, also in the appendix.

Table 1. Key to match Level 1.5 industry number with industry name

#	Level 1.5 industry name
1	Dairy Cattle Farming
2	Heavy and Civil Engineering Construction
3	Building Construction
4	Construction Services
5	Furniture and Other Manufacturing
6	Auxiliary Finance and Insurance Services
7	Wood and Paper Products Manufacturing
8	Printing
9	Professional, Scientific and Technical Services
10	Rental and Hiring Services (except Real Estate)
11	Metal Product Manufacturing
12	Postal, Courier Transport Support, and Warehousing Services
13	Road Transport
14	Electricity, Gas, Water and Waste Services
15	Petroleum, Chemical, Machinery and Equipment Manufacturing
16	Information Media Services
17	Textile, Leather, Clothing and Footwear Manufacturing
18	Administrative and Support Services
19	Financial and Insurance Services
20	Wholesale Trade
21	Machinery and Other Equipment Manufacturing
22	Other Store-Based Retailing and Non-Store Retailing
23	Motor Vehicle and Motor Vehicle Parts and Fuel Retailing
24	Agriculture, Forestry and Fishing Support Services and Hunting
25	Mining
26	Other Services
27	Accommodation and Food Services
28	Rail, Water, Air and Other Transport
29	Transport Equipment Manufacturing
30	Food, Beverage and Tobacco Product Manufacturing
31	Horticulture and Fruit Growing
32	Telecommunications, Internet and Library Services
33	Fishing and Aquaculture
34	Sheep, Beef Cattle and Grain Farming
35	Arts and Recreation Services
36	Poultry, Deer and Other Livestock Farming
37	Forestry and Logging
38	Supermarket, Grocery Stores and Specialised Food Retailing
39	Non-Metallic Mineral Product Manufacturing