NEW ZEALAND
PRODUCTIVITY COMMISSION
Te Kōmihana Whai Hua o Aotearoa

Competition in New Zealand: highlights from the latest data

Research Note 2019/3

August 2019

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The New Zealand Productivity Commission

Te Kōmihana Whai Hua o Aotearoa[1]

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How to cite this document: Schiff, A. & H. Singh (2019). Competition in New Zealand: highlights from the latest data. New Zealand Productivity Commission. Available from www.productivity.govt.nz

Date: August 2019

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JEL classification: C5 Econometric Modelling, D2 Production and organisations, D4 Market structure, pricing, and design

ISBN: 978-1-98-851935-7 (online)

[1] The Commission that pursues abundance for New Zealand

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1 Introduction

This report summarises key features and trends in a recently published dataset of high-level measures of competition and productivity for New Zealand industries (Maré & Fabling, 2019). The part of the dataset summarised in this report provides a consistent set of competition measures for 39 industries for each year between 2001 and 2016. These measures were derived from updated firm-level data in Stats NZ's Longitudinal Business Database (Fabling & Maré, 2019), and build on earlier analysis of competition and productivity in New Zealand industries using firm-level data (Gardiner, 2017, MBIE, 2016, and Fabling & Maré, 2015).

A key finding from Maré and Fabling's (2019) initial analysis of the dataset is that different competition measures show different and sometimes contradictory results about variations in competition across industries and across time. Maré and Fabling suggest that this is possibly because competition plays out in different ways and is affected by different external forces in different industries, and relatively simple measures of competition reflect different aspects of these external forces.

This means the dataset that this report is based on does not provide a single, coherent "story" of competition in New Zealand industries. This leaves us with a choice of either accepting the possibility of multiple and potentially conflicting stories, or, as Maré and Fabling (2019) suggest, "taking a strong stance on a preferred set of competition metrics and, by extension, a clear view on which metrics (if any) capture the aspects of competition that matter most to policy outcomes such as productivity growth".[2]

This report takes the former approach. It does not attempt to choose a single preferred competition measure or to distil a single story about competition. Competition among real-world firms is often multi-faceted and affected by different structural characteristics including production technology, costs, demand, and market institutions and, in our view, simple competition metrics do not always adequately reflect these features. This suggests using a suite of competition metrics rather than a single metric, to give a broader view of the state of competition. Thus, in this report we accept the potential ambiguity that arises from using multiple competition measures and we seek to highlight patterns and trends in these measures. Readers who instead prefer one or more measures can then construct their own story of competition using this report as a starting point.

The graphs in this report are taken directly from a web-based data visualisation tool that was developed by the authors for a collection of agencies: the Commerce Commission, the Ministry of Business, Innovation and Employment (MBIE), the Productivity Commission, the Treasury, and Stats NZ. The tool allows users to visualise and interact with a key subset of the Maré and Fabling (2019) dataset. This tool is freely available via the Productivity Commission's website (www.productivity.govt.nz/competition-in-new-zealand). Note also that, for ease of reference, A3 versions of three of the graphs (Figure 5, Figure 19, and Figure 20) are also available on the Productivity Commission website.

This report is aimed at non-specialist (and non-economist) readers who want a high-level overview of the Maré & Fabling (2019) dataset, as a starting point for deeper analysis of the competition measures contained in that dataset. Competition arises from the actions of profit-maximising firms that sell goods or services in a market. When firms are in competition with each other, the choices of one firm (e.g. choices of prices, product range and quality, store locations, advertising, etc) affect the profits of its rival(s) and vice versa, via their interaction in the market. We refer to competition being more "intense" when the responses of firms to actions of their rivals are relatively stronger.

[2] Maré and Fabling (2019) also offer a third approach – generating "composite" competition measures by combining two or more measures. They implement this approach using the method of principal components. Composite competition measures are beyond the scope of this report.

For example, a 10% price cut by one firm that induces a rival to also cut its price by 10% is a stronger competitive response compared to if the rival cut its price by only 5%. More intense competition is generally associated with better outcomes for consumers and lower profits for firms, although it is important to note that more intense competition does not always translate into lower prices, as firms can compete on other attributes such as product quality, location, innovation, etc.

1.1 Competition measures and dataset dimensions

Each competition measure described below attempts to summarise the intensity of competition among a group of firms as a single number, so that competition can be objectively compared across markets and/or across time. Variations in this number reflect relative differences in the intensity of competition.[3] Firms are grouped into industries comprised of similar activities (see below).

Competition measures are either based on observations about the 'structure' of the market (e.g. the number of firms or their market shares), or market outcomes (e.g. firms' profit margins). Structural measures assume that market structure affects competition in a predictable way, e.g. more firms means more intense competition, everything else equal. The outcome-based measures are derived from observations that are assumed to give some information about the underlying state of competition among firms, e.g. more intense competition leads to lower profit margins, everything else equal.

The competition measures included in the accompanying visualisation tool are as follows (see Maré and Fabling, 2019, for detailed descriptions and mathematical derivations):

- Hirschman-Herfindahl Index (HHI): The sum of squared market shares of firms in the industry. Due to confidentiality constraints, the HHIs included in this report and the visualisation tool are based on the firms' share of labour in the industry, rather than their share of output. That is, each firm's 'market share' is calculated as the value of the labour it uses divided by the total value of labour used by all firms in the same industry. This should be similar to output-based market shares assuming that the ratio of labour input to product output is similar for all firms in an industry. A monopoly has an HHI value of one, and lower HHI values (closer to zero) correspond to more intense competition.[4]

- Price-cost margin (PCM): The difference between the value of firms' output and total variable costs,[5] divided by the value of output, i.e. an estimate of firms' profitability on sales. Two alternative versions of the aggregate PCM across firms in each industry are reported using different weights to calculate the aggregate PCM from the individual firms' PCMs: population-weighted, and output-share plus population-weighted.[6] The output-share plus population-weighted PCM is equivalent to the aggregate PCM for the industry, i.e. the PCM as if the individual firms were divisions of a single larger firm. The population-weighted PCM is the weighted average PCM across firms in the industry. In both cases, a lower PCM corresponds to more intense competition.

- Profit elasticity (PE): The responsiveness of profit to variation in costs of the firms in an industry, relative to a reference firm in that industry, i.e. PE measures the relative extent to which the firms' profits are sensitive to changes in their costs. PE values are typically negative, i.e. firms'

[3] The competition measures do not all represent more intense competition in the same "direction", i.e. more intense competition is reflected by higher numbers for some indicators and lower numbers for others. This is described below, and care must be taken when interpreting relative differences in the competition measures.

[4] HHI values should always lie between 0 (perfect competition) and 1 (monopoly). In the dataset, a small number of HHI values were greater than one. This is probably due to rounding of firms' market shares used in the HHI calculations to satisfy confidentiality requirements. In this report and in the visualization tool, the data is presented in its original form and HHI values greater than one have not been adjusted.

[5] Variable costs are those that vary directly with the quantity of goods or services the firm produces, e.g. costs of raw materials, some types of labour, etc.

[6] Population weights are needed because data for some firms is not observed.

profits decrease when their costs increase. Lower (more negative) values of PE correspond to more intense competition, i.e. changes in costs are assumed to induce larger changes in profits when competition is more intense because firms have to pass costs through to consumers. Two alternative estimates of PE are reported for each industry: standard estimates (using ordinary least squares, or OLS regression models) and estimates that control for firm-specific "fixed effects" (FE).

The PE (OLS) measure reflects the relationship between profits and costs across all firms in an industry. In some industries, the industry definition may encompass many markets, and across these markets there may be variations in the relationship between profits and costs that are not related to competition. For example, in some markets within an industry, high cost firms may tend to make low profits overall, while in other markets in the same industry, high cost firms may tend to make higher profits overall. These variations will feed into the PE (OLS) estimate and affect the estimated intensity of competition in the industry. The PE (FE) measure controls for firm-specific differences in the relationship between profits and costs, and so should get closer to what PE is intended to capture at the firm level. This suggests that the PE (FE) measure should be preferable to the PE (OLS) measure. However, as Maré and Fabling (2019) show, there is empirical evidence that the PE (OLS) measure explains some variation in competition across industries that cannot be explained by other competition measures, hence it is also included in the dataset.

- Subjective measures of competition from the Business Operations Survey (BOS): Respondents to Stats NZ's Business Operations Survey are asked to classify competition in their industry on a four-point scale. For the purpose of this analysis, firms responding that they faced a "captive market / no effective competitors" or "no more than one or two competitors" were classified as "weak competition" and firms responding that they face "many competitors – none dominant" were classified as "strong competition". The proportion of firms in these two categories in each industry were used as competition indicators.

It is important to note that the absolute values of the HHI, PCM, and PE measures are difficult to interpret. For example, if one industry has a PCM that is half of the PCM of another industry, it doesn't mean that the former is twice as competitive as the latter. Instead, we compare industries with each other and across time to determine which industries are relatively more or less competitive, and which industries have become relatively more or less competitive over time.

As discussed further below, structural measures such as the HHI can be misleading unless they are calculated for well-defined markets. Structural measures can under- or over-state competition when applied to aggregated industries, and/or where firms compete in markets that cover different geographic areas from that used in the HHI calculation. For example, firms such as hairdressers may compete in very local markets, in which case HHI calculated at the national level may overstate the actual competition faced by such firms, since a national HHI for hairdressers assumes that each hairdresser competes with every other. Conversely, exporting firms may compete in international markets, in which case HHI calculated at the national level may understate the actual competition they face as it will exclude market shares of foreign firms.

PCM and PE can sensibly be estimated for aggregated industries that comprise multiple markets, and in that case they reflect the overall 'average' competition across all the firms and markets. However, the PCM and PE estimates are subject to uncertainty as they are estimated with econometric techniques applied to firms' financial data. PCM and PE can also vary considerably over time for reasons that do not directly relate to competition. For example, short-term variations in input costs can temporarily affect firms' profit margins but not reflect any underlying change in the state of competition among them. In contrast, the HHI is not subject to any uncertainty (provided market shares are known) and tends to be more stable over time. It is also possible to calculate HHI for industries in particular geographic regions in New Zealand, but the same is not

true for the PCM and PE measures due to data limitations. In contrast to the other measures, the BOS measures are subjective and rely on firms' accurately reporting the state of competition that they face but the BOS measures are more straightforward to interpret than the other measures. Thus, each of the measures has its own advantages and disadvantages, and analysis that focuses on a single measure should take this into account.

The HHI, PCM, and PE measures were published for each of 39 industries for each year between 2001 and 2016, i.e. 624 observations for each competition measure. The BOS measures are available for the same 39 industries but only for years from 2005 to 2016. The HHI and BOS measures are also available for four additional industries (the financial data required to estimate PCM and PE is not available for these extra industries). Table 1 summarises the 39 base industries and four additional industries (with codes LL12, OO, PP11, and QQ11) and describes the composition of these industries.

The indicators described above were all calculated for industries at the national level. In addition, the HHI indicator only (again based on labour input shares) was calculated for each of the 43 industries for firms operating in each of 42 urban areas, for each year between 2001 and 2016.

Table 1 Summary of industries in the competition visualisation tool

Industry code	Industry name and included industries	ANZSIC06 level 1
AA11	Horticulture and Fruit Growing	A
AA12	Sheep, Beef Cattle and Grain Farming	A
AA13	Dairy Cattle Farming	A
AA14	Poultry, Deer and Other Livestock Farming	A
AA21	Forestry and Logging	A
AA31	Fishing and Aquaculture	A
AA32	Agriculture, Forestry and Fishing Support Services and Hunting	A
BB11	Mining	B
CC1	Food, beverage and tobacco product manufacturing • Meat and meat product manufacturing • Seafood processing • Dairy product manufacturing • Fruit, oil, cereal, and other food manufacturing • Beverage and tobacco product manufacturing	C
CC21	Textile, Leather, Clothing and Footwear Manufacturing	C
CC3	Wood and Paper Products manufacturing • Wood product manufacturing • Pulp, paper, and converted paper manufacturing	C
CC41	Printing	C
CC5	Petroleum, chemical, machinery and equipment manufacturing • Petroleum and coal product manufacturing • Basic chemical and chemical product manufacturing • Polymer product and rubber product manufacturing	C
CC61	Non-Metallic Mineral Product Manufacturing	C
CC7	Metal product manufacturing	C

Industry code	Industry name and included industries	ANZSIC06 level 1
	• Primary metal and metal product manufacturing • Fabricated metal product manufacturing	
CC81	Transport Equipment Manufacturing	C
CC82	Machinery and Other Equipment Manufacturing	C
CC91	Furniture and Other Manufacturing	C
DD1	Electricity, Gas, Water and Waste Services • Electricity and gas supply • Water, sewer, drainage, and waste services	C
EE11	Building Construction	E
EE12	Heavy and Civil Engineering Construction	E
EE13	Construction Services	E
FF11	Wholesale Trade	F
GH11	Motor Vehicle and Motor Vehicle Parts and Fuel Retailing	G
GH12	Supermarket, Grocery Stores and Specialised Food Retailing	G
GH13	Other Store-Based Retailing and Non Store Retailing	G
GH21	Accommodation and Food Services	H
II11	Road Transport	I
II12	Rail, Water, Air and Other Transport	I
II13	Postal, Courier Transport Support, and Warehousing Services	I
JJ11	Information Media Services	J
JJ12	Telecommunications, Internet and Library Services	J
KK1_	Financial and insurance services • Finance • Insurance and superannuation funds	K
KK13	Auxiliary Finance and Insurance Services	K
LL11	Rental and Hiring Services (except Real Estate)	L
LL12*	Property Operators and Real Estate Services	L
MN11	Professional, Scientific and Technical Services	M
MN21	Administrative and Support Services	N
OO*	Public administration and safety • Local government administration • Central government admin, defence and public safety	O
PP11*	Education and Training	P
QQ11*	Health Care and Social Assistance	Q
RS11	Arts and Recreation Services	R
RS21	Other Services	S

Source: Stats NZ
Note:

1. * Only the HHI and BOS measures are available for these industries

The Maré and Fabling (2019) dataset also includes PCM and PE measures for a more detailed set of 318 industries for two combined time periods: 2001 to 2008 and 2009 to 2016.[7] Due to scope constraints this data is not included in the visualisation tool or in this report.

1.2 Scope of this report

This report is limited to describing key features and trends in the core competition measures in the Maré and Fabling (2019) dataset. Given the size of this dataset (see section 1.1 above), this report does not attempt to give a comprehensive overview of all aspects of this dataset. Instead this report is intended as a starting point for more detailed analysis of the data. This report focuses on the profit elasticity (OLS and fixed effects versions), price-cost margin (population-weighted and output share-weighted) and HHI competition measures. The BOS measures are largely excluded from the report due to time and space constraints, and the different nature and time period of these measures, which makes it harder to compare these to the other measures. However, some examples of the BOS results are included to illustrate what these measures show.

1.3 Caveats about measuring competition

Market definition

Competition is best analysed within the context of well-defined markets within which firms compete. This is particularly true for 'structural' measures such as the HHI which assume that competition is related to market structure. As explained above, if the market is not defined appropriately in the HHI calculation, we will include firms that don't compete with each other, and/or exclude firms that do compete, and could reach incorrect conclusions about the state of competition. For 'outcome' measures such as PCM and PE, incorrect market definition will add 'noise' to the competition measure, e.g. a measure calculated for a broadly defined industry that includes many markets will reflect the average state of competition across those markets. Such 'noisy' measures are still useful, but must be interpreted carefully.

Defining markets generally involves finding groups of products or services that are close substitutes in terms of demand and/or supply. Changes in the price, quality, or other attributes of a product will also tend to affect profits of firms supplying other products that are close substitutes, via consumer substitution. For example, if a firm unilaterally reduces its price, some of its customers will switch from other suppliers to its product, and this will reduce the profits of the firm's rivals. Such effects among substitute products, driven by the behaviour of consumers will tend to elicit a response from rival firms, hence the products can be thought of as being in the same market for the purpose of analysing competition if the effects are sufficiently strong, i.e. if the products are relatively close substitutes.

The competition measures described above have been calculated for industries rather than markets. In some cases, these industries correspond to a relatively narrow range of activities and hence the industry definition may be closer to a sensible market definition for firms in that industry, and hence competition measured for the industry may be a relatively good estimate of competition faced by firms in the relevant market(s). Examples of such industries include Dairy Cattle Farming and Printing. In other cases, the industries are relatively broad and include activities that probably do not compete. For example, the Wholesale Trade industry includes wholesale supply of a wide variety of products such as agricultural products, machinery, vehicles, groceries, liquor, textiles, pharmaceuticals, furniture, books, toys, etc. It is unlikely that wholesale suppliers of all of these products compete in the same market according to a typical market definition used for competition analysis, and thus competition in the broad industry may not be a very precise estimate of the actual competitive conditions faced by some or all firms. Other industries with similarly broad

[7] Data for these detailed industries was combined into eight-year periods to protect the confidentiality of individual firms at the detailed industry level.

composition include Electricity, Gas, Water and Waste Services, Construction Services, Other Store-Based Retailing and Non-Store Retailing, Accommodation and Food Services, Rental and Hiring Services (except Real Estate), and Professional, Scientific and Technical Services.

In summary, before interpreting any competition measures for industries defined in this dataset, consideration should be given to if and how closely the industry definition is likely to reflect the appropriate market definition for firms in that industry. Where industry definitions and market definitions are likely to be very different, competition measures for industries may still provide a guide to competitive outcomes in the corresponding markets, but further analysis is needed to determine if the same results apply for more narrowly defined markets.

Units of observation

As described by Maré and Fabling (2019, see their section 2), the unit of observation for calculating the competition metrics is the "permanent enterprise". In the underlying datasets, Stats NZ defines an *enterprise* as:[8]

> An institutional unit that generally corresponds to legal entities operating in New Zealand. It can be a company, partnership, trust, estate, incorporated society, producer board, local or central government organisation, voluntary organisation, or self-employed individual.

Maré and Fabling's concept of a permanent enterprise improves on this definition of enterprise by attempting to track continuing enterprises over time via keeping track of their employees. For example, if a partnership subsequently changed its legal form to a company but otherwise continued in business, Stats NZ's definition would record this as two different enterprises, but Maré and Fabling attempt to keep track of such changes and 'join' the separate enterprises into one (see Fabling, 2011, for details on the process of constructing permanent enterprises from the LBD data).

As Maré and Fabling (2019) note, "enterprise groups" (i.e. groups of related firms, with common or substantially overlapping ownership) may be more appropriate, since such firms are likely to maximise their joint profits rather than operating independently. However, data issues prevented them from implementing this approach. As they note, measured competition is likely to be less intense in an enterprise group-level analysis, as dominant firms also tend to be part of dominant groups of dominant firms.

[8] See http://datainfoplus.stats.govt.nz/Item/nz.govt.stats/bdb02aa2-866e-418f-83e8-342234867a0f?_ga=2.185815471.765776429.1557888193-75321905.1557888193#/nz.govt.stats/bdb02aa2-866e-418f-83e8-342234867a0f/43/#.

2 Patterns and trends in New Zealand competition measures

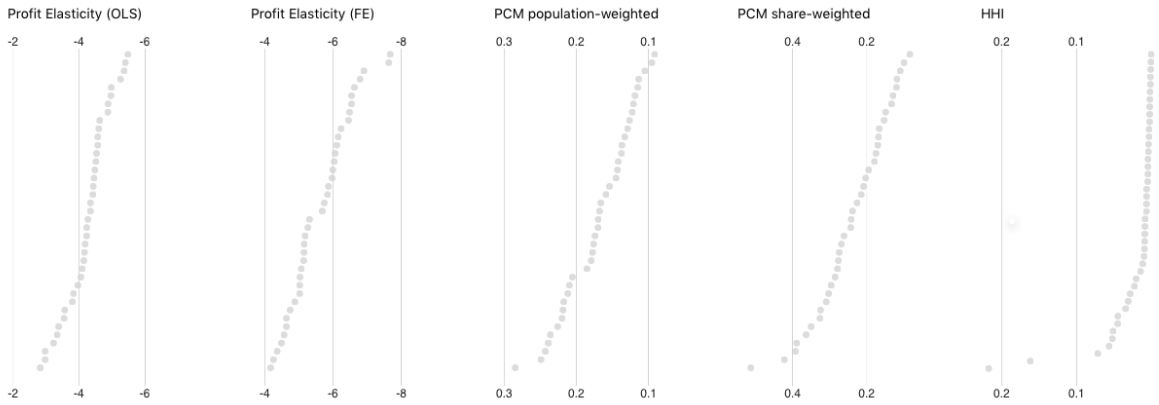
Note: In all graphs that follow, the axes are oriented so that "up" (where values are shown on the vertical axis) and "right" (where values are shown on the horizontal axis) correspond to more intense competition. The PE measures are always negative, and more negative numbers (i.e. greater PE in absolute value) represent more intense competition. The PCM and HHI measures are always positive, and smaller numbers (i.e. closer to zero) represent more intense competition.

2.1 Competition across industries

Competition varies considerably across industries in any given year …

Most of the competition measures show relatively wide variation across industries, as illustrated in Figure 1 for 2016, for the PCM and the PE. The HHI shows a different pattern. At the national industry level, in many cases there are a large number of firms with small market shares (based on their labour inputs), thus many industries have HHI values that are close to zero. This reflects the fact that the HHI is designed to measure competition in well-defined markets, rather than at the national industry level, which could encompass many markets. In 2016, only two industries had an HHI greater than 0.1: Telecommunications, Internet and Library Services (0.16) and Rail, Water, Air and Other Transport (0.22). Arguably, for these industries, the industry definitions and the market definitions are not as differentiated as in most other industries. However, for some other industries such as Wholesale Trade (HHI 0.002) or Construction Services (HHI 0.0003), the industry definition is likely to be considerably broader than the market definition, and thus HHI at the industry level is unlikely to reflect the level of competition faced by many firms in the industry.

Figure 1 Comparison of competition measures across all industries in 2016



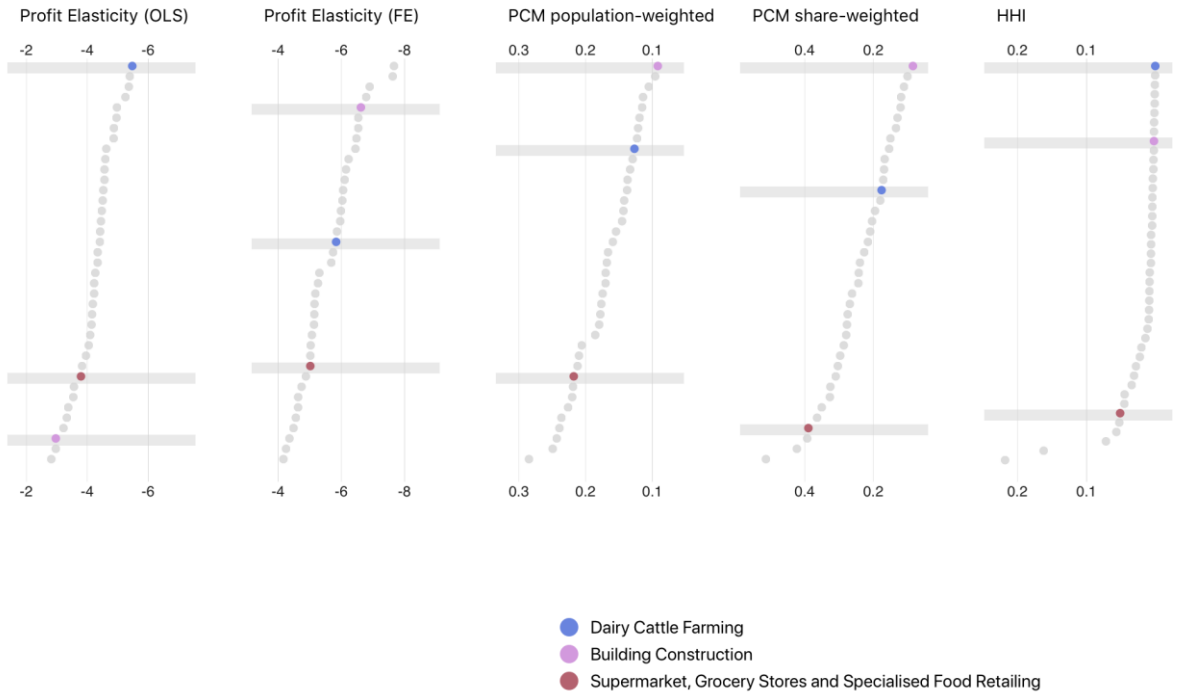
Source: Competition visualisation tool

… and different competition measures tell different stories for an industry

Echoing the conclusions of Maré & Fabling (2019), Figure 2 highlights values of the various competition measures for three selected industries in 2016. This shows that the ranking of an industry among all industries for each competition measure varies substantially in some, but not all cases. For example, Dairy Cattle Farming was the most competitive industry based on HHI and the PE (OLS) measures but ranked toward the middle of all industries on the PE (FE) and PCM measures. This confirms that quite different conclusions could be reached about the relative competitiveness of industries depending on the choice of competition measure. In many cases, competition in real-world markets appears to be more nuanced than can be captured by a single competition metric, and more detailed study of the structure and outcomes in a market is necessary

to fully understand how competition works in that market. Nevertheless, the simple competition metrics are still useful to identify industries where competition may be relatively weak or strong, and to perform high-level comparisons across industries and across time.

Figure 2 Comparison of competition measures for three selected industries in 2016



Source: Competition visualisation tool

Competition measures for some industries are also subject to high uncertainty …

The graphs above only show the point estimate of the competition measure for each industry. The PE and PCM measures were estimated using regression models applied to firm-level data, and there is uncertainty associated with the estimated value for each industry in each year.[9] There is no uncertainty associated with the HHI measure, as these are calculated directly from firms' market shares.

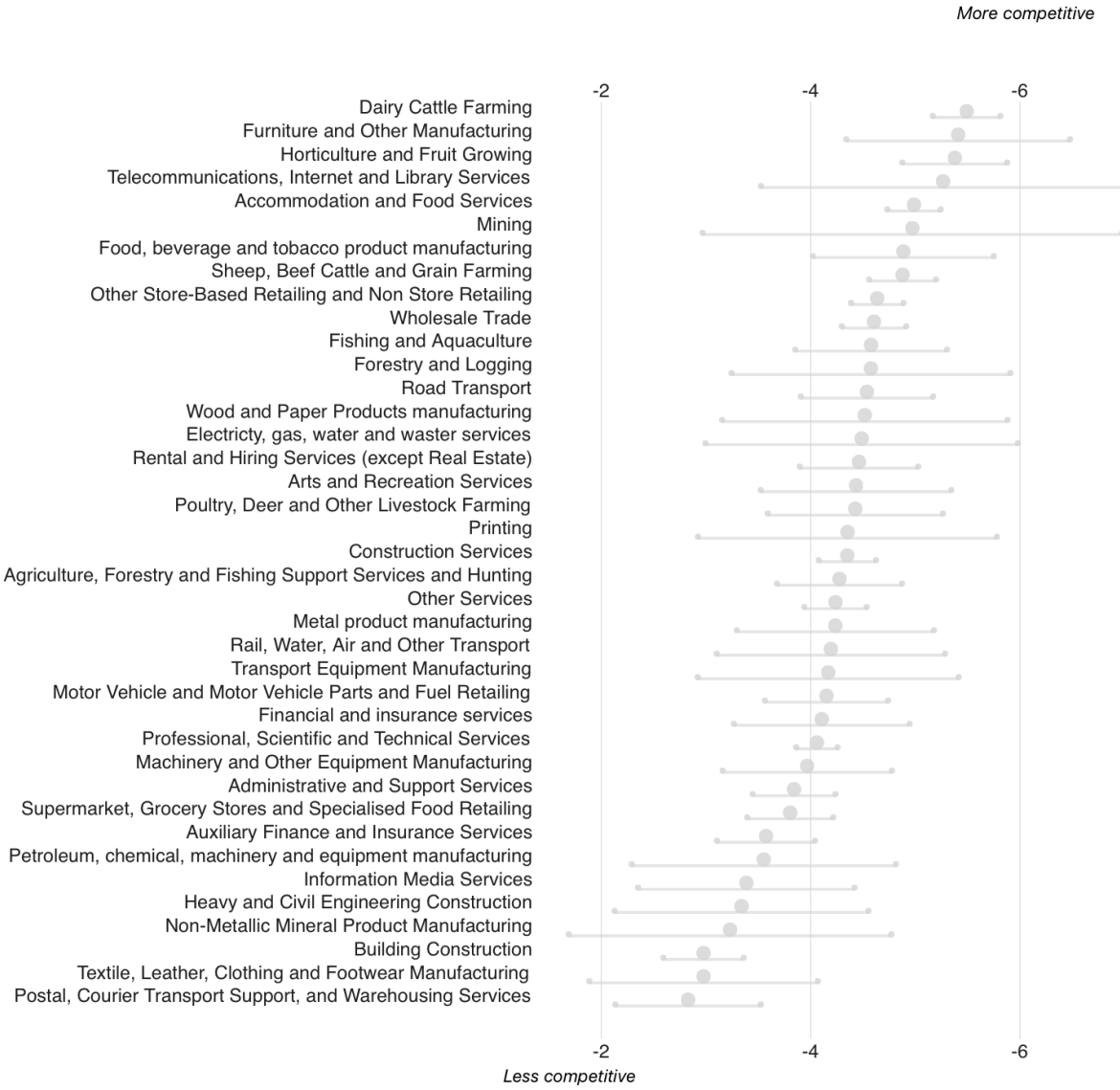
To illustrate, Figure 3 shows the 95% confidence ranges around the PE (OLS) competition measures for all industries in 2016. The width of these ranges varies considerably across industries. For example, the confidence range for the PE (OLS) measure for Dairy Cattle Farming in 2016 is from -5.82 to -5.18, or a variation of about 6% around the point estimate of -5.50. In contrast, the confidence range for the PE (OLS) measure for Mining in 2016 is from -6.99 to -2.98, or a variation of about 40% around the point estimate of -4.98.

The high uncertainties in some cases mean we should be careful when ranking industries if the estimates for all industries have high uncertainty. In all cases, the competition measure for any given industry is not statistically significantly different from that of several industries above or below it in the ranking, i.e. there is too much variation in the measures to have reasonable confidence about which industry is or higher or lower in the ranking. Rather than a precise ordering of industries, the PE and PCM measures should be thought of as generating an approximate ranking of industries from most to least competitive. For industries like Mining with relatively high uncertainty associated with the PE and PCM measures, it is difficult to be sure how these industries compare to others in any given year. For example, the PE (OLS) measure for Mining in 2016 is not statistically significantly

[9] See section 2 of Maré and Fabling (2019) for details of the regression estimation of these indicators.

different from that for any other industry, as the confidence range for this competition measure for Mining overlaps with the confidence ranges of the same competition measure of all other industries in 2016.

Figure 3 Illustration of 95% confidence ranges around the PE (OLS) competition measure for all industries in 2016



Source: Competition visualisation tool

… and can vary a lot from year to year

Variations in competition measures for some industries from year to year also mean that we should be cautious about using values of these measures in a single year to reach conclusions about competitiveness. Figure 4 illustrates this by showing time trends in the various competition measures for the same five selected industries as in Figure 2 above. For some measures and some industries, e.g. the PCM measures for Dairy Cattle Farming, there are considerable variations from year to year, and hence the ranking of the industry can appear to be very different from one year to the next. For Dairy Cattle Farming, the variability of PCM over time possibly reflects volatility of dairy product prices in international markets while production costs are largely fixed in the short term. This means that we could reach quite a different conclusion about the intensity of competition in Dairy Cattle Farming depending on which year the PCM was calculated, but there is no reason to expect that the intensity of competition in Dairy Cattle Farming varies greatly from year to year. It

seems more likely that most of the annual the variation in PCM reflects other factors that go in to the PCM calculation, rather than competition in the industry itself.

Figure 4 Time trends in competition measures for selected industries

Source: Competition visualisation tool

Note:

1. Thicker lines show trends that are statistically significant at the 5% level based on a Mann-Kendall test. Mann-Kendall tests are non-parametric tests for monotonically increasing or decreasing trends over time. These tests can detect a variety of non-linear trends and do not impose specific assumptions about the distribution of changes in the relevant variable over time

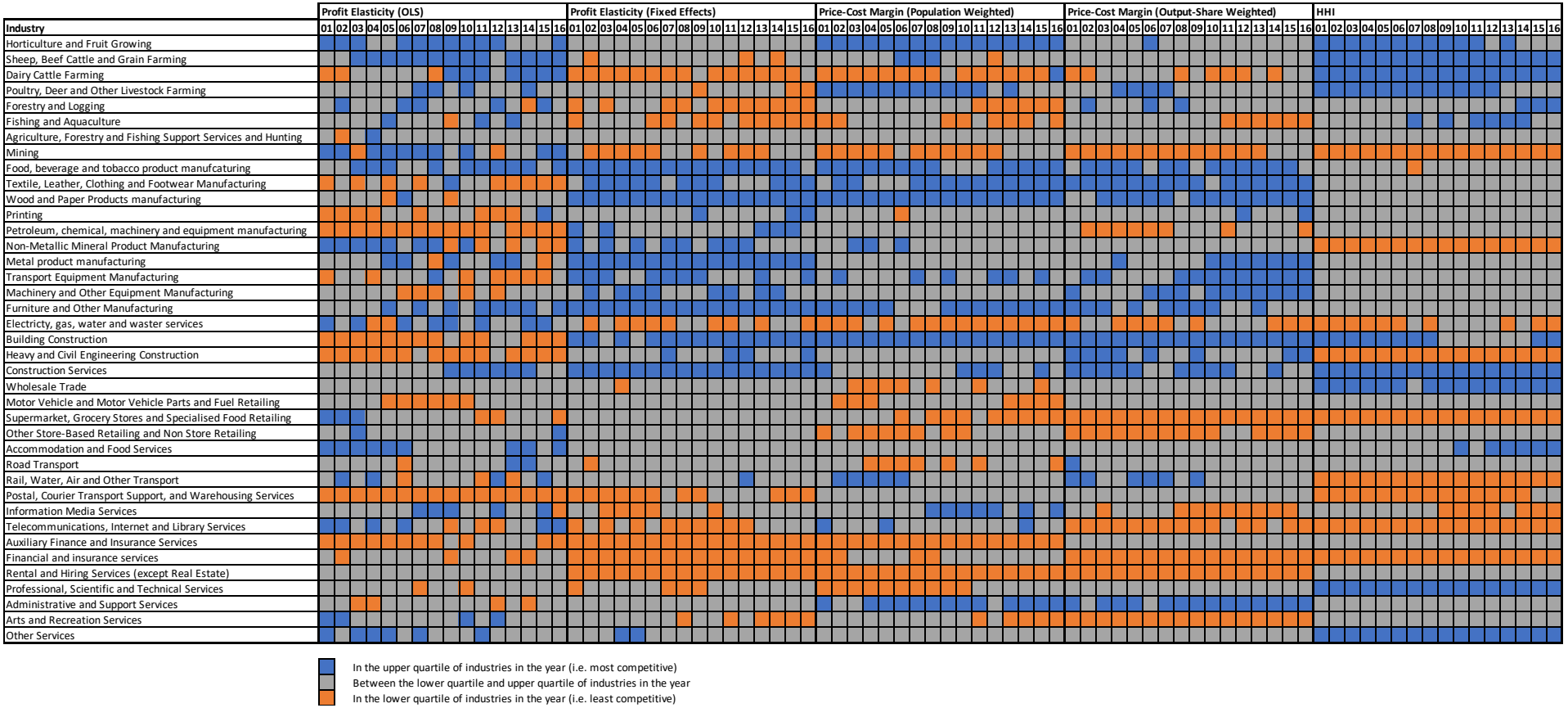
In other industries, some competition measures are relatively stable or show generally consistent trends over time. For example, most of the competition measures for the Supermarket, Grocery Stores and Specialised Food Retailing industry have tended to trend downwards over time (suggesting that competition in this industry may have weakened over time). In contrast, the PCM and PE measures for the Building Construction industry appear to show repeated downward and upward cycles over time (broadly synchronised across the two measures), possibly reflecting the cyclical nature of activity in that industry.

But despite all these variations, there are some consistent patterns

The above analysis strongly suggests that it is necessary to take a broader view of the dataset to get a sense of the industries in which competition is relatively more intense or less intense. Figure 5 provides one such broader view by colour-coding the values of the competition measures for each industry in each year into three categories:

- Blue cells represent industries that were in the upper quartile (i.e. the top 25% of most competitive industries) of the respective competition measure in the respective year.
- Grey cells represent industries that were in the middle half (i.e. between the lower quartile and upper quartile) of industries for the respective competition measure in the respective year.
- Orange cells represent industries that were in the lower quartile (i.e. the bottom 25% of least competitive industries) of the respective competition measure in the respective year.

Figure 5 Overview of the distribution of competition measures across industries and years



Source: Authors' calculations based on competition visualisation tool

From this it is apparent that some industries have remained in the upper or lower quartiles of several competition measures in many years. Despite the uncertainties and variation in competition measures over time, this gives some indications of industries in which average competition is consistently relatively intense or relatively weak compared to other industries.

For example, the following industries were in the upper quartile (most intense competition) for at least three out of the five indicators in at least 10 out of 16 years:

- Horticulture and Fruit Growing
- Food, Beverage and Tobacco Product Manufacturing
- Wood and Paper Products Manufacturing
- Furniture and Other Manufacturing
- Building Construction
- Construction Services

While the above industries have relatively strong competition on average according to the competition measures used in this report, it is important to note that this does not rule out the existence of any competition problems in these industries or in any other industries.

Similarly, the following industries were in the lower quartile (weakest competition) for at least three out of the five indicators in at least 10 out of 16 years:

- Mining
- Supermarket, Grocery Stores and Specialised Food Retailing
- Financial and Insurance Services
- Auxiliary Finance and Insurance Services
- Rental and Hiring Services (except Real Estate)

Figure 5 also illustrates that the PE measure can give quite different results depending on whether fixed effects are included in the estimation. There are some examples of industries that in most years are in the upper quartile of the PE (OLS) measure but the lower quartile of the PE (FE) measure, and vice versa, e.g. Dairy Cattle Farming, Mining, and Building Construction. The two alternative versions of PCM tend to be more consistent (since all that differs is the weighting of individual firms in the calculation of aggregate PCM), but it is clear that PE and PCM can give quite different impressions of the relative competitive intensity of industries.

Across time, the HHI measure tends to be the most stable, but this is not surprising given that in many industries the HHI values based on the national market shares of a large number of small firms. In contrast, the relative performance of industries in terms of the PE and PCM measures is considerably more variable. There are examples of industries that move between the upper and lower quartiles of the PE and PCM measures within one or two years, e.g. Dairy Cattle Farming, Non-Metallic Mineral Product Manufacturing, and Rail, Water, Air and Other Transport.

2.2 Taking a closer look at the least competitive industries

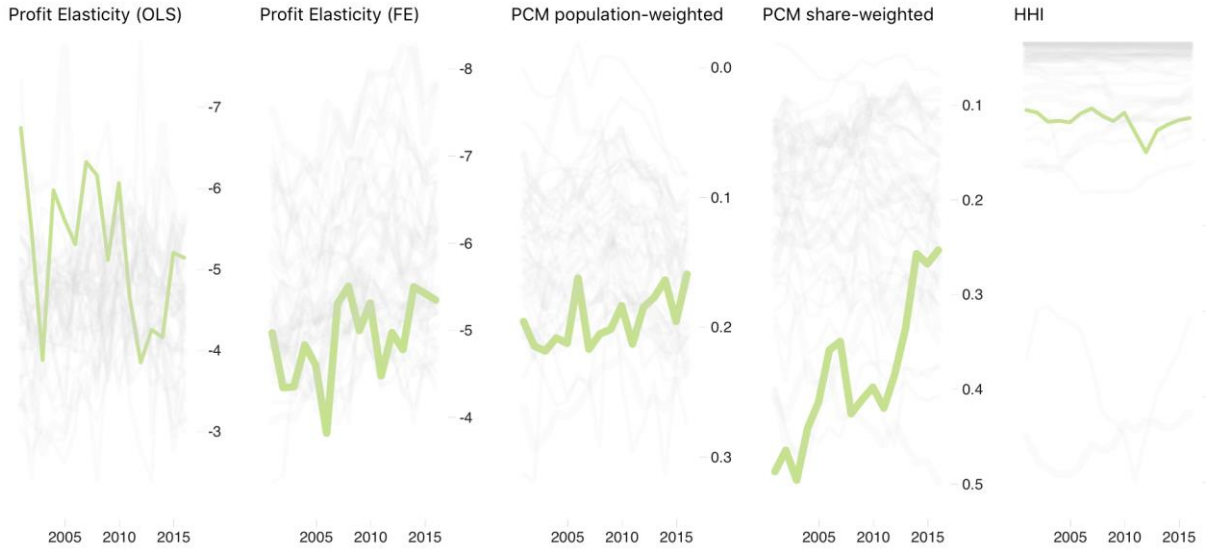
Industries where competition measures consistently indicate weak competition are of interest as these are industries where further investigation could be warranted. However, it is also important to note that that given the limitations of these competition measures, a lack of indication of weak competition does not mean that there are no competition problems in any particular industry.

Mining

The Mining industry (Figure 6) has consistently been in the lowest quartile of industries for the PE (FE), PCM, and HHI measures, but has been in the highest quartile of industries for the PE (OLS) measure. There is some evidence that competition in the Mining industry has strengthened over time, with increasing trends found in the PE (FE) and PCM measures, and for the three years from 2013 to 2016 the Mining industry was not in the lowest quartile for the PE (FE) and PCM measures, but remained in the lowest quartile on the basis of HHI.

This, plus the fact that the HHI has remained relatively constant over time, suggests that the number and market shares of firms in the Mining industry has stayed more or less the same, but firms' margins have reduced, and profits have become more responsive to costs. Given that prices for some outputs of this industry will be determined in international export markets, it is not clear whether these changes reflect stronger competition in the New Zealand mining industry per se, or whether they reflect changes in competition or other market characteristics in international output markets with the domestic market structure and costs remaining relatively constant.

Figure 6 Competition measures over time in the Mining industry



Source: Competition visualisation tool

Note:

1. Thicker lines indicate statistically significant trends over time

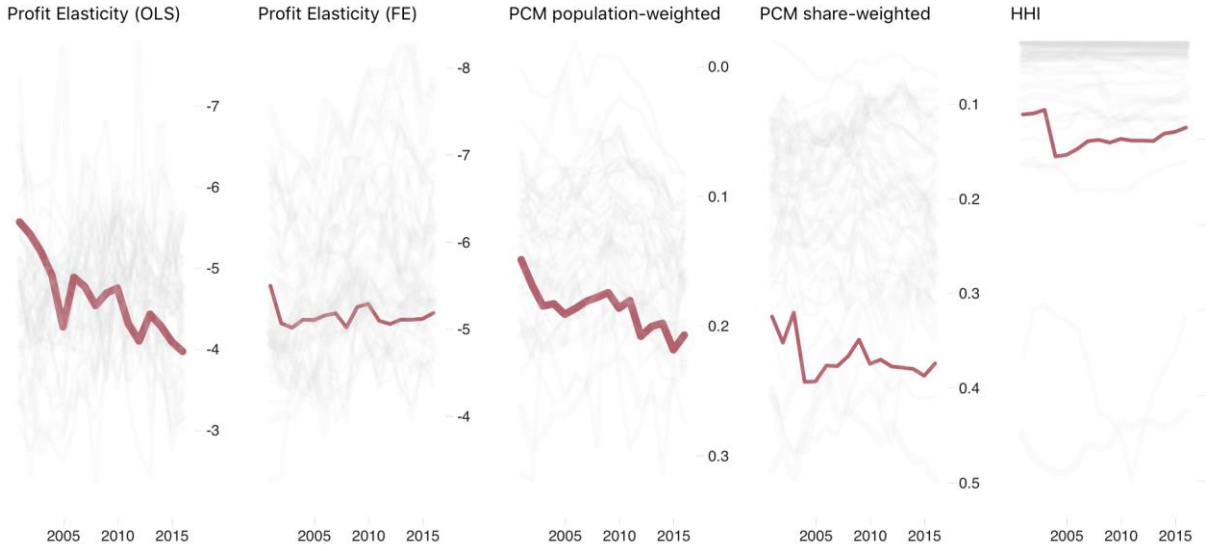
Supermarket, Grocery Stores and Specialised Food Retailing

The Supermarket, Grocery Stores and Specialised Food Retailing industry (Figure 7) has consistently been in the lowest quartile of industries for the PCM and HHI measures. There is also evidence that competition in this industry has weakened over time with statistically significant decreasing trends found in the PE (OLS) and PCM (population-weighted) measures, and the other measures also appear to have decreased somewhat over time.

The national HHI for this industry shows a substantial increase (i.e. reduction in competition) between 2003 and 2004, reflecting consolidation in the sector. Since then the HHI has slightly decreased (reflecting increased competition) but has remained in the upper quartile of all industries. Around the same time as the increase in HHI, an increase in margins and reduced sensitivity of profits to costs also occurred, suggesting that the consolidation was associated with reduced competition. Subsequently, margins have continued to gradually increase and the PE (OLS) measure indicates generally weakening competition over time while the PE (FE) measure has remained relatively constant.

Overall, this suggests a relatively static industry (after the consolidation in 2003/04) with indicators of relatively high margins over variable costs and weakening competition over time.

Figure 7 Competition measures over time in the Supermarket, Grocery Stores and Specialised Food Retailing industry



Source: Competition visualisation tool

Note:

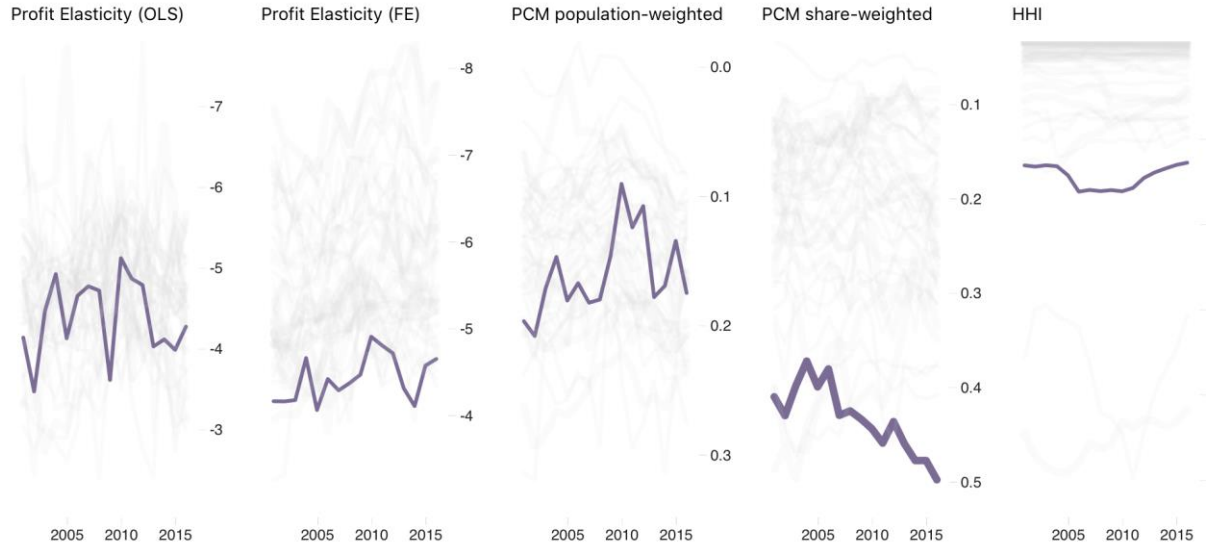
1. Thicker lines indicate statistically significant trends over time

Financial and Insurance Services

The Financial and Insurance Services industry (Figure 8) has consistently been in the lowest quartile of industries for the PE (FE), PCM (share-weighted) and HHI measures. The HHI shows that some consolidation occurred between 2005 and 2007 but this was subsequently reversed between 2012 and 2016. On the PCM (share-weighted) measure, this industry had the highest margins of all industries between 2013 and 2016, and this measure shows strongly increasing margins (i.e. weakening competition), with margins over variable costs reaching 50% in 2016. However, the Financial and Insurance Services industry ranks around the middle of all industries on the PCM (population-weighted) measure and margins calculated on that basis have generally decreased over time, although the trend is not statistically significant. The PE measures for this industry show relatively low responsiveness of profits to costs and have generally remained constant over time.

Overall, the evidence indicates a relatively static industry where the market structure has not changed much over time, but there is some evidence of high and increasing profit margins over variable costs, which could reflect a lack of competition or other factors such as high fixed costs.

Figure 8 Competition measures over time in the Finance and Insurance Services industry



Source: Competition visualisation tool

Note:

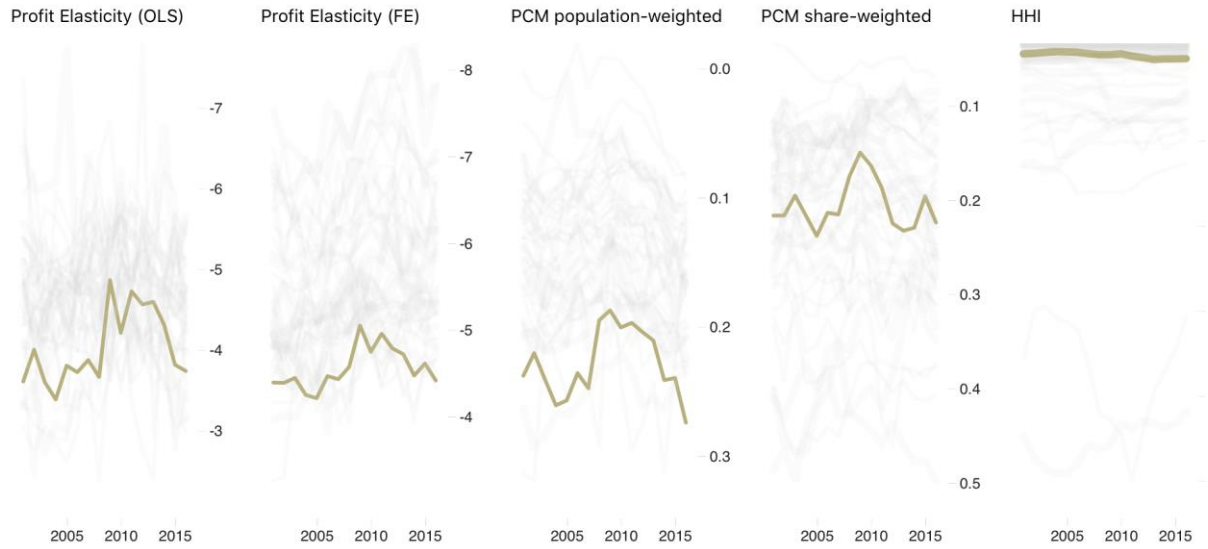
1. Thicker lines represent statistically significant trends over time

Auxiliary Finance and Insurance Services

The Auxiliary Finance and Insurance Services industry (Figure 9) includes firms in the Financial and Insurance Services industry (ANZSIC category K) that do not fall into the Finance and Insurance and Superannuation Fund classifications. These include the following sub-categories: Financial Asset Broking Services (ANZSIC K641100), Other Auxiliary Finance and Investment Services (ANZSIC K641900) and Auxiliary Insurance Services (ANZSIC 642000). This industry has consistently been in the lowest quartile of the PE (OLS), PE (FE), and PCM (population-weighted measures).

However, it has a relatively low HHI, indicating that the industry is comprised of a relatively large number of firms with small market shares. Given that margins (on a population-weighted basis) appear relatively high and profits are relatively unresponsive to costs, the HHI for this industry may not reflect competition that firms face over time. The PE and PCM measures have been somewhat volatile over time and do not show statistically significant trends, but despite the variability these measures have generally remained in the lowest quartile (i.e. weakest competition) suggesting that competitive conditions have not substantially changed over time.

Figure 9 Competition measures over time in the Auxiliary Finance and Insurance Services industry



Source: Competition visualisation tool

Note:

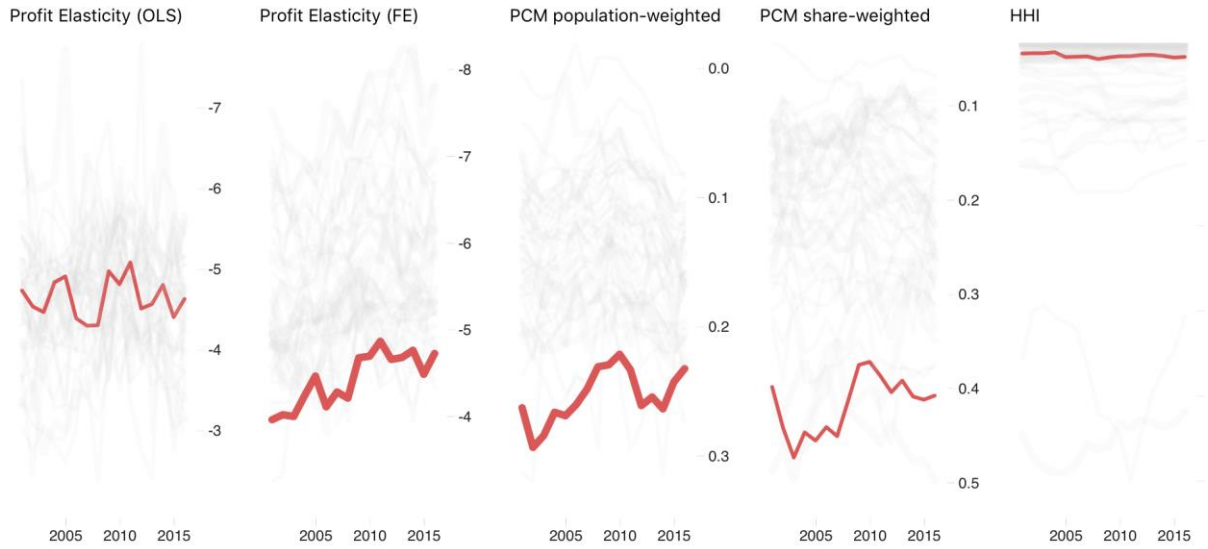
1. Thicker lines represent statistically significant trends over time

Rental and Hiring Services (except Real Estate)

The Rental and Hiring Services (except Real Estate) industry (Figure 10) includes firms in the Rental, Hiring and Real Estate Services industry (ANZSIC category L) except for those in the Property Operators and Real Estate Services category (ANZSIC category L67). This includes Motor Vehicle and Transport Equipment Rental and Hiring (ANZSIC category L661), Farm Animals and Bloodstock Leasing (L662), Other Goods and Equipment Rental and Hiring (ANZSIC category L663) and Non-Financial Intangible Assets (except Copyrights) Leasing (ANZSIC category L664). This suggests that the industry defined for the calculation of these competition measures is relatively diverse and includes a mix of firms that may not compete in practice, e.g. it seems unlikely that firms involved in vehicle rentals would compete with firms involved in livestock leasing.

With that caveat in mind, this industry has consistently been in the lowest quartile of the PE (FE) and PCM measures, so it appears that at least some of the markets covered by this industry have indications of relatively weak competition. Profit margins over variable costs have generally been among the two or three highest industries, although there is evidence that margins have decreased over time. There is also evidence that profits have become more responsive to costs over time (i.e. stronger competition), as measured by the PE (FE) measure. This suggests that competitive conditions in the industry may be improving, and given that the HHI has generally remained unchanged, this may reflect changes in competition among firms rather than new entry.

Figure 10 Competition measures over time in the Rental and Hiring Services (except Real Estate) industry



Source: Competition visualisation tool

Note:

1. Thicker lines represent statistically significant trends over time

2.3 Identifying industries with the greatest changes in competition measures over time

To help identify industries where the intensity of competition had increased or decreased the most, simple linear time trends were fitted to each of the five competition measures for each industry, over the period from 2001 to 2016. Figure 11 shows a visual summary of the slope coefficients of these changes,[10] and the following paragraphs summarise industries with trends that were statistically significant at the 5% level and were in the upper or lower quartile of trends across industries for at least one competition measure.

Figure 11 Summary of estimated linear trend slope coefficients for industries and competition measures from 2001 to 2016

Code	Industry	PE (OLS)	PE (FE)	PCM (pop weighted)	PCM (share weighted)	HHI
AA11	Horticulture and Fruit Growing					
AA12	Sheep, Beef Cattle and Grain Farming					
AA13	Dairy Cattle Farming					
AA14	Poultry, Deer and Other Livestock Farming					
AA21	Forestry and Logging					
AA31	Fishing and Aquaculture					
AA32	Agriculture, Forestry and Fishing Support Services and Hunting					
BB11	Mining					
CC1	Food, beverage and tobacco product manufacturing					
CC21	Textile, Leather, Clothing and Footwear Manufacturing					
CC3	Wood and Paper Products manufacturing					
CC41	Printing					
CC5	Petroleum, chemical, machinery and equipment manufacturing					
CC61	Non-Metallic Mineral Product Manufacturing					
CC7	Metal product manufacturing					
CC81	Transport Equipment Manufacturing					
CC82	Machinery and Other Equipment Manufacturing					
CC91	Furniture and Other Manufacturing					
DD1	Electricty, gas, water and waste services					
EE11	Building Construction					
EE12	Heavy and Civil Engineering Construction					
EE13	Construction Services					
FF11	Wholesale Trade					
GH11	Motor Vehicle and Motor Vehicle Parts and Fuel Retailing					
GH12	Supermarket, Grocery Stores and Specialised Food Retailing					
GH13	Other Store-Based Retailing and Non Store Retailing					
GH21	Accommodation and Food Services					
II11	Road Transport					
II12	Rail, Water, Air and Other Transport					
II13	Postal, Courier Transport Support, and Warehousing Services					
JJ11	Information Media Services					
JJ12	Telecommunications, Internet and Library Services					
KK1_	Financial and insurance services					
KK13	Auxiliary Finance and Insurance Services					
LL11	Rental and Hiring Services (except Real Estate)					
MN11	Professional, Scientific and Technical Services					
MN21	Administrative and Support Services					
RS11	Arts and Recreation Services					
RS21	Other Services					

Decreasing competition over time
Increasing competition over time

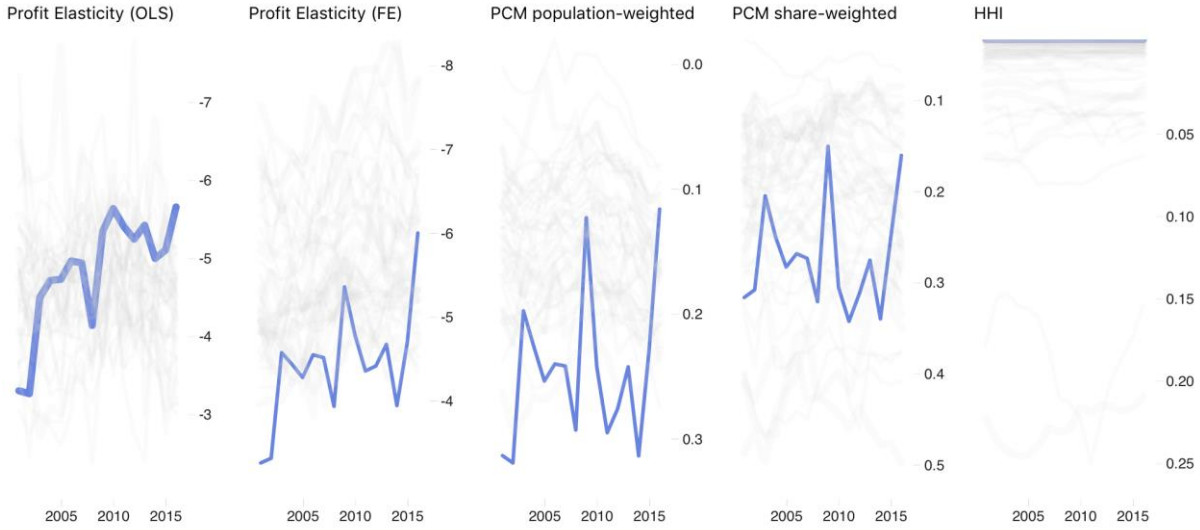
Source: Authors' calculations based on competition visualisation tool

[10] Since each competition measure has a different range of variation, the colour scales are not comparable across competition measures. For all measures, negative slopes correspond to increasing intensity of competition and vice versa.

Dairy Cattle Farming: Increasing competition

According to the PE measure, responsiveness of profits to costs has increased relatively strongly in the Dairy Cattle Farming industry, but margins have fluctuated over a relatively wide range without any clear trend (Figure 12). This may suggest changes in the competitive behaviour of firms, but margins are probably largely determined by external factors, i.e. international prices for exported dairy products.

Figure 12 Competition measures over time in the Dairy Cattle Farming industry



Source: Competition visualisation tool

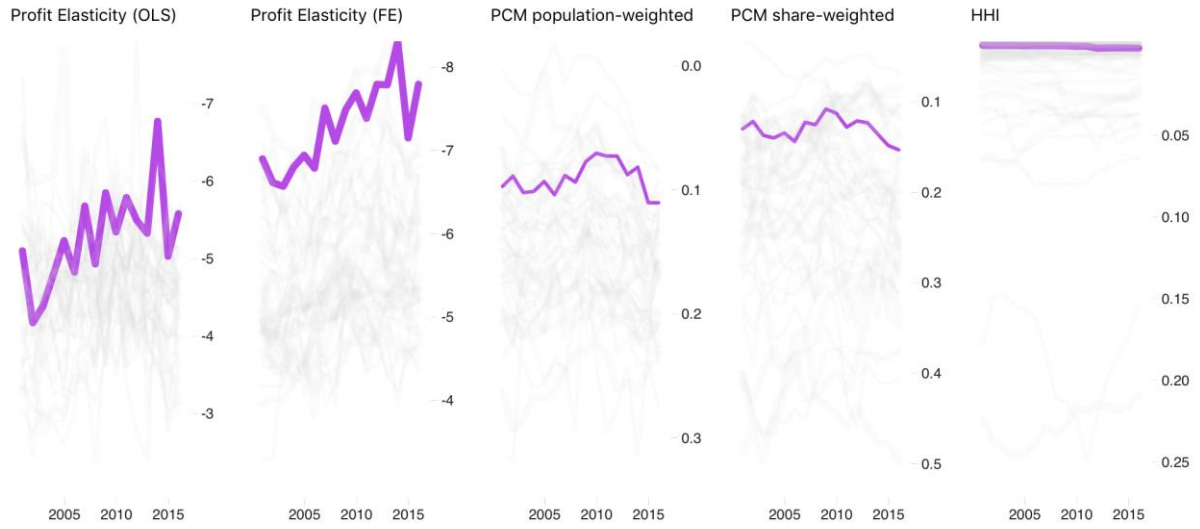
Mining: Increasing competition

The Mining industry shows relatively strong reductions in margins over time (see Figure 11 above). Again, given the likely exposure of this industry to international markets, whether these changes are due to changes in competition in New Zealand markets or changes in international market conditions are not clear.

Furniture and Other Manufacturing: Increasing competition

In the Furniture and Other Manufacturing industry, profits have become significantly more responsive to costs over time, while margins and HHI have remained relatively constant over time (Figure 13).

Figure 13 Competition measures over time in the Furniture and Other Manufacturing industry

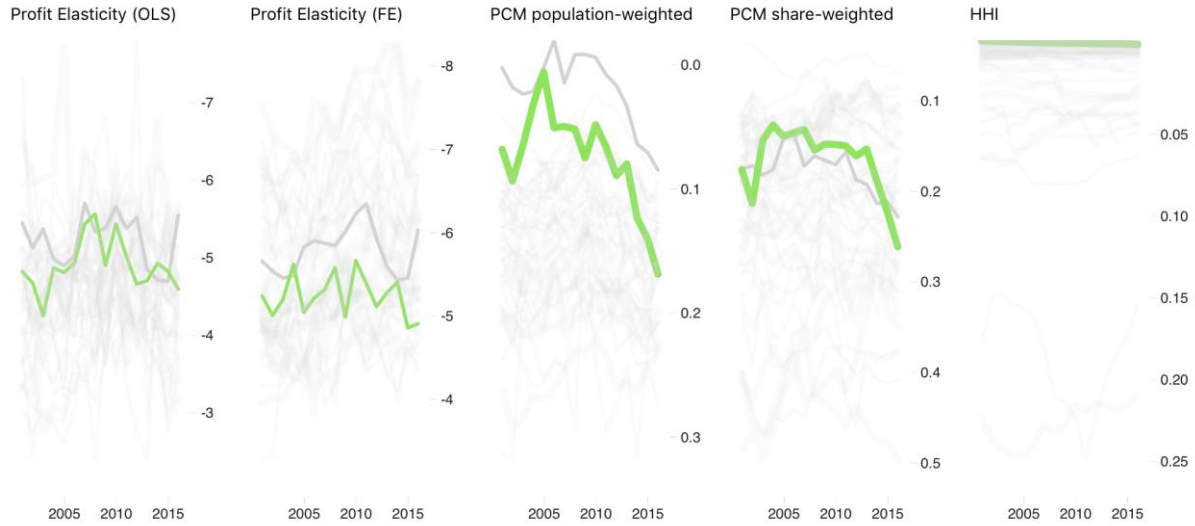


Source: Competition visualisation tool

Poultry, Deer and Other Livestock Farming: Decreasing competition

In the Poultry, Deer and Other Livestock Farming industry, margins have increased significantly over time, particularly since around 2013. The cause of this is not entirely clear as the responsiveness of profits to costs and HHI have remained generally constant over time.

Figure 14 Competition measures over time in the Poultry, Deer and Other Livestock Farming industry

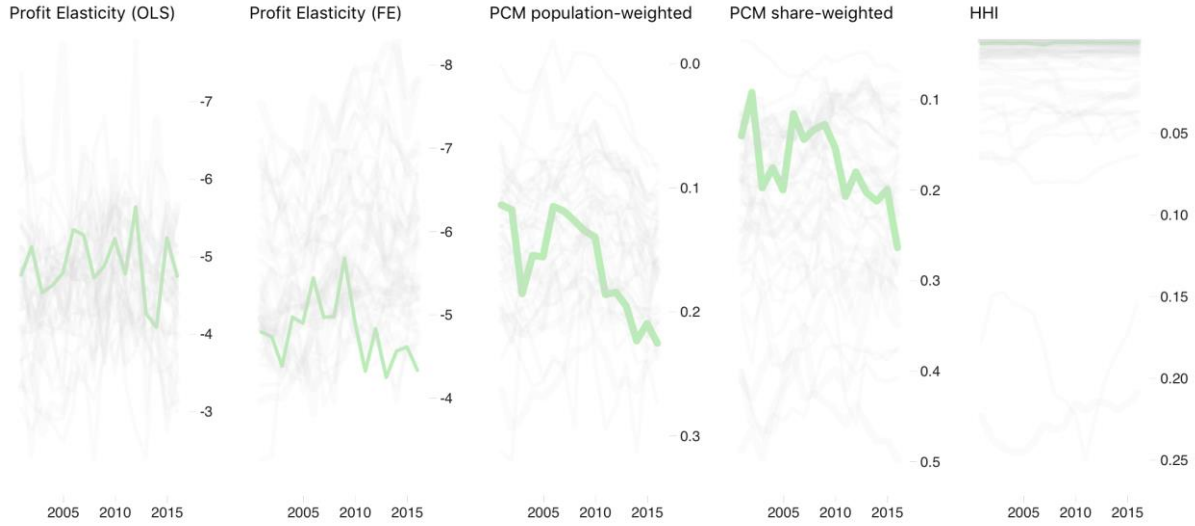


Source: Competition visualisation tool

Forestry and Logging: Decreasing competition

Similarly, in the Forestry and Logging industry, margins have increased substantially over time, while the PE and HHI measures have remained more or less constant. The cause of the changes in margins is not clear.

Figure 15 Competition measures over time in the Forestry and Logging industry

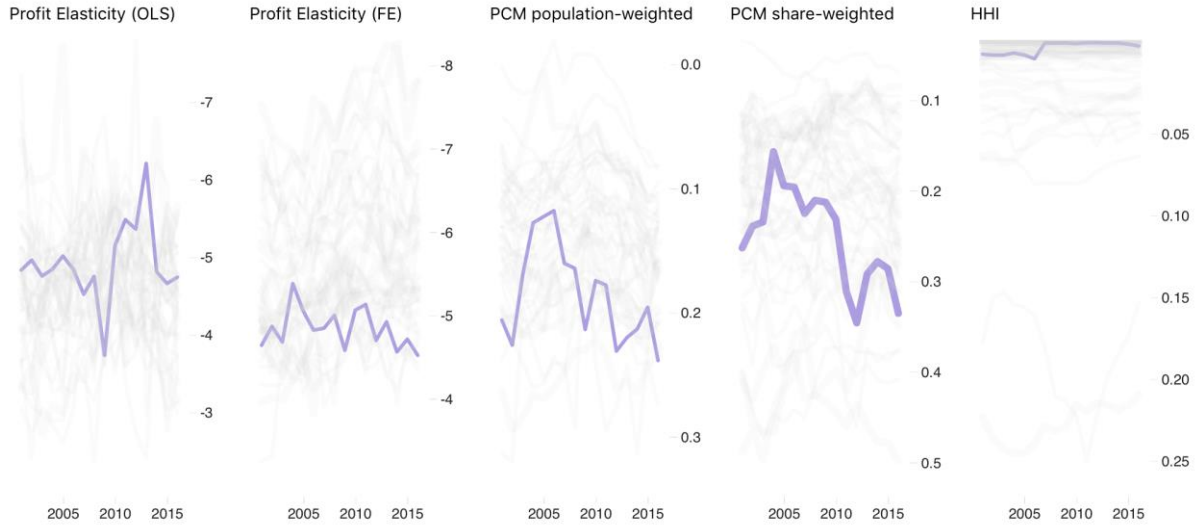


Source: Competition visualisation tool

Fishing and Aquaculture: Decreasing competition

Fishing and Aquaculture is another primary industry where margins have increased over time while the PE and HHI measures have remained generally constant.

Figure 16 Competition measures over time in the Fishing and Aquaculture industry



Source: Competition visualisation tool

Financial and Insurance Services: Decreasing competition

In the Financial and Insurance Services industry (see Figure 8 above), there is some evidence that margins have increased substantially over time. However, other competition measures have remained relatively constant over time.

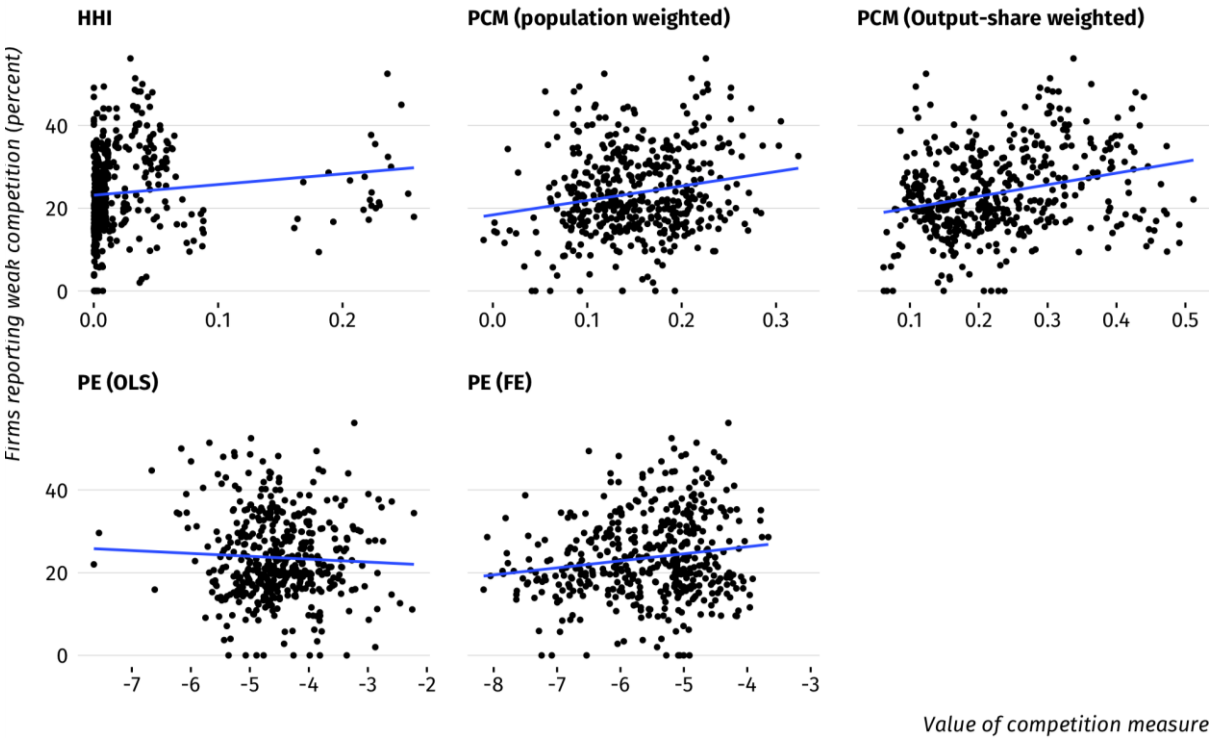
2.4 Comparing subjective vs objective competition measures

As described above, the dataset includes subjective competition measures derived from the BOS, i.e. the proportion of firms in an industry and year reporting that they face "strong" or "weak" competition. It is interesting to explore the extent to which the self-reported intensity of competition correlates with other objective competition measures. As an initial exploration of this question, Figure 17 and Figure 18 show the correlation between self-reported weak and strong competition respectively and the other competition measures, combining data for all industries and all years (i.e. each dot represents an industry-year combination).

This shows that the relationships are generally as expected, i.e. in all but one case the proportion of firms reporting they face weak competition increases as the objective competition measures indicate weakening competition, and in all cases the proportion of firms reporting they face strong competition decreases as the objective competition measures indicate weakening competition. The only exception is the PE (OLS) measure, which is slightly negatively correlated with the proportion of firms reporting they face weak competition.

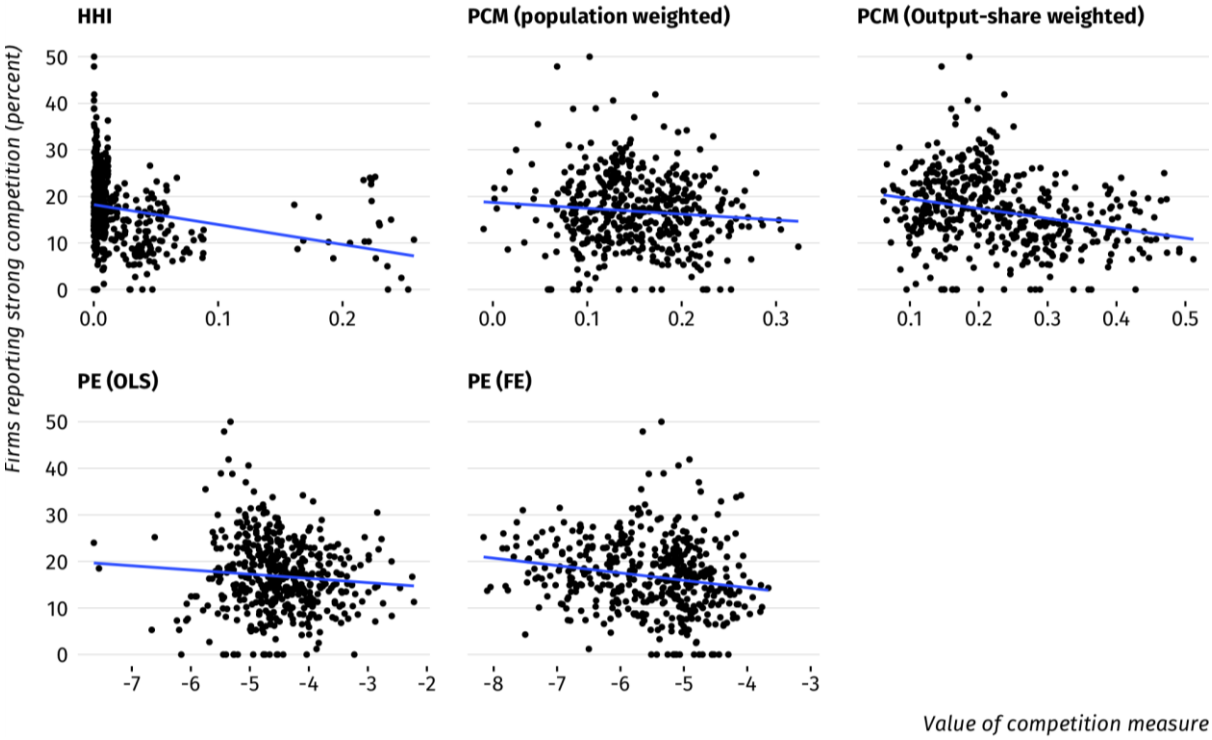
The figures show that while self-reported competition is generally correlated with the objective measures, there is a lot of variation in self-reported competition that is not explained by the objective measures, and vice versa. Using simple linear regression models of the relationship between self-reported competition and the objective competition measures (see the Appendix to this report), we found that with the exception of the PE (OLS) measure, there are statistically significant relationships between the objective measures and self-reported competition. This suggests that most of the objective measures are predictive of self-reported competition (and vice versa), but the objective measures only appear to capture a small proportion of the variation in self-reported competition.

Figure 17 Proportion of firms reporting they face weak competition versus other competition measures (all industries and years combined)



Source: Competition visualisation tool

Figure 18 Proportion of firms reporting strong competition versus other competition measures (all industries and years combined)



Source: Competition visualisation tool

Comparing HHI across geographic areas

The competition dataset includes the HHI measure only for each industry calculated for enterprises operating in each of 42 urban areas in each year from 2001 to 2016. Figure 19 shows a visual summary of the average HHI value across all years, for each combination of urban area and industry (recall that lower HHI values correspond to more intense competition). The following industries ranked in the lowest quartile of HHI (i.e. most intense competition) in at least 21 out of 42 regions in at least 10 out of 16 years:

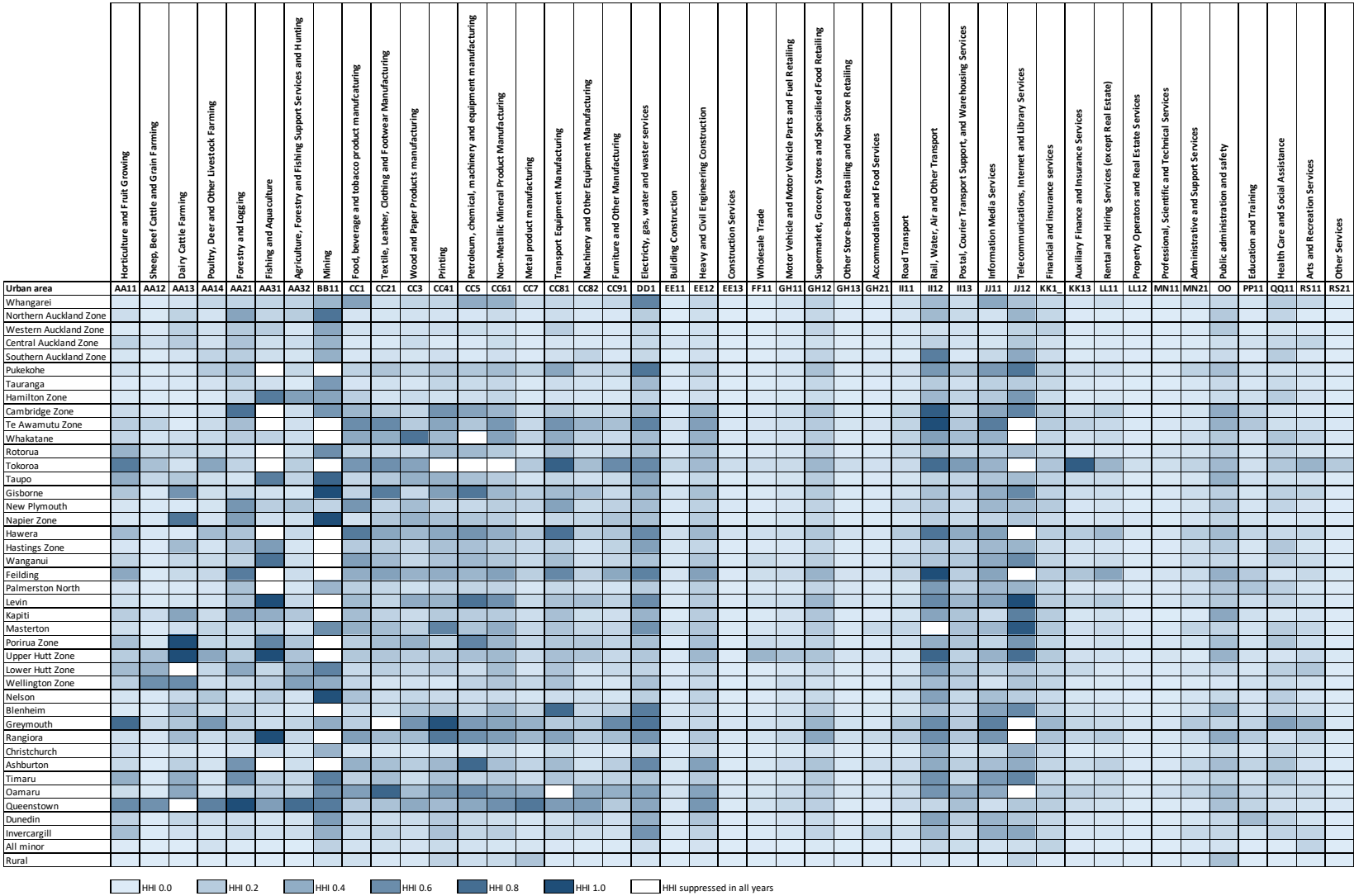
- Sheep, Beef Cattle and Grain Farming
- Building Construction
- Construction Services
- Wholesale Trade
- Other Store-Based Retailing and Non-Store Retailing
- Accommodation and Food Services
- Property Operators and Real Estate Services
- Professional, Scientific and Technical Services
- Other Services

Similarly, the following industries ranked in the highest quartile (i.e. weakest competition) in at least 21 out of 42 regions in at least 10 out of 16 years:

- Electricity, Gas, Water and Waste Services
- Rail, Water, Air and Other Transport
- Information and Media Services
- Telecommunications, Internet and Library Services

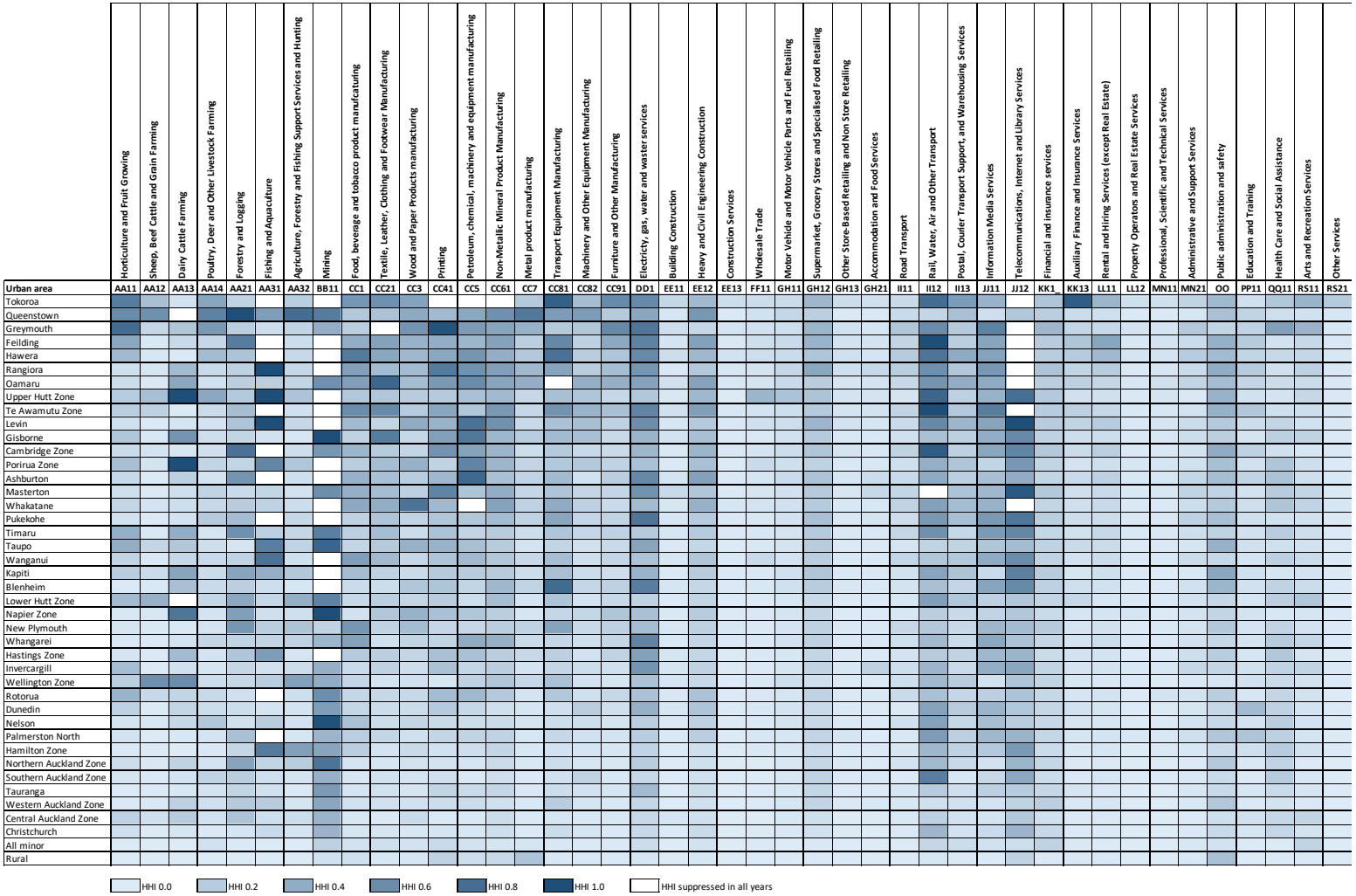
Figure 20 shows an alternative ordering of the geographic areas by sorting them from highest to lowest overall average HHI across all industries. Regions with relatively small populations tend to cluster at the top of the table (i.e. these regions have relatively many industries that are less competitive), while larger regions and cities tend to fall towards the bottom of the table. This suggests that firms in many industries operate in geographically local markets, and in smaller regions fixed costs may prevent a larger number of firms from entering the market, leading to generally higher HHIs. However, there are some exceptions, e.g. Queenstown appears to have relatively many industries with high HHI, despite having a larger population than some other regions at the top of the table (and demand from the local population being complemented by tourism). It is beyond the scope of this report, but it could be useful to further explore the relationships between regional characteristics such as population density, urbanisation, population demographics, and HHI.

Figure 19 Summary of average HHI from 2001 to 2016 by industry and urban area. Geographic areas are ordered from north to south



Source: Authors' calculations based on competition visualisation tool

Figure 20 Summary of average HHI from 2001 to 2016 by industry and urban area. Geographic areas are ordered from highest to lowest overall average HHI



Source: Authors' calculations based on competition visualisation tool

3 Conclusions

This report presented highlights of a newly-updated dataset of measures of competition in New Zealand industries based on firm-level data (Maré & Fabling, 2019). This dataset shows considerable variation in competition measures across industries and across time. Different competition measures tell different stories about competition because they focus on different aspects of market outcomes. Some of the competition measures are also subject to high uncertainty, and we must be cautious when interpreting differences in these measures across industries or from year to year.

Nevertheless, the dataset shows some consistent patterns. There are some industries where measured competition has consistently been relatively strong: horticulture and fruit growing, food, beverage and tobacco product manufacturing, wood and paper products manufacturing, building construction, and construction services.[11] Similarly, there are some industries where measured competition has consistently been relatively weak: mining, supermarket, grocery stores and specialised food retailing, financial and insurance services, auxiliary finance and insurance services, and rental and hiring services (except real estate). Competition appears to have increased over time in dairy cattle farming, mining, and furniture and other manufacturing, and to have decreased over time in poultry, deer and other livestock farming, forestry and logging, fishing and aquaculture, and financial and insurance services.

We also compared the objective competition measures for each industry with the subjective self-reported intensity of competition faced by firms in the same industry. In general, the objective measures are correlated with self-reported competition, but there is considerable variation in self-reported competition that is not explained by the objective measures and vice versa. This could be due to various factors including the fact that the objective measures do not capture all aspects of the competitive environment in an industry, and/or that managers of firms have different views of the intensity of competition in their industry, or of the firms with which they compete compared to the objective measures.

[11] As noted earlier, finding relatively strong competition in any industry dues not rule out the existence of competition problems.

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Appendix A Linear regression models of self-reported competition versus objective competition measures

The following tables report the estimated coefficients of linear regression models of self-reported competition versus the objective competition measures, as shown in Figure 17 and Figure 18.

Table A.1 Estimated slope coefficients of simple linear regression models of the proportion of firms reporting they face weak competition versus competition measures (all industries and years combined)

Competition measure	Slope	Slope standard error	Slope *p*-value	R-squared
HHI	23.775	9.234	0.005	0.015
PCM (population weighted)	34.859	8.136	< 0.001	0.038
PCM (output-share weighted)	28.081	4.615	< 0.001	0.074
PE (OLS)	-0.697	0.638	0.276	0.003
PE (FE)	1.701	0.505	0.001	0.024

Source: Authors' calculations

Table A.2 Estimated slope coefficients of simple linear regression models of the proportion of firms reporting they face strong competition versus competition measures (all industries and years combined)

Competition measure	Slope	Slope standard error	Slope *p*-value	R-squared
HHI	-42.748	7.206	< 0.001	0.066
PCM (population weighted)	-12.502	6.438	0.053	0.006
PCM (output-share weighted)	-21.108	3.607	< 0.001	0.069
PE (OLS)	-0.905	0.496	0.069	0.007
PE (FE)	-1.589	0.392	< 0.001	0.034

Source: Authors' calculations