Competition, Agency and Productivity *

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Abstract

This paper tests a set of hypotheses relating to agency and Schumpeterian views on how competition affects performance. A survey data set of Australian workplaces is used, with the change in labour productivity growth as the dependent variable. The results show strong support for the idea that intense competition raises productivity growth in managerial workplaces, but not in non-managerial workplaces (i.e. where the principal owner also works). Testing the agency theories in more detail we find no evidence that the number of competitors, the price elasticity of demand or a proxy for bankruptcy (pre-tax losses) are the mechanisms behind the process. For non-managerial workplaces the results indicate support for the idea that greater demand uncertainty reduces productivity growth. In contrast, for managerial workplaces greater demand uncertainty tends to raise productivity growth.

Keywords: Competition, agency, Schumpeterian, productivity.

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1. Introduction

How does the intensity of competition a firm faces affect its productivity growth? This is a question with a long history in economics, business and policy, although there are relatively few empirical analyses. Many economists believe that at least some degree of competition is necessary as an incentive to invest in change and innovation, although it is far from clear how one would define the degree of competition. This paper reviews the theoretical contributions to these issues and constructs a series of hypotheses for empirical testing. These hypotheses are tested using a survey-based dataset on a large sample of Australian workplaces.

The existing literature tends to focus on one of two approaches: Schumpeterian or agency. The basic Schumpeterian approach focuses attention on profitability. Past and current profits are important in providing funds for the investment necessary to increase productivity (this assumes that there are credit market imperfections), while the level of expected future profits provide the incentive for any such investment. These ideas in isolation suggest that increasing competition, and the (likely) associated reduction in profits, may both reduce investment funds available and also lower incentives, resulting in reduced productivity growth. In contrast, the basic agency approach – the idea that some firms have a principal-agent problem and, as a result, managers may have 'suboptimal' effort levels – suggests that increasing competition will reduce agency problems and raise the effort level of managers. If the effort level influences the rate of productivity growth then the 'agency effect' suggests increasing competition may raise productivity growth. Many policymakers and non-specialists appeal to the idea of the 'agency effect', even if they do not use the actual term, when they assert that competition can be beneficial for productivity growth.

The basic thrust of these two approaches generates opposite effects on the competition-productivity relationship although, as will become clear, further analysis of the two basic approaches blurs this conclusion. Nevertheless, it is argued here that empirical analysis can and should distinguish between these two mechanisms, something that has not been highlighted in the existing literature. The data used here allows us to identify workplaces that are likely to suffer from an agency effect, hence

we can analyse the impact of competitive conditions for these workplaces in isolation. In addition, this paper tries to separates out the various mechanisms within the Schumpeterian and agency effects and then provides an empirical testing of these mechanisms. The ability to do this is hampered by lack of data on key factors, however, the previous literature often fails to make any attempt at all. An important implication of the analysis is that existing empirical studies, which fail to control for the different potential mechanisms, will not accurately assess the impact of competition on performance.

The structure of the paper is straightforward. The next section outlines the existing theoretical ideas and develops these into a set of hypotheses. This section also discusses recent empirical analyses. Section 3 discusses the data and the empirical specification. Section 4 contains the results from a series of ordered probit regression models. Section 5 concludes.

2. Theoretical and empirical background

As stated in the introduction, there are two main frameworks for thinking about competition and performance: agency and Schumpeterian. There are a number of reviews of the issues (Cohen, 1995, Nickell, 1996, Symeonidis, 1996, Boone, 2001, Ahn, 2002), hence the aim here is to summarise the main arguments and to formulate hypotheses.

Hypotheses

Although Schumpeter's views on competition and innovation are complex, a main idea associated with his work is that the existence of monopoly profits may provide greater incentives and resources for innovation.[1] These ideas have become central to

[1] See Hagerdoorn (1996) for a general discussion and Aghion and Howitt (1998) for the way in which Schumpeterian ideas have been incorporated into endogenous growth models. Schumpeter defined an innovation as new-to-the-market, while more recent definitions have extended this to include new-to-the-firm (OECD, 1997)

economists working on innovation, patents and growth.[2] Two specific hypotheses from this literature are as follows. First, assuming that productivity growth is a monotonic function of investment in innovation, a lower expected rate of profitability (due, say, to more intense competition) should lower investment and productivity growth. Second, if a firm is credit constrained, the existence of higher past and current profitability will enable the firm to invest more, again increasing productivity growth. Both of these hypotheses suggest that increased competitive pressures may reduce current and expected profits, thereby reducing investment in innovation and slowing productivity growth. Testing these hypotheses is not straightforward. The first hypothesis requires data on expected future profitability, which will be a function of both technological and market uncertainty. The second requires knowledge of credit constraints that are specific to investments in innovation. In addition, and of central relevance here, these arguments assume the lack of a principal-agent problem that may also provide a mechanism which links competition and productivity.

Let us define a managerial firm as one where a principal-agent problem exists, which is when owners and managers have different information sets (asymmetric information) and so an incentive contract must be used. Managers are assumed to prefer low effort ('slack') and have to be induced by an incentive contract to raise effort. Since managerial effort is likely to influence decisions regarding organisational change, innovation and investment, these models have a link to firm performance and, specifically, productivity change. In particular, a commonly held view is that increased competitive pressure may raise managerial effort and thereby performance. This view is the opposite to the basic Schumpeterian view, which suggests more competitive pressure may reduce performance, hence the following testable hypothesis is implied:

Hypothesis 1 The impact of competition on productivity varies between managerial firms and non-managerial firms.

[2] Early work on these issues includes Arrow (1962) and Scherer (1967), with more recent work summarised in Scherer (1990, 1992) and the reviews mentioned above.

While the basic intuition of the agency approach coincides with commonly held views of economists and others, more formal models of agency allow greater insight into the possible mechanisms. For our purposes, there are two distinct groups of agency models. One is concerned with the *number* of competitors in the market, while the other is concerned with how the intensity of competition affects demand and profits, which in turns affects the incentive contract used.

Some agency models assume that as the number of competitors increases, the degree of asymmetric information may fall, and managers may have to reduce slack. In other words, a specific principal (owner) is able to reduce the informational asymmetry by observing competitors (Nalebuff and Stiglitz, 1984). Hence, this approach suggests more competitors will imply more managerial effort and, hence, faster productivity growth.[3] A related mechanism occurs when managers are concerned about their future pay, which is dependent to some extent on current performance (this has been called the 'reputation effect'; Meyer and Vickers, 1995, Vickers, 1995). In this situation more competitors may give owners better information on which to base future pay decisions. This suggests that, as the number of competitors rises, managers have to exert more effort now to maintain future pay. However, if managers' abilities are highly correlated, these theoretical models indicate that individual managers may attempt to free ride on the cohort's performance, and this would tend to reduce current effort. The theoretical analysis is, therefore, ambiguous: more competitors could raise or lower effort and hence productivity growth. This discussion of information-based agency models motivates a further hypothesis testable on managerial firms:

Hypothesis 2 The number of competitors may have an effect on effort and, subsequently, productivity performance.

A second group of agency models suggest that increased competition has the dual effect of reducing demand (and profits) and raising the price elasticity of demand facing an individual firm. The former will tend to reduce the ability of owners to offer incentive contracts, leading to reduction of effort and lower productivity growth. The

[3] Hart (1983) and Scharfstein (1988) model the impact of the number of entrepreneurial firms on managerial firms, again with the prediction that more entrepreneurial firms raise managerial effort.

latter implies that effort is even more critical, hence the owner may offer a stronger incentive contract, raising effort and productivity. Depending on the structure and parameters of the model, it is possible for either effect to dominate (Willig, 1987, Martin, 1993). However, the implication with respect to price elasticity is clear: firms with a principal-agent problem that face a high price elasticity of demand will have higher effort than those facing a low elasticity, *ceteris paribus*. For managerial firms this suggests:

Hypothesis 3 The elasticity of demand a firm faces may affect effort and, subsequently, productivity performance.

Returning to links between competition and profitability, some argue that lower profits increases the possibility of bankruptcy and, assuming managers wish to avoid this, this would raise managerial effort (Aghion et al, 1997, assume such a link). However, increased competition also implies lower average profitability and, as noted above, a principal may find it more costly to offer a manager an incentive contract (Schmidt, 1997). These two effects – the threat of bankruptcy and the higher cost of incentives – work in opposite directions and so, once again, the overall outcome is ambiguous. Unfortunately, the dataset used here does not contain full details of past and current profits, hence it is not feasible to fully test these ideas. The only variable that is available is a dummy variable indicating whether a loss was made in the last year, which allows us to test:

Hypothesis 4 Loss making firms may have higher managerial effort and higher productivity growth.

It should be clear that hypotheses 2 to 4 are concerned with allowing the data to adjudicate which aspects of the various theories are more important. There are uncertainties within the theories about whether, and in which direction, the intensity of competition may affect performance. A further complication is that hypotheses 2 to 4 are concerned only with managerial firms and assume that Schumpeterian forces do not apply. Clearly, managerial firms are also likely to be influenced by Schumpeterian forces. Hypothesis four is, perhaps, the best example since a loss making firm may have limited cash flow for investment. For empirical work this represents a problem, since separating out all the various forces requires much more data than are available

(both here and in existing studies). However, in the empirics below, some insight can be gained from the results on non-managerial workplaces since these results should be solely driven by Schumpeterian forces.[4]

Empirical background

Previously used proxies for the intensity of competition include levels of profitability, industry concentration, market share and qualitative measures of barriers to entry. All of these can be criticised in some respect, for example, market share has been considered an indicator of the past success of the firm, rather than the firm's current market power (i.e. lack of competition). Hence, inferences based on the assumption that high market share is associated with high profits and/or high productivity growth may reflect some unobserved characteristic of the firm and not a relationship with the intensity of competition (Demsetz, 1973, Martin, 1993). Other analyses have used measures of the persistence of profitability as a proxy for competition (e.g. Mueller, 1990). Most recently, some researchers have used changes to legislation as (exogenous) proxies for shifts in competition conditions (Symeonidis, 2001, Griffith, 2001).

Measuring productivity is also difficult. Researchers face an initial choice between partial measures (e.g. labour productivity) or total measures (total or multi-factor productivity), with associated issues concerning the measurement of capital, labour and value added. Perhaps of more concern is that, as the intensity of competition varies, the measured level of productivity may also vary. To quickly see the potential problem, note that value added is measured as final price times real output less input value. Hence, it is possible that price rises, caused by a fall in competition, will raise measured value added and increase productivity (unless calculations for constant prices are fully accurate). This issue has been highlighted in the case of total factor

[4] It is likely that the owners of non-managerial workplaces will have diverse objectives, which may lead to satisficing behaviour and the pursuit of specific goals. At a basic level this will introduce 'noise' into any empirical analysis of the link between competition and performance, which would lead to high standard errors. Of more concern is the possibility that the owners of non-managerial workplaces deliberately select particular markets where, for example, competition is low and productivity performance is less critical. Table 1 below suggests this is not the case.

productivity (TFP) where it has been noted that increases in mark-ups (reductions in competition) will raise TFP (Griffith, 2001, Hulten, 2000).

Empirical analysis of the link between competition and productivity have used a wide variety of data, variables and techniques (Cohen, 1995, Nickell, 1995, 1996, Symeonidis, 1996, Ahn, 2002, provide reviews). As noted above, these studies tend to focus on either the Schumpeterian or the agency approach. Nickell (1996) finds that more competitors and lower economic rents (an inverse indicator of competitive pressure) boost productivity growth in a sample of 670 UK firms (1972-86). Other papers try to proxy firms that are likely to have agency problems, usually by shareholder information (e.g. Nickell, 1996, Nickell et al, 1997) or whether the plant is a single establishment (e.g. Griffiths, 2001). These papers offer support for the idea that competition can increase effort and thereby innovation or productivity. In contrast, other papers have focused on Schumpeterian issues, particularly with respect to innovation. A recent example is Aghion et al (2002) who find an inverted-U shaped relationship between competition and patenting for UK firms; a result that has some historical support (Scherer, 1965, Scherer and Ross, 1990). Other studies have found various results: a positive or neutral influence of competition on firm performance in the UK (Geroski, 1990, Broadberry and Crafts, 2000); a negative effect of import competition on R&D in US high-tech firms (Scherer and Huh, 1992); a positive effect of import competition on German firms (Bertschek, 1995). In many ways these and other studies confirm the basic thrust of the theoretical literature: the competition-performance link is uncertain. The contribution of the empirics here is to show that some of the variance in results may be due to a failure to distinguish accurately between agency and Schumpeterian effects.

3. Data and empirical specification

This paper uses survey data on 807 commercial workplaces in Australia in 1995 from the Australian Workplaces Industrial Relations Survey (AWIRS). The survey covered all workplaces in Australia with 20 or more employees and had a response rate of 80% (see Appendix for full details). The data used here come from a survey with the senior manager at the workplace. The data are particularly rich in information that allows us to identify agency issues and market conditions, as well as controlling for a

host of other possible factors. A drawback of the data is, however, that there are no financial data. The survey asked questions about the intensity of competition, as well as the extent of labour productivity growth over the last two years. In both cases these rely on managers' subjective judgements, which may contain errors (to the extent that managers are not fully informed or deliberately mis-report[5]). Although survey data do have drawbacks, they avoid many of the problems of measuring competition and productivity discussed above. For example, managers are less likely to confuse productivity changes with price changes. Equally, the use of survey data removes the need to make various assumptions about capital stock, labour and raw material inputs. In addition to the questions on productivity and competition, the survey also asks whether 'the principal owner of the firm works at this workplace'. This provides a method of dividing the sample into managerial workplaces, which may experience agency problems, and owner-present workplaces which should be subject to fewer informational asymmetries between the owner and manager(s) (indeed they may be the same person).

Testing the above hypotheses requires controlling for other possible determinants of productivity growth (see Oulton and Mahoney, 1994, Dawkins and Rogers, 1998, for reviews). The regressions shown below control for a number of other factors, including investment, the nature of industrial relations, firm size and export status. All regressions also include a set of industry dummies (two digit level) to control for industry-specific technological and market effects. Full details of the variables are shown in the appendix, here we focus on the productivity and competition variables.

The dependent variable in the regression analysis is the extent of labour productivity improvement over the last two years. This is a categorical variable with a value of 5 for 'a lot higher' to 1 for 'a lot lower', hence an ordered probit model is used to estimate parameters (see Appendix for details). The use of a productivity change measure, rather than a measure of innovative activity is deliberate. Although AWIRS does contain variables relating to the introduction of new products, processes and organisational change, these do not indicate the importance of such changes or, indeed, whether the changes have been successful or unsuccessful (Rogers, 1999).

[5] The survey is confidential so the latter is thought unlikely to be a major problem.

The top panel of Table 1 shows the responses to the questions on productivity conditions, by managerial and non-managerial workplaces. Almost 30% of the full sample state that productivity is 'a lot higher' than two years ago, however, only 21.7% of non-managerial workplaces reported productivity was 'a lot higher'. The differences across managerial and non-managerial workplaces are statistically significant according to a chi^2 test. As can be seen from the data appendix, non-managerial and managerial workplaces are different in a number of ways perhaps, most notably, in terms of workplace size: 81% of non-managerial workplaces have 100 or fewer employees, compared to 53% of managerial workplaces. This suggests the need to control for workplace size in any regression analysis.

The main explanatory variable for competition comes from a question on the nature of competitive conditions, with managers having to rate competitive conditions in one of five categories from 'intense' to 'limited'. The lower panel of results in Table 1 shows how competitive conditions vary, with these statistics also broken down by managerial and non-managerial workplaces. Almost all the workplaces consider competitive conditions either 'intense' or 'strong'. Note that slightly more non-managerial workplaces consider competitive conditions 'intense' or 'strong', although testing for significant differences in responses between the workplace types, the differences are not statistically significant. This suggests that non-managerial workplaces are not locating in less competitive markets.

Table 1 Productivity and competition variables

	Productivity change over last two years					
	A lot lower	A little lower	About the same	A little higher	A lot higher	Total
Managerial	5	28	89	239	179	540
%	0.93	5.19	16.48	44.26	33.15	100
Non-managerial	8	19	77	105	58	267
%	3	7.12	28.84	39.33	21.72	100
Total	13	47	166	344	237	807
%	1.61	5.82	20.57	42.63	29.37	100

Pearson $chi^2(4) = 28.12$ Pr = 0.00

	Competitive conditions					
	Intense	Strong	Moderate	Some	Limited	Total
Managerial	228	222	60	11	19	540
%	42.22	41.11	11.11	2.04	3.52	100
Non-managerial	121	118	21	4	3	267
%	45.32	44.19	7.87	1.5	1.12	100
Total	349	340	81	15	22	807
%	43.25	42.13	10.04	1.86	2.73	100

Pearson $chi^2(4) = 6.71$ Pr = 0.15

4. Regression results

The first column of results in Table 2 shows the results of an ordered probit regression on the full sample. This shows that the coefficient on the intense competition dummy is not significant.[6] Hypothesis 1 states that the impact of competition may vary depending on workplace type. Hence, columns R2 and R3 separate the sample into managerial workplaces and non-managerial, or owner-present, workplaces. The

[6] Additional regressions have been run that include dummies for 'strong' and 'moderate' competitive conditions. These show a similar pattern of results to those shown in Tables 2, 3 and 4, with the coefficient on the 'intense' dummy positive and significant for managerial workplaces, although often only at the 10% significance level.

results show that the coefficient for intense competition is positive and significant for managerial workplaces, supporting hypothesis 1 and the idea that competitive pressure increases managerial effort and performance.[7] In contrast, the regression on the sample of non-managerial workplaces shows a negative, but insignificant, coefficient on the competition dummy. The result in R3 suggests that the Schumpeterian view that more competition may reduce productivity growth has little statistical support. This strengthens the interpretation of the results in R2 made above, namely, that the results are primarily due to agency effects. How important is the effect of 'intense' competition? One of the problems of ordered probit analysis is interpreting the coefficients, since they represent the impact on an underlying latent variable (see Appendix). One method of assessing the economic impact of the results is to ask: if all workplaces were now subject to 'intense' competition, how would productivity be affected? If this hypothetical change is carried out, the percentage of firms predicted to have 'a lot higher' productivity growth increases from 17% to 24%.[8]

The other coefficients in Table 2 indicate i) that good industrial relations are conducive to high labour productivity growth only in managerial workplaces, ii) that productivity growth is higher when demand is expanding, iii) high levels of physical investment are associated with productivity growth only in managerial workplaces, and iv) smaller and larger managerial workplaces tend to have slower productivity growth.

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[7] A test of whether the coefficient on intense competition is the same across samples is rejected (1% significance level). Similarly, a joint test for the equivalence of the coefficients shown in Table 2 across the two samples is rejected at the 5% level.

[8] Formally, the standard predicted value of the latent variable ('productivity change') is given by $X\beta$, where X is the explanatory variable matrix and β are the coefficients. The hypothetical case is where $X \rightarrow X'$, where the only difference in X' is that all workplaces now face 'intense' competition (i.e. instead of 43% of workplaces facing 'intense' competition, see Table 1, we set this to 100%).

Table 2 Ordered probit analysis of productivity growth

Explanatory variable	*R1*	*R2*	*R3*
	Full sample	*Managerial*	*Owner at workplace*
Intense competition dummy	0.107	0.257***	-0.153
	(1.31)	(2.46)	(-1.03)
Industrial relations rated 'good' dummy	0.152*	0.247**	0.070
	(1.81)	(2.22)	(0.47)
Market expanding dummy	0.246***	0.212**	0.336**
	(3.04)	(2.12)	(2.20)
Investment increasing dummy	0.155**	0.249***	0.069
	(1.94)	(2.50)	(0.46)
Small workplace (≤ 100 employees) dummy	-0.250***	-0.240**	-0.274
	(-2.72)	(-2.09)	(-1.35)
Large workplace (≥ 500 employees) dummy	-0.223	-0.289	0.287
	(-1.39)	(-1.61)	(0.61)
Exporter dummy	0.076	-0.119	0.285
	(0.74)	(-0.89)	(1.46)
Observations	807	540	267
Industry dummies	Yes	Yes	Yes
R-squared	0.054	0.064	0.085

Notes: *** significant at 1% level, ** significant at 5% level, * significant at 10% level (two tailed tests). The dependent variable is a categorical measure of labour productivity growth in the last two years. A set of two-digit industry dummies is also included as explanatory variables. Robust t-statistics are shown in brackets. See Appendix for summary statistics and further information.

Table 3 below shows a set of regressions on a sample of managerial workplaces which test hypotheses 2, 3 and 4 (i.e. the different potential mechanisms for the agency effect). The first column of results in Table 3 includes a dummy variable for whether the workplace faces 'many' competitors, as opposed to 'few'. The coefficient is insignificantly different from zero, indicating that the data show no support for hypothesis 2. The basic interpretation is that the number of competitors appears to have no association with productivity performance. This said, since the information-based agency models do yield ambiguous predictions, it is possible that the theoretical mechanisms of specific models are valid, but these mechanisms offset one another in the data.

The second regression (R3) includes a dummy variable for whether the workplace reported that price competition was important. This provides a proxy for whether the price elasticity of demand is high. The coefficient on this variable is negative, although not significantly different from zero, implying no support for hypothesis 3 (i.e. price responsiveness appears not to be a key factor in allowing the principal to raise managerial effort). The third column of results in Table 3 includes a dummy variable for whether the workplace has made a pre-tax loss in the last year. Hypothesis 4 stated that loss-making managerial workplaces may engender greater effort and hence productivity growth. Again, although the coefficient is positive, it is not significantly different from zero, offering no direct support for this hypothesis. It is, of course, likely that loss making workplaces have reduced investment funds available, or may simply be reaching the end of their working lives, hence any increase in effort may be offset by other factors that reduce productivity growth.

The fourth column in Table 3 includes a dummy variable for whether the manager considers that demand is unpredictable in their market. One of the Schumpeterian arguments was that greater uncertainty over future profits might reduce investment in innovation and thereby reduce productivity growth. The positive and weakly significant coefficient on demand unpredictability in R4 suggests this is not the case for managerial firms. Reasons why this may occur include that profits can be higher under demand uncertainty, possibly reflecting a risk premium, but also due to upward sloping marginal cost curves.[9] The final column in Table 3 includes all the additional variables and shows similar results.

[9] Standard theory of the firm notes that upward sloping marginal cost curves causes firms to reduce output if demand is lower and make less profits, but to increase output and profits when demand increases. Overall, if demand fluctuations are symmetric, the increases in profits outweighs the losses in profits, hence expected profits are higher under uncertainty (this is an argument used in debates over price fluctuations due to exchange rate changes, e.g. De Grauwe, 1997).

Table 3 Ordered probit analysis (managerial workplaces)

Explanatory variable	*R1*	*R2*	*R3*	*R4*	*R5*
Intense competition dummy	0.260**	0.264***	0.253**	0.232**	0.241**
	(2.40)	(2.52)	(2.42)	(2.20)	(2.19)
Industrial relations rated 'good' dummy	0.248**	0.237**	0.242**	0.252**	0.239**
	(2.22)	(2.11)	(2.17)	(2.26)	(2.13)
Market expanding dummy	0.212**	0.206**	0.214**	0.218**	0.215**
	(2.12)	(2.05)	(2.14)	(2.17)	(2.11)
Investment increasing dummy	0.249***	0.242**	0.250***	0.249***	0.243***
	(2.50)	(2.43)	(2.51)	(2.50)	(2.45)
Small workplace (<100 employees) dummy	-0.241**	-0.231**	-0.248**	-0.263**	-0.259**
	(-2.10)	(-2.00)	(-2.13)	(-2.28)	(-2.20)
Large workplace (>500 employees) dummy	-0.290	-0.287	-0.286	-0.273	-0.269
	(-1.62)	(-1.60)	(-1.59)	(-1.52)	(-1.51)
Exporter dummy	-0.120	-0.123	-0.119	-0.108	-0.113
	(-0.90)	(-0.93)	(-0.89)	(-0.81)	(-0.84)
Many competitors dummy	-0.015				-0.017
	(-0.13)				(-0.15)
Price sensitive demand dummy		-0.096			-0.095
		(-0.88)			(-0.87)
Loss making workplace dummy			0.071		0.054
			(0.47)		(0.35)
Demand unpredictable dummy				0.212*	0.210*
				(1.68)	(1.66)
Observations	540	540	540	540	540
Industry dummies	Yes	Yes	Yes	Yes	Yes
R-squared	0.064	0.064	0.064	0.066	0.067

Notes: As table 1.

Table 4 shows regressions on the sample of workplaces where the principal owner is also present. Looking at the core set of explanatory variables, these results indicate that the factors associated with productivity growth are different from the managerial worplaces. Industrial relations and past investment do not seem to be important, and the evidence on the role of workplace size is weak. There is weak evidence that being

an exporter is associated with higher productivity growth.[10] With respect to competition, these workplaces should reflect the impact of any Schumpeterian forces. Table 2 has shown that the intense competition dummy is not significant for this sample. Table 4 reinforces this conclusion: in all of these regressions the coefficient on the intense competition dummy is negative but not significantly different from zero. The regressions in Table 4 also show that the dummies for 'many competitors', 'price sensitivity' and 'loss maker' have no significant associations with productivity growth. The only coefficient that is weakly significant is that on the 'demand unpredictable' coefficient, and this is negative, indicating that increased uncertainty reduces productivity growth. The coefficient is therefore the opposite of that obtained in the managerial sample. One explanation is that non-managerial workplaces, which are on average smaller, have fewer financial resources to cope with demand fluctuations and, as a result, investment in productivity suffers.

The previous result fits with the idea that credit constraints on smaller firms may reduce investment funds available. The Schumpeterian view suggests that an intensely competitive environment, which should reduce profitability, would further increase any impact of such credit constraints. Conceptually, this is testable using an interactive term between intense competition and proxies for credit constraints. Further regressions were run to try to test this issue by interacting the intense competition dummy with the 'loss maker' dummy, the small workplace dummy, the large workplace dummy and a dummy for whether the workplace is part of larger firm. In no cases were the results significant. Although these variables are likely to be far from perfect proxies for credit constraints, the results indicate no support for such a view.

The robustness of all the above results has been checked in various ways. First, re-estimating the above models after removing insignificant variables from the set of explanatory variables does not change the broad pattern of the results. Second,

[10] There is a literature on performance and export status. It is likely that highly productive firms become exporters due to competitive advantage. Equally, some argue that exporters have greater access to international technology, which can boost productivity (e.g. Bernard and Jensen, 1995, Aw and Hwang, 1995).

different variables to control for workplace size were included and again the results are little changed.[11] Third, some argue that including an investment variable may cloud results, as investment and productivity growth should be highly related, however, omitting the dummy variable for investment does not affect the results.

A further issue is whether the inability to control for endogeneity is driving the results. It is the case that the intensity of competition is determined by other, more fundamental, characteristics of the market. The determinants can be thought of as relating to three aspects: natural barriers to entry (e.g. technology of production, transport costs, regulation); strategic barriers to entry (e.g. R&D, advertising, brand proliferation, distribution networks); and the extent of collusion (Porter, 1980, Scherer, 1990, Sutton, 1991, 1998). For our results, a critical issue is whether investment in productivity growth and competition is determined by a third factor. The most likely candidate is R&D, with high levels of R&D driving both (high) productivity growth and competitive conditions. However, if this were the case, the normal interpretation is that high R&D creates a barrier to entry and that this would *reduce* the reported level of competition. Hence the implied outcome – high productivity growth together with low competition – is the opposite of the relationship found above. Thus, if this mechanism did exist in some or all industries in the sample, the above results would underestimate the true effect of competition.

Another concern is that managers may mis-report competitive pressures or productivity. In particular, the results would be biased if, for example, managers associated rapid productivity growth in their workplace as indicating a competitive environment. Clearly, the above analysis shows that, if this were the case, it is only occurring in managerial workplaces: owner-present workplaces show no support for this argument.

[11] The log of employees was included as a variable (generally this is insignificant), different combinations of workplace and firm size dummies were investigated.

Table 4 Ordered probit analysis (non-managerial workplaces)

Explanatory variable	*R1*	*R2*	*R3*	*R4*	*R5*
Intense competition dummy	-0.196	-0.169	-0.142	-0.135	-0.194
	(-1.31)	(-1.14)	(-0.96)	(-0.92)	(-1.31)
Industrial relations	0.077	0.055	0.076	0.115	0.114
rated 'good' dummy	(0.52)	(0.36)	(0.51)	(0.75)	(0.74)
Market expanding dummy	0.346**	0.352**	0.349**	0.322**	0.364**
	(2.24)	(2.29)	(2.30)	(2.09)	(2.34)
Investment increasing dummy	0.064	0.071	0.069	0.086	0.083
	(0.43)	(0.47)	(0.46)	(0.57)	(0.55)
Small firm (<100 employees)	-0.277	-0.261	-0.252	-0.268	-0.236
Dummy	(-1.37)	(-1.30)	(-1.24)	(-1.29)	(-1.15)
Large firm (>500 employees)	0.326	0.271	0.282	0.277	0.301
Dummy	(0.71)	(0.56)	(0.60)	(0.60)	(0.65)
Exporter dummy	0.278	0.300	0.285	0.329*	0.339*
	(1.43)	(1.53)	(1.46)	(1.66)	(1.70)
Many competitors dummy	0.166				0.195
	(0.95)				(1.11)
Price sensitive demand dummy		0.156			0.175
		(1.05)			(1.17)
Loss making workplace dummy			-0.298		-0.277
			(-1.32)		(-1.20)
Demand unpredictable dummy				-0.278*	-0.293*
				(-1.76)	(-1.85)
Observations	267	267	267	267	267
Industry dummies	Yes	Yes	Yes	Yes	Yes
R-squared	0.086	0.086	0.087	0.089	0.095

5. Conclusions

The aim of this paper has been to test a set of hypotheses relating to agency and Schumpeterian views on how competition affects performance. The data that allow us to test these hypotheses comes from a survey of Australian workplaces in 1995. The key aspects of the data are the ability to identify which workplaces have the principal

owner working there – a proxy for the absence of agency effects – and also information on competitive conditions. The latter includes both a rating of whether competition is ‘intense’, ‘strong’ or ‘moderate’, and also whether there are ‘many’ or ‘few’ competitors. The data also provide a variable on how labour productivity has changed over the last two years.

The results are interesting in a number of ways. First, there is a clear distinction between the effects of intense competition between managerial and non-managerial workplaces. This is exactly what the basic insight from the agency models would have predicted. Regressions on samples of managerial workplaces, where agency effects are likely to be present, indicate that ‘intense’ competition raises productivity growth. In contrast, the initial regressions on non-managerial workplaces show no impact of competitive conditions. These results imply that the failure to control for the presence of agency effects has influenced the findings of existing empirical studies. Second, testing the different theoretical mechanisms for the agency effect we find no evidence that the number of competitors matters, or that managers facing price sensitive markets have higher effort levels. Similarly, we can find no evidence that managing a loss-making workplace (a proxy for likelihood of bankruptcy) raises effort and thereby productivity growth. The implication is that competition acts through a diverse set of pressures not captured by any single model.

Analysis of the non-managerial firms offers a number of insights. If one assumes that non-managerial workplaces reflect any Schumpeterian forces with respect to competition, the results indicate no support for ‘intense’ competition reducing productivity improvement. This said, there is evidence that greater demand unpredictability reduces productivity improvement, which could be explained by the Schumpeterian argument that greater uncertainty reduces the incentive to investment in change.

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Appendix Australian Workplace Industrial Relations Survey data sample

Description

The data used for the analysis in this paper are from the Australian Workplace Industrial Relations Survey (AWIRS) 1995 data set. The Survey was a stratified, by industry and workplace size, sample of all workplaces in Australia with 20 or more employees, excluding those in workplaces in agriculture, forestry, fishing and defense. The survey covered 2001 workplaces and the response rate was 80%. Administrative, public sector and non-profit organisations are excluded from the analysis as they do not answer questions relating to competitive conditions. The survey was carried out in persons with the senior manager at the workplace.

Variable	*Description*	*Managerial*	*Non-managerial*
		Mean	
Productivity growth (ordered)	1='lot lower', 2='little lower', 3='same', 4='little higher', 5='lot higher'	4.04	3.70
Intense competition	=1 if answer intense, else 0	0.42	0.45
Industrial relations 'very good'	=1 if 'very good' or 'good', else 0	0.35	0.55
Market expanding	=1 if demand for product expanding, else 0	0.51	0.42
Investment increasing	= 1 if workplace has increased substantially expenditure on equipment and premises in the last two years, else 0	0.49	0.54
Small workplace	=1 if workplace employment <= 100 in Australia, else 0	0.53	0.81
Large workplace	=1 if workplace employment >= 500 in Australia, else 0	0.09	0.02
Exporter	=1 if export, else 0	0.41	0.30
Many competitors	=1 if 'many' competitors for major product, else 0	0.07	0.12
Price sensitive	= 1 if price consider most crucial to competitive success, else 0	0.71	0.76
Loss making	= 1 if pre-tax loss last financial year, else 0	0.40	0.37
Demand unpredictable	= 1 if workplace's major product/service is expanding, else 0	0.14	0.12

Key questions

The productivity growth variable comes from the response to the question "Looking at the card, how would you generally describe labour productivity at this workplace compared with 2 years ago?" The categories are 'a lot higher', 'a little higher', 'about the same', 'a little lower' and 'a lot lower' – a 'don't know' option was also allowed.

The question for competition is "Looking at the card, how would you rate the degree of competition for this workplace's major product or service?" This question is only asked to workplaces with competitors.

The question used to distinguish managerial and non-managerial workplaces is 'Does the principal owner(s) of this workplace work here?'

Ordered probit model

The ordered probit model assumes a latent variable *y* which is determined by various workplace characteristics. In the current context, the latent variable is productivity growth. The vector of latent variable values can be expressed as

$$\bar{y} = X\beta + \bar{\varepsilon} \quad ,$$

where X is a matrix of explanatory variables, β is a vector of coefficients to be estimated and $\bar{\varepsilon}$ is an error vector (normally distributed). Since the underlying productivity growth of a workplace is not directly observed, it is assumed that higher levels of productivity coincide with higher choices from the survey question, specifically,

$$\begin{aligned}
c &= 1 \quad \text{if} \quad y \le \delta_1 \\
c &= 2 \quad \text{if} \quad \delta_1 < y \le \delta_2 \\
c &= 3 \quad \text{if} \quad \delta_2 < y \le \delta_3 \\
c &= 4 \quad \text{if} \quad \delta_3 < y \le \delta_4 \\
c &= 5 \quad \text{if} \quad \delta_4 < y
\end{aligned}$$

where c represents the productivity groupings shown above. The δ_i represent the so-called cut-off, or boundary, parameters which are estimated along with the coefficients using maximum likelihood.