THE EFFECTS OF COMPETITION ON MANAGEMENT PRACTICES IN NEW ZEALAND – A STUDY OF MANUFACTURING FIRMS[1]

INTRODUCTION

Researchers have long believed that competition improves corporate and economic performance (Vickers, 1994; Caves, 1980). A competitive environment is healthy for economic progress as it drives managerial effort and firm performance (Vickers, 1994) by reducing slack, exerting a downward pressure on costs and generating efficiency in production and resource allocation (Nickell, 1996). It has also been argued that competition may boost innovation (Porter, 1990; Nickell, 1996), including technological innovation (Henderson and Clark, 1990; Utterback, 1994), process innovation (Pisano, 1996), service innovation (Gallouj and Weinstein, 1997; Agarwal and Selen 2009, 2011, 2013; Suarez and Cusumano, 2009; Lusch and Nambisan, 2015), strategic innovation (Hamel, 1998; Markides, 1997), and managerial innovation (Birkenshaw, Hamel and Mol, 2008; Mol and Birkinshaw, 2009; Birkinshaw and Ansari, 2015; Schoemaker, Heaton and Teece 2018). According to Demsetz (1973), competitive rivalry promotes entrepreneurial efforts in firms with a focus on achieving (short-term) monopoly power, which may be associated with increased concentration within the industry. This in turn can lead to better management practice.

As such, the objective of this paper is to examine the association between the level of competitiveness and management practices across firms in the New Zealand manufacturing sector. It has unique geographical features, strong institutions and economic policies approaching what is considered best practice, particularly in the areas considered to be beneficial to competition (McCann 2009; MBIE, 2016). New Zealand is a relatively small economy, physically distant from

[1] Funding Source: Ministry of Economic Development (MED), Wellington New Zealand.

its neighbours and trading partners, but it is also an open economy. It has largely removed tariffs and other protective mechanisms, it has established free trade agreements with many key trading partners, and it has very high levels of migration relative to other countries. In macroeconomic terms, it has a policy of openness to external capital, its monetary policy focused on domestic price stability, and has had a free-floating exchange rate (Treasury, 2014).

New Zealand has a firm size structure with a large number of small firms and very few large firms, where management capability is generally found to be higher (Stevens, 2012). The largest firms include a large dairy cooperative, and a number that are parts of foreign multinationals, as in banking, but it does have relatively high levels of firm and job entry and exit (MBIE 2016). Nevertheless, New Zealand has a low level of labour productivity, about 80% of the OECD average (MED *et al.*, 2011), which has led to the idea of the 'New Zealand Paradox' (McCann 2009). "The mystery is why a country that seems close to best practice in most of the policies that are regarded as the key drivers of growth is nevertheless just an average performer" (OECD, 2003, p. 29).

Given this backdrop, an understanding of how the intensity of competition affects the quality of management practices is both interesting and important from a policy perspective. A few recent studies on management practices of the US manufacturing sector found that competition has some association with the quality of management practices (see Bloom and Van Reenen, 2007; Bloom, Propper et al. 2015; Bloom, Brynjolfsson et al 2018), while other studies (see Agarwal et al 2013 for New Zealand; Agarwal et al. 2014 for Australia) have found no real association between the two. In part, the conclusions for these two latter studies can be explained by their use of simple measures of competition that is, using only the number of competitors as a measure of competition. We reconcile these differences by employing a more appropriate measure of competition. While

there are various approaches in the literature on how to best characterise and measure the level and intensity of competition, there is lack of clarity on the process by which competitive forces influence the quality of managerial practices. In this paper, we explore this relationship between competition and management practices by adopting a more appropriate measure of competition. The measure of competition developed by Boone (2008a) represents one such measure. Boone (2008a) derives a theoretically more robust measure of competition where intensity of competition is motivated by either more aggressive interaction between firms and / or through reductions in the barriers to entry. Other available measures of competition are either too simplistic (for example, using the number of competitors in the market) or fail to account for the intensity of competition (for example, the Herfindahl-Hirschman and the Lerner Index). We would expect to find that measures which fail to account for the intensity of competition don't fully capture the reality of competition in the market and therefore represent a poor indicator for understanding how competition impact on the quality of management practices. Our findings suggest that it is the *type* of competition, not just competition *per se*, that influences management practices. Our findings will be of significance to researchers who are interested in studying the role of competition in driving individual and firm behaviour in markets, and policy makers who are designing policy initiatives to increase the management capability and productivity of firms.

The remainder of the paper is structured as follows. In Section 2 we provide an overview of the literature on competition and its effect on management practices. In Section 3 we discuss the research methodology used in this study and in Section 4 we analyse the results and discuss the findings from several multivariate tests using Boone's (2008a) measure of competition applied to New Zealand manufacturing firms. In Section 5 we conclude by providing a number of potential explanations for the reported results.

COMPETITION AND ITS EFFECT ON MANAGEMENT PRACTICES

To conduct a robust study on the association between competition and management practices, it is important to define what is meant by competition and understand its association with managerial effort and practices, and its relationship to technical efficiency, production and innovation.

Salop (1977) defines high product market competition as a reduction in unit transport cost while Dixit and Stiglitz (1977) viewed it as an increase in the substitutability between differentiated products. Later, Nickell (1996) argued that the presence of an increased number of competitors (or fewer monopoly rents), and the consequential decrease in monopoly power within an industry, as an indicator of higher intensity of competition. Measures of the number of competitors and average rents (profits less capital costs) normalised on value-added[2], are often used to denote the degree of competition. Nickell (1996), proposed a measure of the firm's ability to raise prices above marginal cost as an indicator of a firms' market power while Aghion et al. (2005) proposed a representation of competition intensity using the Price-Cost Margin (PCM) or *Lerner Index* method. In principle, as competition increases, the ability for all firms to raise prices over marginal cost decreases. Aghion et al. (2001) also proposed a substitutability parameter as the measure of competition intensity within each industry, which was denoted by a monotonically increasing transformation of the elasticity of substitution in demand between two rivals' outputs and a

[2] Nickell (1996) defines rents as profits before tax + depreciation + interest payments – cost of capital X capital stock. The capital stock is the replacement cost capital stock at current prices. The cost of capital is equal to $rr + \delta + \lambda\rho$ where rr is the real interest rate, δ is the rate of depreciation, ρ is the risk premium, and λ is the weight ($0 \leq \lambda \leq 1$).

monotonically decreasing function of the measure of market power, i.e., the share of profits in value added.

While the literature provides a number of alternative measures of competition, it is relatively scant on describing the relationship between competition and management practices with the exception of a few pioneering papers (see Bloom and Van Reenen, 2007, Bloom and Van Reenen, 2010; Bloom, Eifert, et al, 2013; Bloom, Propper et al. 2015; Bloom, Sadun and Van Reenen 2016; Bloom Brynjolfsson et al 2018). A possible reason for this is that competition has different conceptions, many manifestations and several indicators or measures. The few studies on the association between competition and management practices (including innovation) are generally supported by a diverse variety of arguments. Agency models comprise the main arguments in favour of a positive association between competition and management performance and innovation (Bloom and Van Reenen, 2007, Bloom and Van Reenen, 2010). The central theme of this argument is that a competitive market drives managerial effort, efficiency, productivity and innovation both at the firm level and the industry level, thereby leading to selection of 'better' management practices. However, the literature also propositions an alternative view as to why competition may have a negative influence on managerial effort, efficiency, productivity and innovation (Martin, 1993; Horn et al., 1994). The argument is that competition tends to induce managerial effort within a firm only when the impact it has on increasing the elasticity of demand exceeds the impact it has on reducing demand (Willig, 1987; Hermalin, 1992). However, there is no clear consensus in literature on how competition impacts the demand for better managerial practices. This is reflected in the findings in Agarwal et al. (2013; 2014) who find, contrary to other studies (e.g. Bloom and Van Reenen, 2008; Bloom et al., 2015), no association between competition and better management practices.

In the following sections we draw out the links between management quality and competition by linking management quality to the links between competition and managerial effort technical efficiency, productivity and innovation.

Competition, managerial effort, and management quality

The profit motive may act as a strong incentive for firms to increase their managerial effort in a competitive market. Arguably, greater managerial effort would result in additional and / or better management practices with a view to increasing profit in the face of competition. Nickell (1996) presents empirical evidence to support that competition tends to cause monopoly rents to dwindle, and as a result firms respond by increasing managerial effort and reduce managerial slack, thereby positively influencing productivity performance. Another argument for competition driving managerial effort is that product market competition makes firm profits more responsive to managerial action (see Nickell, 1996), and this provides an incentive for firms to increase managerial effort. The fear of bankruptcy associated with increasing competitive pressure may also act as a strong incentive for increasing managerial effort and lessening managerial slack (Hart, 1983). Theory suggests two other ways in which increased competition in the industry helps boost managerial effort and company performance. The first is by motivating managerial incentive schemes (Holmstrom, 1982; Nalebuff and Stiglitz, 1983; Hart, 1983; Mookherjee, 1984); and the second, by influencing the rewards on managerial effort based on the market's estimate of the manager's ability (Holstrom, 1982; Meyer and Vickers, 1995). However, there is lack of robust empirical studies to support these analytical theories and to inform what kind of rewards and incentive schemes can drive higher managerial effort, and improved management practices.

Competition, technical efficiency, productivity, and management quality

Empirical studies have also shown that competition tends to increase technical efficiency (see Caves and Barton, 1991; Green and Mayes, 1991; Caves, 1992), as it leads to more efficient managerial systems and structures within companies (Caves, 1980). At an industry level, competition can induce a "Darwinian selection process" whereby greater product market competition drives inefficient firms out of the market and more efficient firms to enter (Jovanovic, 1982; Nickell, 1996; Bloom and Van Reenen, 2007, 2010). Those firms that survive and eventually prosper tend to exhibit homogenously more efficient management practices. However, there are also reasons why competition may lead to technical inefficiency. In industries with high intensity of competition, more efforts may be allocated to limit competitive rivalry through a process of reducing the amount of resources for internal capability and capacity improvements, thereby directly resulting in production inefficiency (Nickell, 1996). Also, competitive environments are associated with higher market uncertainty and unstable cash flows for incumbent firms, leaving less resource for investment to raise the level of production efficiency (Schumpeter, 1943). Again, there is a mixed view in literature as to what influence competition has on technical efficiency.

More broadly however, there is evidence to suggest that an increase in market concentration or a decrease in competition is associated with an increase in total factor productivity (Haskell, 1991; Nickel et al, 1992; Hay and Liu, 1997). Nickell (1996) present empirical evidence to show that competition is also associated with a higher rate of productivity growth. However, the extent to which differences in management quality or innovation are driving this result remains unclear While limitations in the archival data set utilised in this study prevent the testing of this set of relations, the above set of arguments suggests that there would likely be a positive association

between competition and management practices, due to many management practices being key mechanisms utilised by managers to achieve technical efficiency and productivity growth.

Competition, innovation, and management quality

Competition may act as an incentive for firms to improve innovation. Arguably, firms come up with innovative products and services and/or improvements in organizational and managerial processes to create a sustainable competitive advantage in the market. Existing theories of competition and innovation suggest that a competitive environment encourages both diffusion of knowledge and the adaptation and imitation of the learning process amongst competing firms in a way that positively affects the level of innovation (Wiel & Creusen, 2008; Polder et al., 2009).

On the other hand, models of product differentiation and monopolistic competition posit that product market competition tends to decrease rents after entry, and consequently reduces the number of entrants (Salop, 1977; Dixit and Stiglitz, 1977). Models of endogenous growth also propose that in high product market competition, firms have an expectation of reduced monopoly rents, negatively influences their decisions to invest in innovation (Romer, 1990; Aghion and Howitt, 1990; Grossman and Helpman, 1993).

Schumpeterian competition and the concept of creative destruction is an alternative, dynamic model of competition and innovation. The process of creative destruction is based on fundamental breakthroughs that "incessantly revolutionises the economic structure within, incessantly destroying the old one, incessantly creating a new one" (Schumpeter, 1942). This occurrence is reliant on the level of research and development (R&D), which in turn is motivated by the monopoly rents that acts as a reward to the successful innovator (Schumpeter, 1942 cited in Aghion and Howitt, 1990). Since competition tends to reduce monopoly rents, earlier theorists inspired by

Schumpeter (1943) conjectured a negative relationship between competition and innovation. Moreover, creative destruction leads to monopoly rents earned through one innovation being destroyed by the next innovation (Aghion and Howitt, 1990). An incumbent monopolist has less of an incentive to perform R&D and innovate in these analytical models, since it is already enjoying monopoly rents (Aghion and Howitt, 1990). When markets operate in this way, imitation and weaker patent protection reduces the longevity of rents, further diminishing the incentives for investment in R&D and innovation (Zeng, 2001, Davidson and Segerstrom, 1998).

The above discussion suggests a variety of ways in which competition may influence demand for improving better management practices, associated managerial effort, technical efficiency and innovation. While there are multiple explanations, the extent to which variation in competition may influence the management quality in organisation is open to empirical investigation.

MEASUREMENT APPROACHES AND DATA

To empirically investigate the association between competition and management practices, we use an archival data set on management practices of New Zealand manufacturing firms from Agarwal et al. (2013), which we combine with alternative measures for the level of competition in the industry. The sample consists of 152 manufacturing firms for which data on management practices was collected using an interview methodology (referred to in the literature as double-blind, double-scoring methodology) as part of the New Zealand Management Practices and Productivity global benchmarking project (see Green et al., 2010).

Table 1 lists the number of firms within each of the industry sub-sector groupings in accordance with ANZSIC classification codes.

<Insert Table 1 here>

Measuring Management Practices

The research project titled 'Management Matters – How Does Manufacturing Measure Up?' was commissioned by New Zealand Ministry of Economic Development (MED) and implemented as part of a world-wide study led by the London School of Economics (LSE), Stanford University, and McKinsey and Co, the World Management Survey. The project applied a methodology originally developed by Bloom and Van Reenen (2007) to measure the quality of management practices in New Zealand manufacturing firms, which comprised 18 management practice dimensions. Details of the 18 individual management practices dimensions measured are given in Table II. Each of the 18 dimensions were drawn from prior literature which suggested that the dimension comprised a range of practices which could be classified as generally better vs worse for manufacturing industry firms. We utilized this archival dataset of 152 medium- and large-sized[3] manufacturing firms. The interview method used in data collection was a structured conversation-based interview scoring grid, which defines and describes the scoring criteria from one (worst practice) to five (best practice) across eighteen management practices dimensions comprising three broad management areas: operations (consisting of seven practices), performance (consisting of five practices) and people management (consisting of six practices). The technique of 'double blind, double scoring' was adopted to minimise bias and measurement error (Bloom and Van Reenen, 2007; 2010).[4] In order to collect accurate responses and for benchmarking

[3] As small size firms in New Zealand were not in scope of the research project, only firms with > 50 employees were included in the study.

[4] The 'double blind' nature of the interviews meant that the interviewed managers were unaware that their responses were being scored, and the interviewers were also not privy to any background information on the interviewed firm, so as to eliminate any response or scoring bias. Approximately 80 per cent of all interviews were 'double scored', in that while they were run and scored by a main interviewer, and were also silently listened to and independently scored by another team member. As per privacy regulation, interviewees in New Zealand were informed of their call being monitored for quality and control purposes. The scores of the listener were used for calibration and not for analysis purpose.

purposes at a global level, the interviewers were given specialised training to ensure consistency in standards and to make the results comparable with those of other similar global studies.

<Insert Table II here>

To maintain a consistent approach with that of Bloom and Van Reenen (2007) the overall management score of each firm was treated as unidimensional[5] and constructed by averaging the management practice scores across each of the 18 management areas. This score was transformed into a z-score by normalizing individual practice to mean zero and standard deviation one.

Measuring Competition

The research project titled 'Competition and Management Practices in New Zealand Manufacturing Enterprises' was commissioned by the Ministry of Economic Development (MED). This research project investigated the nature of competition in various industries in the New Zealand economy and its influence on firm outcomes was matched to determine whether competition indeed create a spur to better management practices. The competition data was collected as part of 2-year research project conducted by the Treasury, the Commerce Commission and the Ministry of Foreign Affairs and Trade which investigated the nature of competition in various industries of the NZ economy and its influence on firm outcomes (R&D, innovation and productivity).

As we have noted earlier, there is little consensus regarding the best measure by which to gauge competition. The choice of method used requires an understanding of the context within which the measure of competition will be applied. With this in mind, our starting point is to consider the

[5] Consistent with the view that the measure is unidimensional, there is high correlation between the 18 management practices, with one factor explaining over 80% of the variance.

most commonly used measures of competition and to determine which of these is most suited to understanding how competition impact on management practices. The most four common of the measures for competition are[6]:

1. Profit Elasticity (PE)
2. Herfindahl-Hirschman Index (HHI)
3. Price Cost Margin or Lerner Index (PCM)
4. Number of competitors, self-reported by interviewed firms

In Appendix A we provide further detailed descriptions of the HHI and Lerner measures of competition. In Appendix B we provide a summary of literature on competition and management practices, identifying both the measures of competition used and their association with management practices. Further discussion of these measures of competition and their relevance in gauging the effects of competition on management practice is provided below.

The first three measure of competition were constructed by MED at the 4-digit ANZSIC level at the industry level. The data for number of competitors was collected through the *Management Matters – How Does Manufacturing Measure Up?* management practices project for which interviews were conducted with the 152 manufacturing firms, and each interviewed firm was asked to self-report on the number of competitors[7]. The construct of the number of competitors used is identical to that constructed by Bloom and Van Reenen (2007, 2010). A limitation of this proxy

[6] Devine *et al.* (2011) provides a fuller discussion of these four measures and their limitations

[7] The competition data obtained from this project defined the number of actual competitors ie. valued at the actual figure reported by the interviewed firm in case the number of competitors claimed was less than ten; and capped at an upper limit of ten if the claimed figure reported is ten or more.

measure as interviewees' perceptions of the degree of competition intensity they face may not be completely accurate.

In Table III we provide a summary description of these four competition measures, their relevance to competitive pressures influencing management practices and the association competition is hypothesised to have with the measure of management practices. Of these 4 measures of competition, the profit elasticity measure of competition (Boone, 2008a) is the most relevant of the measures of competition for the purposes of studying the relationship between management practices (of New Zealand manufacturing firms) and competition. Specifically, the profit elasticity measure captures the effects of external influences on firm profitability that requires a reaction by management through some change to its management practices. Whilst we focus on the profit elasticity measure of competition to better understand the effects of competition on management practices, we provide estimates using three measures to evaluate our hypothesis: *competition intensity has a positive and significant effect on the quality of management practices adopted by firms*. The details of respective hypothesis as per different measures of competition are given in column 5 of Table III. We expect to find mixed results using the three measures of competition for reasons discussed below.

<Insert Table III here>

There is a consensus in the economics literature that the HHI index developed by Hirschman (1964) is an inefficient indicator of intense competition (Leon, 2015; Devine et al, 2011). The reasons range from being unable to account for intensity of competition in product markets, the importance of larger firms being assigned a greater weight than smaller firms, and the sensitivity of the measure to the number of competitive firms present in the market. Perhaps the biggest weakness – and one which is particularly relevant for a small, open economy like New Zealand –

is its inability to measure the intensity competition originating from overseas. For this reason, the PCM measure (Aghion et al. 2005) is often preferred as a measure of competition over HHI; it is not as susceptible to the same range of weaknesses typical of the HHI index. However, the PCM measure is susceptible to other problems that have been demonstrated by Boone (2008a, 2008b) to include inaccurately gauging the intensity of competition in concentrated (oligopoly) markets. In addition to this, Boone, van Ours and van der Wiel (2013) also find that PCM inaccurately measures competition when declines reductions in entry barriers lead to more firms in the market and the intensity in competition of the incumbent firms increases quickly. Boone (2004) also identifies inadequacies in the PCM as a measure of competition when it is used to examine the relationship between productivity and competition, something that is important in our framework as we are focused on the relationship between competition and management practices that directly impacts on the level of productivity.

Perhaps the simplest measure of competition is the count of the number of competitors. Whilst this has the advantage of simplicity, it is unable to account for the way the intensity of competition may vary from one market to another due to the differences in production technology, the nature of demand and the impact of imports on the domestic market.

The remaining measure of competition in our suite of competitiveness measures is the Profit Elasticity measure proposed by Boone (2008a). This measure of elasticity overcomes many of the concerns afflicting the other measures of competition. Boone's (2008b) measure of competition using Profit-Elasticity (PE) examines how a change in marginal cost causes a change in profits of firms in an industry, expressed as a negative number. The more (less) negative the PE coefficient, the greater (less) the decrease in profit relative to the increase in marginal cost, and so the higher (lower) the level of competition. This measure is based on the premise that increased competition

will increase the relative profit difference between more and less efficient firms, as more efficient firms are better able to exploit their advantage over inefficient firms in a competitive market. Griffith et al. (2005) extend this concept to a more general, industry-wide measure of competition. The PE measure is calculated by estimating an Ordinary Least Squares (OLS) regression of firms' profits on their average variable costs. The specification for this regression model is as follows:

$$PE_{ij} : \ln\left(y_{ij} - tvc_{ij}\right) = \alpha_j - \beta_j \ln\left(\frac{tvc_{ij}}{y_{ij}}\right) + \varepsilon_{ij} \qquad (1)$$

where profit equals gross output of firm i (y_i) less total variable cost (tvc_i) (labour costs and intermediate consumption), and average variable costs are equal to total variable cost (tvc_i) divided by gross output (y_i). The β coefficient (sometime known as the Boone Indicator) estimates the elasticity of profits to changes in cost. β is expected to be negative, indicating that as average costs increase, profits of the firm will decrease. In a more competitive market, β will be more negative, indicating that firms' profits are more sensitive to similar changes in their average costs.

The PE measure assumes that all firms are otherwise completely symmetric except for their marginal cost and that all firms choose their strategic variables simultaneously and independently. Under these assumptions, it is monotonic with competition. As competition intensity increases, the negative relationship between average cost and profit becomes stronger. Therefore, PE, unlike the other measures used here, is robust to the ambiguity of the reallocation and selection effects.

When firm productivity varies across industries, increasing competition can increase market concentration. Consider an industry where there is a distribution of firms with different price mark-ups, due to differences in efficiency. More efficient firms have higher profits and profit margins, and the least efficient firms have lower profits and margins. We shall assume, for the sake of

simplicity, that increased competition affects all firms' prices in a similar way (i.e. that all firms must lower their prices to compete and it does not change the rankings of prices). This will lead to the mark-ups of all firms to fall. Beyond the impact on each individual firm's mark-up, an increase in competition is likely to have two broader effects - a *reallocation* effect and a *selection* effect (Devine *et al.,* 2011) as explained below:

- The *reallocation effect* relates to the fact that inefficiency is punished in more competitive markets. When competition increases, profits will be reallocated from less efficient firms to more efficient firms, as the former have less ability to reduce margins while remaining profitable.
- The *selection effect* operates through firm exit, as the least efficient firms become unprofitable and are forced to exit the market. The remaining firms – those with higher mark-up – will increase their output to compensate for the exit of less efficient firms, ceteris paribus.

The net effect of these factors has implications for measuring competition. If firms in a market are not homogenous in terms of their productivity (as a wealth of evidence suggests is the case, e.g. Syversen, 2011), these mechanisms will have an ambiguous effect on many methods for measuring competition. A broad definition of efficiency covers the spectrum of phenomena from the effectiveness with which a firm employs its inputs (including its management practices and technology), to its ability to charge a premium price through strategies like product differentiation (through advertising and creating 'niche' markets). The greater the distribution of efficiency across firms in a market, the greater the potential ambiguous measures of competition. For this reason, the PE measure proposed by Boone (2008b) provides the best of these measures for gauging the effects of competition on management practices.

Descriptive statistics

Table IV Panel A provides the descriptive statistics on all relevant variables from the sample of 152 NZ firms used in this analysis, and Table IV Panel B reports on the correlation matrix. This data reveals that there is variation in the sample statistics. The average management practices score is 2.85 and the average firm has 290 employees and a reported an average of 6.83 competitors. Two firms did not provide information on the number of competitors, and the level of education of management and employees.

<Insert Table IV Panel A here>

<Insert Table IV Panel B here>

RESEARCH METHOD

The level of competition has long been argued to drive social well-being and economic growth. At the firm level, the intensity of competition amongst firms has been posited to drive better performance amongst managers (see Nickell, 1996). The argument is that competition provides opportunities to improve firm performance and in return incentives are offered to managers to generate better returns and increase market share. Consequently, if managers are to achieve this dual objective of improving firm performance in order to meet their incentive targets, managers need to improve their managerial capabilities. Therefore, the greater the level and intensity of competition, the greater the impact competition is likely to have on managerial capabilities.

Following Bloom and Van Reenen (2007) we assess the association between competition and management practice using Ordinary Least Squares (OLS), after controlling for many potential confounding variables. We regress management practice scores against the profit elasticity

measure of competition as discussed above. The general controls we include are industry dummies, region dummies, firm size, age of the firm, the share of the workforce with higher degree qualifications, average hours worked, union membership, whether a firm is listed as a public company, and other controls including interviewer dummies, the seniority, gender, tenure, the day of the week the interview was conducted, the time of the day the interview was conducted, and the duration of the interviews. As industries may have systematically different management practices, there is the possibility that the results may be affected as a result of co-linearity. Therefore, we estimate the model with and without industry controls. We also estimate the model without controls to provide an indication of the explanatory power of the variables of interest.

The model takes the following general specification:

$$MPS_{i,t} = \alpha_1 + \alpha_2 Competition + \alpha_3 Controls_{i,t} + \varepsilon_{i,t} \quad (2)$$

where:

MPS = Average of 18 Management Practices standardised to a *z*-score.

Competition = Profit Elasticity (as defined by Boone, 2008b)

Controls = General controls and noise controls specified above.

To evaluate whether there is a positive association between management practices and competition, we test the following hypothesis:

Hypothesis: There is a positive association between better management practices and competition amongst firms within industry.

ANALYSIS AND RESULTS

Figure I provides a margin plot of Boone's (2008a) estimate of competitiveness (PE) on MPS, which shows a negative association. The results of the multivariate tests using Boone's (2008a) estimate of competitiveness across NZ manufacturing firms is reported in Table V. The coefficient estimates and the corresponding p-values (in parenthesis) from estimating Equation 2 are reported for Boone's (2008b) profit elasticity (PE) measure. In column 1, the estimated PE coefficient is negative (as expected) and significant at the 5% level suggesting that the more (less) negative the PE coefficient, the greater (less) the decrease in profit relative to increasing marginal cost and the higher (lower) the level of competition. In column 2 of Table V we re-estimate the model using standard errors clustered by industry grouping to find the results are largely unaffected. In each case, the coefficient estimates on Boone's measure of competition (PE) were found to be negatively associated with management practices and significant at the (5% level) with an adjusted R-squared of 0.37. The results imply that increases in the level of competition leads to better management practices. According to Boone (2008b), PE is a measure of the sensitivity of profits to firms' efficiency within an industry, and accordingly the findings suggest that firms in industries with greater profit elasticity (more competitive) have better management practices. Our results confirm this finding. This implies that, at the firm level, better management practice tends to be associated with: (i) a presence in markets where firms could gain higher margins and (ii) a presence in markets in which firms' profits were more sensitive to firms' efficiency.

<Insert Figure I here>

<Insert Table V here>

Robustness testing

In order to test the robustness of the results, the model is re-estimated with the most influential firms removed and using a number of different specifications. t Various methods to detect outlier were used to ensure that the estimates were not unduly affected. It is important to note that data on management practices have been collected directly from the firms, while competition measures has been calculated over a large number of observations at the industry level. This indicates the common rationale for excluding outliers (e.g. data errors, unusual firm observations, unusually high or low values). We specifically use Hadi's method (1992, 1994) and Cook's Distance to identify which firms have the greatest influence on the results. Observations which influenced more than one model were identified and excluded from the results. These methods identified 7 observations to be excluded from the available sample. The results are reported in Columns 3 of the Table V. The estimated PE coefficient remains within the same order of magnitude as the coefficient reported in column 1 and significant at the 5% level. This finding suggests that the estimates are not sensitive to the outliers removed from the overall sample set.

To evaluate further the sensitivity of the results, the model was again re-estimated without industry and regional effects controls (and excluding outliers). The motivation for doing so is that industry and regions may have a 'fixed' effect, where industry participants or firms operating in closer proximity have similar management practices. This is consistent with Green *et al.* (2010) and Agarwal et al (2013) who found that some NZ manufacturing industries (and regions) have better management practices than others. As different industries also have different level of competition, having both industry dummy variables and industry competition variables may bias the estimated

results due to co-linearity. Accordingly, we estimate the model with industry and region controls excluded, as presented in Column 4 of Table V. The adjusted R-squared values increased from 37.1% to 41.0%, which is somewhat higher when compared to the situation of including industry and region controls. As shown in the Table V, the associations between competition measures and PE were also of similar size and direction and significant at the 5% level.

Another avenue which we explored is the possibility that competition has non-linear effects on managerial practices. For example, Aghion, Bloom, Blundell, Griffith and Howitt (2005) find an inverted U shape association between a measure of competition and a proxy for innovation. It is beyond the scope of this study to explore the theoretical reasons why a non-linear association may or may not exist between the adoption of 'better' management practices and competition. However, we do empirically test for a non-linear association but we do not find any evidence that such a non-linear association exists.

Other Measures of Competition

The focus of our analysis has been on the use of Boone's (2008b) profit elasticity measure to gauge the impact competition has on management practices. In this section we estimate equation (2) using the other three measures of competition (PCM, HHI and Number of Competitors) given in Table III, noting the expected sign and likely significance of the relationship that was hypothesised. In Table VI, we report the results for each of the three measures of competition.

<Insert Table VI here>

We find, as suggested in Table III, that the results are inconclusive with respect to the impact competition has on management practices. As argued earlier, this finding is not surprising given the inadequacies of each of these three measures of competition. In particular, we find that using these three measures a firm facing substantial competition is unlikely to see any significant effects on its management practices – a result that is contrary to the findings when using the profit elasticity measure of competition. However, for reasons given in column 3 in Table III, these measures of competition have little compatibility with the definition and measure of management practices. The coefficients have the wrong signs and they are all insignificant at the 5% significance level. These findings are consistent with the earlier justifications that these alternate measures of competition are inappropriate for the purposes of evaluating the effects of competition on management practices.

DISCUSSION AND CONCLUSION

The objective of this paper has been to investigate whether there is an association between competition and management practices across New Zealand manufacturing firms using Boone (2008b) profit elasticity measure. We find a statistically significant, negative association between PE and management practices which implies that, at the firm level, better management practices tended to be associated with (i) firms earning higher margins and (ii) firms' profits being more sensitive to firms' level of efficiency. The findings point to some evidence of an association between the level of competition within an industry and overall management practices and capability in the New Zealand manufacturing sector.

There are number of potential explanations for this result. The finding of a positive association between the level of competition and management practices is consistent with other studies (Bloom and Van reenen, 2007; Bloom Sadun and Van Reenen, 2016) that have found an association between better management practices and firm performance. The findings also extend the work of Agarwal, et al. (2013) that used only a simplistic measure of competition, namely the number of competitors (with a maximum of 10) identified by those being interviewed on their organisation's management practices. Such a measure does not capture the extent nor the magnitude of competition facing each firm. Notably, we also find no association between better management practices and competition when it is measured using similarly deficient representations of competition including the overall number of competitors, industry concentration (HHI) and price cost margin. The weaknesses of these alternative measures of competition have already been described and explain why their association with management practices leads to (at times) a theoretically inconsistent result. We argue in this paper that the use of the Boone indicator provides a more theoretically consistent measure of competition which we find has a positive and significant association with management practices in the manufacturing sector in New Zealand. Our findings are consistent with the idea that it is competition *intensity*, rather than the level of competition (e.g. the number of competing firms), that explains changes in the quality of firm level management practices.

Further, this result is consistent with the argument that the profit elasticity measure better gauges the competitive intensity in a market than measures such as mark-ups and numbers of firms, which are both the outcomes of competitive process, and also of other factors that may vary across markets – e.g. size of the market in terms of consumers or openness to trade. Indeed, a better example than New Zealand cannot be found; it is a small, geographically dispersed, economy, with

strong institutions that is physically distant from the rest of the world. Some sectors that are geographically concentrated in small markets (e.g. services like cafés and restaurants) may have small numbers of firms but be highly competitive. Conversely, they might have large numbers of firms nationally, but if the appropriate measure of a market is a small locality, this may look like a highly competitive market nationally, even if it were made up of a large number of small monopolies. This would not be identified using measures like the HHI or counts of firms but will through profit elasticity. It would be interesting in future work to see whether the technical and social changes that have come about due to services such as Uber Eats have an impact on these markets.

That is not to say that competition alone influences the quality of management practices. There are also other factors that also affect the quality of management practices – for example, those which can be explained by the diffusion of innovation literature (Agarwal et al. 2014). In small, distant economy, such as New Zealand, the size of the rents that can be earned by a competitive investment in assets such as the management capability of the organisation, will be smaller. This will attenuate the relationship between competition and management practices and, therefore, reduce the productivity-enhancing benefits of competition. This may, in part, explain New Zealand's 'productivity paradox' (McCann, 2009).

This finding has policy implications for upholding and promoting competition across industries. First, the results suggest that policy makers need to be cognisant that the various measures of competition available perform a different function and the use of appropriate measures matters is critical when making inferences. In the context of this study, the measure of price elasticity signals the degree of substitutability between products (a fundamental basis for competition) that an alternative measure of competition (e.g. the number of competitors) will not indicate. In this case,

the use of the Boone measure of competition is the most appropriate measure of competition in this context. Second, to have the greatest effect on management capability, policy makers may be better focusing on the specific type of competition in the market and research is required to tease out the specific relationship between such policies and the degree of competition. Third, the findings have implications for managerial policy at the firm level. Firms operating in highly competitive markets need to invest in better management practices (e.g. better strategic management systems) if they are to survive pressure from their competitors over the longer term.

There are several areas limitations and future research opportunities in this area. The limitations include that this study uses cross-sectional data and the use of panel data may provide more findings that are reliable. The study is also limited to manufacturing firms (for one economy) and it would be interesting to either conduct (i) a similar study for another country; or (ii) an extension of the study to other industries. More research is required to better understand the links between policy settings, competition dynamics and the effects of competition in the real economy. Our work suggests that previously used measure of competition, which have been relied up by policy makers and other may not be as informative when inference based on this informed decision making.

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Table I –Sample of Industry groupings

Industry group	**Frequency**
21: Food, Beverage and Tobacco Manufacturing	36
22: Textile, Clothing, Footwear and Leather Manufacturing	13
23: Wood and Paper Product Manufacturing	20
24: Printing, Publishing and Recorded Media	3
25: Petroleum, Coal, Chemical and Associated Product Manufacturing	22
26: Non-Metallic Mineral Product Manufacturing	7
27: Metal Product Manufacturing	19
28: Machinery and Equipment Manufacturing	27
29: Other Manufacturing.	5
Total	**152**

Table II – Management Practices Dimensions

Operations Management
1. Adoption of Lean Manufacturing: Assesses how well lean (modern) manufacturing techniques have been introduced *Better practice*: All major aspects of Lean have been implemented *Worst practice*: Other than just-in-time, no other aspects of Lean have been introduced
2. Rationale for the adoption: Assesses the motivation and impetus behind changes to operations and what change story was communicated *Better practice:* Lean was introduced to meet business objectives *Worst practice*: Lean was introduced to catch up to competitors
3. Process problem documentation: Assesses processes for and attitudes to continuous improvement and whether learning's are captured / documented *Better practice*: Exposing problems is integral to individuals' responsibilities rather than ad hoc solutions *Worst practice*: No process improvements are made when problems occur
4. Operations Performance tracking: Assesses whether performance is reviewed with appropriate frequency and communicated to staff *Better practice*: Performance is continuously tracked and communicated to all staff using a range of visual tools *Worst practice*: Tracking is ad hoc, and measures being tracked do not indicate directly if overall business objectives are being met
5. Operations Performance review: Assesses whether performance is reviewed with appropriate frequency and communicated to staff *Better practice*: Performance is continuously reviewed, based on indicators tracked; follow-up ensures continuous improvement *Worst practice*: Performance is reviewed infrequently and only success or failure is noted
6. Operations Performance dialogue: Assesses the quality of review conversations *Better practice*: Regular performance conversations focus on addressing root causes. Purpose, agenda, and follow-up steps are clear to all *Worst practice*: Relevant data are often not present at meetings or discussion is based on data that is not meaningful. Agenda and purpose are not clear
7. Consequence management: Assesses whether differing levels of performance (not personal but plan / process based) lead to different consequences *Better practice*: Failure to achieve agreed targets drives retraining or moving individuals around. *Worst practice*: Failure to achieve agreed targets does not carry any consequences
Performance Management
8. Types of goals: Assesses whether targets cover a sufficiently broad set of metrics and whether financial and non-financial targets are balanced *Better practice*: Goals are a balance of financial and non-financial goals *Worst practice*: Goals are exclusively financial or operational
9. Interconnection of goals: Assesses whether targets are tied to the organization's objectives and how well they cascade down the organisation *Better practice:* Corporate goals increase in specificity as they cascade through the business units *Worst practice:* Individual workers are not aware of how their contribution is linked to corporate goals

10. Time horizon: Assesses whether the firm has a '3 horizons' approach to planning and targets (short and long term goals and targets)
Better practice: Short-term goals are set so that they become a staircase to reach the long-term goals
Worst practice: Top management's main focus is on short term goals

11. Setting stretch goals: Assesses whether targets are based on a solid rational and are appropriately difficult to achieve
Better practice: Goals are demanding for all divisions, and are grounded in solid economic rationale
Worst practice: Goals are either too easy or impossible to achieve

12. Clarity of goals: Assesses how easily understandable performance measures are and whether performance is openly communicated to staff
Better practice: Performance measures are well defined and well communicated;
worker performance is made public to induce competition
Worst practice: Performance measures are complex and not clearly
understood; worker performance is not made public

People Management

13. Instilling a talent mindset: Assesses what emphasis is on overall talent management within the organisation
Better practice: Senior managers are evaluated and held accountable on the strength of the talent pool they actively build
Worst practice: Senior management do not
communicate that attracting, retaining, and developing talent is a top priority

14. Rewarding top performance: Assesses whether there is a systematic approach to identifying good and bad performers and rewarding them proportionately
Better practice: The firm provides ambitious stretch targets with clear
performance related accountability and rewards
Worst practice: People within the firm are rewarded equally irrespective of performance level

15. Addressing poor performance: Assesses how well the organisation is able to deal with underperformers
Better practice: Poor performers are moved to less critical roles or out of the company as soon as weaknesses are identified
Worst practice: Poor performers are rarely removed from their positions

16. Promoting high performers: Assesses whether promotion is performance based and whether talent is developed within the organisation
Better practice: Top performers are actively identified, developed, and promoted
Worst practice: People are promoted primarily upon the basis of tenure

17. Attracting high performers: Assesses the strength of the employee value proposition
Better practice: The firm provides a unique value proposition to encourage talented people to join the company instead of the competitors
Worst practice: Competitors offer stronger reasons for talented people to join their companies

18. Retaining high performers: Assesses whether the organisation will go out of its way to keep its top talent
Better practice: Managers do whatever it takes to retain top talent
Worst practice: Managers do little to try and keep the top talent

Source: Green et al. (2009)

Table III – Summary of competition variables and expected associations

	Name (1)	Variable description (2)	Relevance to Management Practices (3)	Expected hypothesis and direction of association (4)	Expected Sign (5)
1	Profit Elasticity (PE) Boone (2008)	Measure of how a change in marginal cost causes a change in profits of firms in an industry, expressed as a negative number.	This measure of competition entails a specific response by management both to its own initiatives to improve its financial performance but also to respond to competitive pressures in the market. As such, this measure of competition captures the effects of external influences on firm profitability that requires a reaction by management through some change to its management practices.	The more (less) negative the PE coefficient, the greater (less) the decrease in profit relative to increasing marginal cost, the higher (lower) the level of competition.	Negative (and significant association with management practices likely for reasons given in column (3)
2	Herfindahl-Hirschman Index (HHI) Hirschman (1964)	Estimate of the level of industry concentration for all industries in the sample.	Although market concentration may influence management practices, HHI fails to account for difference in geographic locations of competitors and also fails to take into account the specific market in which the competitors are operating in. This measure may suggest competitive pressures are present but to the competitors may in fact not be credible (i.e., a likely threat).	The greater (smaller) the index, the more (less) concentrated the industry, indicating lower (higher) levels of competition	Negative (although a weak association is likely given reasons in column (3)
3	Price Cost Margin or Lerner Index (PCM) Aghion et al. (2005)	Indicator of the firm's market power, its ability to raise prices above marginal cost, aggregated by firm's market share.	The Lerner index does not take into account varying initiatives by firms in using resources across different innovative activities to improve firm performance, as such does not capture the effects competitive pressures are likely to have on management practices.	The greater (smaller) the price cost margin, the more (less) profitable the industry, indicating lower (higher) levels of competition	Negative (although a weak association is likely given reasons in column (3)

4	Number of competitors	Total number of firms in the same industry or product/service range .	Although the number of competitors influences how management may respond to competitive threats, this variable does not take into account the real nature of the competition – whether it is a credible threat or not.	The greater (smaller) the number of competitors, the greater (smaller) the competition and pressure on management to improve practices.	Positive (although a weak association is likely given reasons in column (3)

Table IV Panel A– Descriptive Statistics of sample

Variable	n.	Median	Mean	Std. Dev.
Management Practices Score (MPS)	152	2.83	2.85	0.56
PE (4 digit ANZSIC)	152	-1.13	-1.31	1.26
Number of perceived competitors	150	8	6.83	3.34
Firm Size (number of employees)	152	150	290	482
Firm age (years)	152	29.50	32.16	22.55
% of employees with tertiary degree	150	2	7.56	13.5
Average hours per week worked by employees	152	42	43.72	5.78
Percentage of employees belonging to a union	152	31.50	41.51	35.64

Table IV Panel B – Correlation matrix of sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Management Practices Score (MPS) (1)	1									
PCM (4 digit ANZSIC) (2)	0.121	1								
	(0.138)									
PE (4 digit ANZSIC) (3)	-0.064	0.29	1							
	(0.433)	(0.000)								
HHI (4 digit ANZSIC) (4)	0.012	0.222	0.096	1						
	(0.892)	(0.012)	(0.287)							
ln(Number of perceived competitors) (5)	0.005	-0.053	0.039	-0.113	1					
	(0.951)	(0.519)	(0.633)	(0.212)						
Firm Size (number of employees) (6)	0.346	-0.032	-0.083	0.077	0.171	1				
	(0.000)	(0.696)	(0.311)	(0.390)	(0.037)					
Average hours per week worked by employees (7)	-0.148	0.025	-0.094	0.168	-0.164	0.021	1			
	(0.069)	(0.764)	(0.253)	(0.062)	(0.045)	(0.797)				
% of employees with tertiary degree (8)	0.277	0.025	-0.072	-0.057	0.073	0.116	-0.171	1		
	(0.001)	(0.763)	(0.384)	(0.530)	(0.380)	(0.158)	(0.036)			
Ln(Firm age (years)) (9)	0.078	0.004	0.019	0.07	0.094	0.029	-0.106	-0.032	1	
	(0.337)	(0.956)	(0.818)	(0.433)	(0.253)	(0.727)	(0.197)	(0.694)		
Percentage of employees belonging to a union (10)	0.131	0.103	0.13	-0.039	0.035	0.238	-0.197	-0.027	0.067	1
	(0.107)	(0.208)	(0.110)	(0.662)	(0.674)	(0.003)	(0.015)	(0.746)	(0.410)	

Table V– Management Practices and Price Elasticity (PE) Competition Measure

Column (Model)	(1)	(2)	(3)	(4)
Dependent variable	MPS (all controls)	MPS (all controls - standard errors clustered by industry groupings)	MPS (all controls – outliers removed)	MPS (all controls except industry and region dummies – outliers removed)
PE (4 digit ANZSIC)	-0.138	-0.138	-0.158	-0.123
	(0.047)	(0.018)	(0.026)	(0.003)
Region dummies	Yes	Yes	Yes	No
Industry dummies	Yes	Yes	Yes	No
General controls	Yes	Yes	Yes	Yes
Noise Controls	Yes	Yes	Yes	Yes
Observations	150	150	143	143
Adjusted R-squared	0.37	0.37	0.43	0.47

Note: All columns estimated by OLS with all controls with the p values in parentheses under coefficient estimates (the p values are estimated using robust standard errors). The sample includes all firms with available competition data. **"PE"** is Profit Elasticity which indicates how a change in marginal cost causes a change in profits of firms in an industry, expressed as a negative number. "**Region dummies**" include the 4 Region dummies. **"Industry dummies"** include a full set of ANZIC industry codes. "**General controls**" comprise of firm-level controls including ln(firm size), ln(firm age), the share of workforce with degrees, ln(average hours worked), union membership dummy and dummy variables if the firm is listed. **"Noise controls"** are interviewer dummies, the seniority, gender, tenure, the day of the week the interview was conducted, the time of the day the interview was conducted, the duration of the interviews. "**MPS"** is the firm-level management score, standardised to a z-score, where each individual practice is z-scored, then average across all 18 questions, and then this average is z-scored so the management index has a standard deviation of unity.

Table VI– Evaluating the effects of other three measures of competition on management practices (PCM, HHI and Number of Competitors).

Column (Model)	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Dependent variable	**MPS**	**MPS**	**MPS**	**MPS**	**MPS**	**MPS**	**MPS**	**MPS**	**MPS**
	all controls			**all controls – with outliers removed**			**all controls except industry and region dummies – with outliers removed**		
PCM (4 digit ANZSIC)	1.680			1.492			1.033		
	(0.090)			(0.157)			(0.211)		
HHI (4 digit ANZSIC)		1.095			1.081			0.562	
		(0.149)			(0.168)			(0.303)	
Number of Competitors			-0.011			-0.001			-0.015
			(0.649)			(0.980)			(0.478)
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
General controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Noise Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150	124	148	143	119	141	143	119	141
Adjusted R-squared	0.361	0.355	0.353	0.417	0.385	0.413	0.453	0.438	0.455

Note: All columns estimated by OLS with all controls with the p values in parentheses under coefficient estimates (the p values are estimated using robust standard errors). The sample includes all firms with available competition data. **"PE"** is Profit Elasticity which indicates how a change in marginal cost causes a change in profits of firms in an industry, expressed as a negative number. "**Region dummies**" include the 4 Region dummies. **"Industry dummies"** include a full set of ANZIC industry codes. "**General controls**" comprise of firm-level controls including ln(firm size), ln(firm age), the share of workforce with degrees, ln(average hours worked), union membership dummy and dummy variables if the firm is listed. **"Noise controls"** are interviewer dummies, the seniority, gender, tenure, the day of the week the interview was conducted, the time of the day the interview was conducted, the duration of the interviews. "**MPS"** is the firm-level management score, standardised to a z-score, where each individual practice is z-scored, then average across all 18 questions, and then this average is z-scored so the management index has a standard deviation of unity.

Figure I – Plot of Management Practices Score (MPS) on competition measured with Price Elasticity (PE)