A Dynamic Panel Analysis of the Profitability of Australian Tax Entities*

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Melbourne Institute Working Paper No. 22/00

ISSN 1328-4991

ISBN 0 7340 1502 X

November 2000

* This paper is the result of work being undertaken as part of a collaborative research program entitled 'The Performance of Australian Enterprises: Innovation, Productivity and Profitability'. This project is generously supported by the Australian Research Council and the following collaborative partners: The Australian Tax Office, Commonwealth Office of Small Business, IBIS Business Information Pty Ltd, Productivity Commission, and Victorian Department of State Development. The views expressed in this paper represent those of the authors and not necessarily the views of the collaborative partners. We are grateful to David Prentice and John Creedy for helpful comments.

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Abstract

This paper investigates the determinants of profitability of Australian tax entities over the period 1993/94 to 1996/97 for each of 91 three-digit ANZSIC industries. The theoretical model is based on that of Cowling and Waterson (1976). However, it is augmented by the inclusion of lagged profitability to allow for habit persistence in entity profitability. The so-called operational Wansbeek-Bekker estimator is used to control for endogeneity of this lagged dependent variable, whilst simultaneously controlling for observed and unobserved entity heterogeneity. Aggregate results suggest that profitability in the previous year, entity capital intensity, and barriers to entry have the expected positive association with current profitability measured by the price-cost margin. Entity market share—and to a lesser extent concentration—are found to have a U shaped relationship with profitability.

Contents

1. Introduction

The aim of this paper is to estimate the profitability of Australian tax entities using the structure-conduct-performance framework and a unique data set containing tax return records of Australian business entities. There are two major differences between this dataset and firm level datasets. The population of Australian tax entities made available by the Australian Tax Office (ATO) enables the analysis to be undertaken at the 3-digit ANZSIC industry level. If profitability varies across industries, and the determinants of profitability also vary by industry, it is important to ensure that analysis is carried out on an industry-by-industry basis. This represents a departure from most previous studies, which often include industry dummy variables to allow for changes in firm profitability between industries, but coefficients on the determinants of profitability are restricted to be constant across industries. The finding that the determinants of entity profitability do vary widely across industries validates the approach adopted in this paper. The second difference is that financial information is available at the entity level. Firms commonly undertake a wide range of activities and operate in a number of different industries. A tax entity may be used to report a specific activity of a firm within a well-defined industry and therefore closer to a 'line of business'. Market structure variables such as market share and concentration are therefore likely to have a greater degree of accuracy when calculated using entity level data rather than from a firm level dataset.

The Wansbeek-Bekker dynamic panel estimator is utilised to analyse the tax return information because one of its strengths is that it removes any unobserved heterogeniety, leaving only estimates of the 'true' effect of market structure on profitability. The use of a panel—as opposed to a time-series or cross-section model—addresses a number of issues that are important in considering entity profitability. Firstly, both observed *and* unobserved heterogeneity can be adequately controlled for. Unobserved heterogeneity causes numerous problems in empirical work, not least of which is the possibility of making erroneous inferences on the effects of measured variables. Secondly, the chances of a particular cross-section being in some sense atypical are reduced (see Mátyás and Sevestre, 1996, on the benefits of panel data in general)

The following section outlines the theory underlying why certain factors are considered important in the structure-conduct-performance analysis. Section 3 describes the data set more fully, followed by the estimation procedure in Section 4. The results are discussed in Section 5 and Section 6 concludes.

2. Structure-Conduct-Performance and Profitability

One theoretical approach to analysing the financial performance of firms is that provided by the structure-conduct-performance paradigm, which was developed in the industrial organisation framework. This approach (in its simplest form) suggests that market structure influences market conduct, which in turn has an impact on the performance of the organisation. Those features of market structure that are expected to have the most influence over market conduct are seller and buyer concentration, product differentiation and barriers to entry (Capon, 1996).[1] Although this framework has been established for the firm, it can just as easily be applied to tax entities. This is because the concept of the firm is flexible enough to allow tax entities to be treated as 'firms' for the purposes of this analysis, in that they have the potential to represent the financial data relating to a specific activity within a well-defined industry. The nature of the tax system could introduce into the analysis entities that are used for tax planning purposes, although the method used to calculate the price-cost margin and the estimating technique should limit the number of such entities entering into the analysis (see Section 3).

The homogenous product oligopoly model set out in Cowling and Waterson (1976) is the base for the empirical work in this paper. Following Machin and Van Reenen (1993) profitability—the price cost margin in this case—of entity *i* is given by

(1) $$PCM_i = \frac{MS_i + \phi_i(1 - MS_i)}{\varepsilon}$$

where MS_i is the market share of entity *i*, ϕ_i is a conjectural variation elasticity (the rival firm(s) output changes expected if firm *i* alters output) and ε is the industry price elasticity of demand. As in Machin and Van Reenen (1993), ϕ_i is a time varying function of concentration, minimum efficient scale and capital intensity.[2] Given that (1) is to be estimated for each 3-digit ANZSIC industry, it can be assumed that the industry price elasticity of demand is the same for all firms in a given industry, such that ε becomes a

[1] More recent developments in the analysis of firm performance have involved integrating industrial organisation and strategic choice, but these issues will not be covered in this paper.

[2] Entity size is excluded because the only practical measure available (log of total assets) is highly correlated with market share.

constant and therefore does not feature in the estimation procedure (Cowling and Waterson, 1976, p. 269).

The price cost margin is the most commonly used measure of profitability in empirical studies of firm performance and indicates the ability of firms to elevate price above marginal cost (Feeny and Rogers, 1999, Liebowitz, 1982). Following Domowitz, Hubbard and Petersen (1986a, 1986b) and Prince (1994), the price cost margin is defined as:

$$PCM = \frac{Sales + \Delta Inventories - Cost\, of\ sales}{Sales + \Delta Inventories}$$

Cost of sales includes the cost of materials and labour cost. Depending on the stage of the business cycle, the value of sales may differ considerably from the value of output because of changes in inventories (Prince, 1994). Consequently, this definition of the price cost margin includes changes in inventories (calculated as closing stock minus opening stock) as their exclusion can cause biases in price cost margins.

The simple static structure-conduct-performance view of firm performance implies a positive relationship between market share and profitability due to market power. Advocates of this hypothesis contend that those with greater market power are able to charge higher prices (and therefore achieve superior levels of profit) due to ‘market share related product differentiation’ (Gale and Branch, 1982).

However, the structure-conduct-performance paradigm can be criticised in two important ways. The first is that firms are assumed to be homogenous within industries. All firms produce the same product using the same production methods. As mentioned in the introduction, firms rarely produce one product and operate in a single well-defined market. Once this unrealistic assumption is relaxed, the profitability of firms can differ due to differences in costs and product differentiation. Secondly, the paradigm fails to address the dynamic nature of firm performance.

Dynamic views of firm performance are better able to explain how differences in costs and products between firms exist. These views also offer an alternative explanation for a positive association between market share and profitability. Efficiency instead of market power provides the link, and stems from Brozen (1971) and Demsetz (1973). Their dynamic view of firm performance postulates that previous investments in innovations made by firms increase their sales and therefore increase their market share. Firm characteristics that lead to lower cost techniques—and therefore efficiency in production—allow the organisation to expand at the expense of its rivals. Once the firm garners enough of the market, the ability to maintain these efficiency advantages may be reinforced by factors such as economies of scale. This view therefore further differs form the traditional structure-conduct-performance view by assuming that industries can be out of long run equilibrium.

The debate between efficiency and market power and their role in determining profitability has important policy implications. If the market power view is perceived to be “correct”, authorities may wish to intervene to limit the power of such firms through regulatory controls. However, such intervention would be very damaging to the economy if firms have large market shares simply because of superior efficiency.

Advocates of the hypothesis that as market share (and therefore market power) increases and competitive pressures are weakened, suggest that profitability is lower because the incentive to minimise costs is no longer as important. The limited amount of Australian empirical work on this issue either finds no significant relationship between profitability and market share (McDonald, 1999) or some evidence of a U-shaped relationship (Feeny, 2000; Feeny and Rogers, 1999). On the basis of the possible U-shaped relationship, market share and the square of market share are included, where market share is defined as the ratio of entity income to the 4-digit ANZSIC industry income to which the entity has been assigned.[3]

Concentration is hypothesised to facilitate collusion between firms and thereby increase profitability (Bain, 1956). It is also included as a proxy for the (possible) superior efficiency of larger firms (Levy, 1987), and is calculated in this paper as the sum of the market shares of the four largest entities in each 4-digit ANZSIC industry (also known as the four-firm concentration ratio).[4] Early Australian studies that examine the relationship between profit and seller concentration do not reveal any significant association (Dixon et al, 1987 and Round, 1976, 1980a, 1980b for manufacturing; Tucker, 1977 for non-manufacturing). However, some recent studies have yielded more promising results. Although they adopt different approaches, both Feeny and Rogers (1999) and McDonald (1999) find the expected positive relationship between industry concentration and firm profit margins.

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[3] 4-digit ANZSIC industry income is calculated as the sum of the income of all tax entities that are assigned that industry.

There is a range of definitions of barriers to entry (see for example Demsetz, 1982) and all relate to the industry characteristics that place new entrants at a disadvantage relative to the established entrants in an industry. Barriers to entry are an important part of any industrial organisation framework. They imply that new firms are unable to easily enter the market to compete away supernormal profits that may have arisen because of concentration or market share (Hay and Morris, 1991). However, the relationship between barriers to entry and profit is difficult to capture in empirical estimation, as there is a wide variety of possible barriers. Additionally, the barrier is typically unobserved, that is, the size of the barrier is related to the *expectation* a potential entrant has about the post-entry equilibrium in the market (Geroski, 1991). Absolute cost advantages, product differentiation and scale economies are typically used in empirical estimation because they are relatively easy to measure (Hay and Morris, 1991).

Given the nature of the data to be used for this paper, a measure of scale economies is included, proxied by the minimum efficient scale (MES), one of the most common methods for measuring this variable. The minimum efficient scale is the size of firm at which long run average costs are at a minimum; if an industry has a very large minimum efficient scale, this may discourage potential firms from entering that market, thereby enabling the incumbent firm to realise greater profits. Following Comanor and Wilson (1967), minimum efficient scale is calculated as the average assets of the largest entities that account for 50 per cent of the industry. This measure is justified on the grounds that large firms should be able to take advantage of scale economies, as well as being insensitive to small firms that may be operating at a suboptimal scale.

Studies that use the price cost margin as the dependent variable commonly include capital intensity as an explanatory variable (Domowitz, Hubbard and Petersen 1986a, 1986b and Prince, 1994). There are two main reasons for this. The pragmatic reason is that the price cost margin is calculated without taking into account the cost of capital in production, and the capital intensity measure is included to capture this effect.[5] The theoretical reason is that it can also proxy barriers to entry. A high capital intensity may reflect the existence of large

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[4] Preliminary analysis also found this ratio was highly correlated with the Herfindahl measure of concentration.

[5] Such an approach can be criticised for assuming that the rate of depreciation and barrier to entry effect of increments in the ratio is the same across all industries (Scherer and Ross, 1990). However, this is not an issue of substance for this paper, as the analysis is carried out at a 3-digit ANZSIC level of aggregation.

sunk costs that act as a barrier to entry into the industry and so give rise to monopoly profits (McDonald, 1999). A positive association is therefore expected between entity profitability and capital intensity. Capital intensity is measured as the ratio of entity total assets to total income.

3. The Australian Tax Office Tax Return Database

This paper uses annual data from the Australian Tax Office tax return database for the 6-year period 1991/92 to 1996/97. Each year approximately 500,000 tax entities return data on their sales, costs, expenses and other financial activities. The size of the sample, the range of responses, and the panel nature of the dataset make this information ideal for the purposes of this study. Although there has been work done in Australia on the determinants of profitability, the limited availability of this particular dataset means that very little empirical research has been undertaken using this source.[6]

Many previous studies of the determinants of profitability have focused on the manufacturing sector. This is particularly true in Australia (see Feeny, 2000, for a review of the Australian literature). Using tax return data, analysis can be extended to industries throughout all sectors of the economy. On the tax return form, each tax entity is asked to allocate itself an ANZSIC code based upon the entity's activities that yield the highest amount of revenue.[7] Therefore the large size of the database allows analysis to be carried out separately for individual industries, defined at a 3-digit ANZSIC level of aggregation.

A balanced panel of 28,951 tax entities is constructed, yielding a total of 173,706 observations for the six years of data. To be included in the panel, entities must have reported the financial information necessary to construct the price-cost margin and explanatory variables for each year of data[8]. The final panel accounts for over 17 per cent of the total operating income of industries in Australia in 1997 (ABS, 1998).

A potential problem arising from using entities is that a tax entity could be a firm or a specific part of a firm, and there is no official limit on the number of tax entities a firm is able to have.

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[6] These data are confidential and remote access was authorised only to Melbourne Institute researchers under the specific research project agreement.

[7] Before 1995-96, industry classification was based upon an internal Australian Tax Office categorisation.

[8] Additionally, the use of a balanced panel means tax entities that have ceased operations are excluded, which may possibly introduce self-selection bias into the estimation.

At best, a tax entity may be used to report a specific activity of a firm within a well-defined industry. At worst, a tax entity could be used for tax planning purposes and not represent any particular activity of a firm, thereby yielding no meaningful information as to what makes some firms more profitable than others.

This problem is ameliorated in two ways. Firstly, the profitability measure used here—the price-cost margin—is a much ‘cleaner’ measure than a definition based on income minus expenses. This is because income and expenses are more likely to be used as a method of reducing the company tax burden, rather than reflecting the income and expenses underlying the production process. In contrast, there are fewer opportunities for businesses to misrepresent their sales, inventories and cost of sales, which are required to calculate the profitability measure. As a result, there is a good chance that companies that are used for tax holding purposes will be removed from the data because they are unable to provide information on sales and cost of sales. Secondly, if any ‘undesirables’ are missed in this first round, they are accounted for through the adopted estimation technique. The Wansbeek-Bekker dynamic panel estimator is utilised to analyse this tax return information, and one of its strengths is that it removes any unobserved heterogeniety, leaving only estimates of the ‘true’ effect of market structure on profitability.

3.1. Summary Statistics

Table 1 below reports some 1997 summary statistics for the tax entities included in the regression analysis. The summary statistics vary widely across the sample. For example, the average market share across the entire sample is 0.3 per cent of the industry total. However, there are tax entities that control a large part of their own market, with one entity accounting for nearly 90 per cent of the total. The capital intensity measure shows similar results. The average size of total assets is 57 per cent of total income, but there are some entities that have either very few assets, or their assets are more than 6 times that of their income.

Summary statistics by three-digit ANZSIC industry for the price cost margin and concentration are provided in Appendix Table A1. There is considerable variation in profitability and the market structure variables. Motor vehicle retailers (531) apparently have the smallest margins, averaging only 17.2 per cent, whereas dairy cattle farmers (013) enjoy price cost margins of nearly 90 per cent. Market concentration estimates also vary widely across industries. Exhibiting very low levels are veterinary services (864), which have an average 4-firm concentration ratio of 7.8 per cent, compared to nearly 80 per cent for department stores (521).

Table 1: Summary Statistics for the Regression Sample

Variable (1997)	Entities	Mean	SD	Min	Max
Price Cost Margin (%)	28,951	43.41	22.19	-20.20	99.99
Capital Intensity (%)	28,951	56.90	58.57	0.00	611.86
Market Share (%)	28,951	0.30	2.03	0.00	87.74
Concentration (%)	28,951	29.04	19.13	0.64	99.86
Log Minimum Efficient Scale	28,951	16.98	2.16	12.07	24.19

Note: The minimum values for capital intensity and market share are very small but are not zero. Entities with the lowest 1% of price-cost margin values were excluded from the regression analysis as where entities with the highest 1% of capital intensity values. This was a simple case of not wanting excessive outliers to bias the subsequent results and conclusions.

4. Estimating Profitability in the Structure-Conduct-Performance Framework

To move from Equation (1) to an equation that can be estimated, ϕ is specified as a function of the entity's contemporaneous characteristics x'_{it} with unknown weights $\underline{\beta}$. The vector x_{it} includes concentration, minimum efficient scale and capital intensity. A criticism of this basic specification is that the results may be driven by *unobserved* firm level heterogeneity (Machin and Van Reenen, 1993, Martin, 1993, Mueller and Raunig, 1999). However, use of this data set allows us to condition on such unobserved heterogeneity (Mátyás and Sevestre, 1996), which is labelled α_i. In addition, this paper follows McDonald (1999), in postulating that there will be a significant degree of habit persistence in entities' profit margins. That is, it is expected that current profit margins will be heavily influenced by past realisations of such. Econometrically, this necessitates the additional inclusion of a lagged dependent variable (with unknown weight δ) into the basic specification. Thus the estimated equation is

(2) $$y_{it} = \alpha_i + \delta\, y_{it-1} + \underline{x}'_{it}\,\underline{\beta} + u_{it},$$

where u_{it} are the usual white noise disturbance terms.[9]

The usual method of estimating equation (2), that is, when there is no lagged dependent variable, is biased and inconsistent as $N \to \infty$ and finite T (Nickell, 1981, Sevestre and

[9] Whether to treat the individual effects as "fixed" or "random", (see, for example, Mundlak, 1978a, b and Hsiao, 1985, 1986) is not an issue for the estimation procedure employed in this paper, as an unspecified transformation of the data is employed, such that the individual effects are removed. Indeed, the α_i of equation (2) are essentially 'nuisance' parameters.

Trognon, 1985, and Nerlove, 1967, 1971). The dataset employed in this paper is of these dimensions, with ‘small’ T and ‘large’ N. In the random effects setting this bias arises from a correlation between the lagged dependent variable and the individual effect, and in the fixed effects setting, there is the usual bias resulting from a lagged dependent variable and a short time-series (as is typical in panel datasets). However, many consistent estimators have been proposed (see Harris and Mátyás, 1996, for a useful review). Generally these take the form of Instrumental Variable estimators or, more generally, Generalised Method of Moments estimators. The approach taken in this paper follows that of Harris and Mátyás (2000), which in turn extends that of Wansbeek and Bekker (1996), as this estimation procedures has a robust performance (Harris and Mátyás, 1996, and Harris *et al*, 1996).

The usual way to estimate this model is to apply the Instrumental Variable/ Generalised Method of Moments approach (see, for example, Sevestre and Trognon, 1996). The original Wansbeek-Bekker estimator (which assumes that β = 0) extends the set of instruments proposed by Anderson and Hsiao (1982), for example, by including lags and leads of the dependent variable (and linear combinations of these). That is, by defining the variable y from t = 1 to t = T, this estimator considers linear functions of y_+ as instruments, where y_+ is the stacked vector of observations defined from t = 0 to t = T for each observation. The linear functions are defined by the $(T+1)\times T$ matrix A_i, which yields $A'y_+$ as the full set of instruments (where $A = I_N \otimes A_i$). Restrictions are imposed on A such that the individual effects are eliminated and consistency of the estimator ensured (Wansbeek and Bekker, 1996).[10]

With exogenous variables in the model, two types of such IV estimators can be derived depending on whether the instrument set is extended to similarly include transformations of the exogenous variables, such that

$$Z = \left(A'y_+, X\right) \qquad \text{or} \qquad Z_+ = \left(A'y_+, A'X_+, X\right).$$

To estimate model (2) using instrumental variables the variance-covariance matrix of the vector $Z'u$ or Z'_+u is required (Bowden and Turkington, 1984). However, this matrix is quite complex due to the fact that $E\left(y'_+u\right) \neq 0$. Harris and Mátyás (2000) propose an approximation

[10] This structure of A not only eliminates the individual effects, but also means that the effects of any time invariant variables cannot be identified.

of this true covariance matrix as $\sigma_u^2(Z'Z)$ or $\sigma_u^2(Z_+'Z_+)$, which effectively means that the cross correlation components of this (these) matrix (matrices) are not taken into account. Accordingly, the approximation of these estimators' semi-asymptotic covariance matrices are respectively, $\sigma_u^2\left(\tilde{X}'Z(Z'Z)^{-1}Z'\tilde{X}\right)^{-1}$ and $\sigma_u^2\left(\tilde{X}'Z_+(Z_+'Z_+)^{-1}Z_+'\tilde{X}\right)^{-1}$, both of which are functions of *A*. Thus the optimal choice of *A* is that which minimises the trace of this (these) covariance matrix (matrices).[11] Once *A* has been found using any constrained optimisation routine, *Z* and Z_+ are known and the estimators become simple applications of the instrumental variables technique (Bowden and Turkington, 1984).

In addition to the endogeniety of the lagged dependent variable, the application is further complicated by the fact that both capital intensity and market share are also likely to be endogenous. This endogeniety arises from fact that entity-level variables are likely to be correlated with unobserved firm specific effects. This again justifies use of the Wansbeek-Bekker estimator, as, through the transformation matrix *A*, it will reduce this correlation by elimination of any time-invariant heterogeneity. The approach followed in this paper was to use the expanded instrument set Z_+ variant, but to use only the strictly exogenous elements of X_+ (concentration and minimum efficient scale) and to instrument capital intensity and market share by two period lags of themselves.

5. Results

Regressions were run on a common set of variables for each of 91 three-digit ANZSIC industries that have more than 25 observations (58 per cent of all industries available). For ease of exposition, only the results for each of the significant coefficients are presented in Tables 2 through 6.[12] The full set of significant results are presented in Appendix Table A2. The first column of each table provides the coefficients found on each explanatory variable from the empirical analysis. Where there are a large number of different coefficients, then a range of coefficient values is provided. The second column of each table relates these values to the 3 digit ANZSIC industry codes for which they were significant. The industries associated with each code are provided in Appendix Table A1. As the model is linear the coefficients are interpreted as marginal effects.

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[11] It is also possible to minimise the determinant but the resulting estimator is virtually identical (Harris and Mátyás, 2000).

[12] At the 5 per cent level.

5.1. Lagged price cost margin

The coefficient on the lagged entity price cost margin is positive and significant for 40 per cent of industries and negative and significant for just one industry, Clubs in hospitality (574). Due to the number of industries that have significant coefficients on the lagged price-cost margin, the results are presented in bands in Table 2. Most of the coefficients are grouped between 0.60 and 0.89, indicating that a 1 per cent increase in the price-cost margin last year will result in a 0.60-0.89 per cent increase in the price-cost margin this year. The size of these coefficients implies that the return to equilibrium is monotonic $(\hat{\delta} < 1)$ but "slow" $(\hat{\delta} \to 1)$. Several industries had at least a one-for-one relationship with price-cost-margins last year. If the value of the coefficient exceeds one (or is less than minus one), it implies that profit margins never return to equilibrium. However, this is unlikely to be sustained in the long run, as in practice entities do not exhibit exponential profit growth. In general, there does not seem to be any particular trend of consistent levels of habit persistence across industries.

For more than half the industries in the sample a positive and significant coefficient on the lagged price cost margin was not found. One possible explanation for this finding is the movement of funds between different entities of a firm to minimise the tax bill. Another possibility is that these industries may be very competitive. In the absence of barriers to entry, high profits may lead to an increase in the number of firms (entities) into the industry and the resultant increase in competition will cause profits to fall. Under changing market conditions, profits in the previous year may not be a good indication of profits in the current year. If this were the case, insignificance of the lagged price cost margin and barriers to entry should go hand in hand. However, this is true of only 56 per cent of the industries, providing only limited support for this theory.

Table 2: Coefficients on Lagged Price Cost Margin

Coefficient	3-digit ANZSIC code
-1.34	574
0.49	294
0.50 – 0.59	217, 241, 451
0.60 – 0.69	218, 276, 283, 453, 531, 573, 862, 912, 951
0.70 – 0.79	273, 479, 931
0.80 – 0.89	255, 263, 275, 462, 512, 524, 526, 783
0.90 – 0.99	281, 525
1.00 – 1.09	13, 261, 286, 571
1.10 & above	12, 141, 521, 786, 863

5.2. *Capital intensity*

Table 3 shows that capital intensity has a significant positive effect on the price cost margin for only 12 per cent of industries. The observation that very few industries are positive and significant should not necessarily be taken as an indication that capital intensity is an ineffective barrier to entry for the majority of tax entities. The minimum efficient scale measure (discussed below) is perhaps a better indicator of capital barriers to entry, as the primary function of capital intensity is to serve as a control variable for the price cost margin.

Table 3: Coefficients on Capital Intensity

Coefficient	3-digit ANZSIC code
0.02	Printing and services to printing (241)
0.05	Building construction (411)
0.06	Building completion services (424)
0.06	Furniture, houseware & appliance retailing (523)
0.06	Technical services (782)
0.08	Other crop growing (16)
0.08	Site preparation services (421)
0.09	Machinery & equipment wholesaling (461)
0.10	Basic chemical manufacturing (253)
0.11	Dairy product manufacturing (212)
0.16	Food, drink & tobacco wholesaling (471)

5.3. *Market share*

Previous analysis (Feeny, 2000) has indicated evidence of a U-shaped relationship between market share and profitability. That is, market share is significantly negative (a result also found by McDonald (1999) on a different data set), but the square of market share is significantly positive. As Bennenbroek and Harris (1995) point out, such a relationship is implied by U-shaped average variable costs. Using these results, it is possible to determine a “threshold” level of market share, above which profitability increases with market share and below which it decreases.

These implied threshold values are reported in Table 4. Only 18 per cent of industries have significant coefficients on the market share variables. All of the industries that have a threshold level above the average (13 per cent) are engaged in manufacturing, with the exception of computer services (783). For basic chemical manufacturing (253), nearly 40 per cent of the market is required to be captured by an entity before any profits can be made from sheer market dominance. In comparison, building completion services (424) and clubs hospitality (574), require very minimal market share before reaping the rewards in terms of higher profitability. Unfortunately, it does not appear possible to empirically test whether the positive association between market share and profitability in these industries is due to greater efficiency or greater market power.

Table 4: Market Share Threshold Levels

Coefficient	3-digit ANZSIC code
0.016	Clubs (hospitality) (574)
0.018	Building completion services (424)
0.038	Installation trade services (423)
0.044	Dairy product manufacturing (212)
0.054	Accommodation (571)
0.076	Food, drink & tobacco wholesaling (471)
0.076	Motor vehicle retailing (531)
0.090	Household good retailing (473)
0.092	Electronic equipment manufacturing (284)
0.132	Computer services (783)
0.230	Ceramic product manufacturing (262)
0.262	Electrical equipment & appliance manufacturing (285)
0.320	Textile product manufacturing (222)
0.386	Basic chemical manufacturing (253)

5.4. Concentration

Preliminary analysis that included a concentration variable indicated that concentration was negatively related to profitability for around one-third of industries, running counter to the theoretical arguments presented earlier. Previous empirical work (on cross section data) has suggested that the expected positive relationship between profitability and concentration does *not* appear in the 'line of business' regression with market share included (Gale and Branch, 1982; Ravenscraft, 1983; Shepherd, 1972). Feeny (2000) also found evidence of a negative relationship between concentration and profitability for some industries, a result that held regardless of whether or not market share was included.

Table 5: Concentration Threshold Levels

Coefficient	3-digit ANZSIC code
0.304	Cafes & restaurants (573)
0.337	Printing and services to printing (241)
0.404	Other crop growing (16)
0.430	Motor vehicle retailing (531)
0.452	Electronic equipment manufacturing (284)
0.466	Machinery & equipment wholesaling (461)
0.536	Dairy product manufacturing (212)
0.680	Building completion services (424)
0.719	Photographic & scientific equipment manufacturing (283)
0.719	Supermarket & grocery stores (511)

Collusion between entities is more likely to occur when seller concentration is high. This implies that the concentration–profit link is discontinuous, with the expected relationship occurring above a threshold level. Studies of US data have found a critical level of four firm concentration to be between 46 and 60 per cent, and that there is little evidence that increases in seller concentration to levels below 50 have any effect on profitability (Scherer and Ross, 1990). To investigate this possibility, a 'square of concentration' variable is included in the estimation to identify concentration threshold levels. Table 5 shows that only 11 of the 91 industries have what could be classified as a U-shaped relationship between concentration and profitability, covering a range of industries. The critical bounds appear to be wider than that found for the US, ranging from around 30 per cent for cafes and restaurants (573) to around 70 per cent for photographic and scientific equipment manufacturing (283) and supermarket and grocery stores (511).

5.5. *Minimum efficient scale*

Minimum efficient scale coefficients are presented in Table 6 and show that this variable has a positive and significant effect on the price cost margin for 38 per cent of industries. The magnitude of the coefficients indicates that a relatively small amount of capital is required to ensure a positive relationship with profitability. These estimates are in direct contrast to Feeny (2000), where it was found that only 19 per cent of industries had a significant coefficient on minimum efficient scale, and, of those, most were negative. However, less than 30 per cent of industries that exhibit a positive association between barriers to entry and profitability also have a positive and significant coefficient on the lagged price cost margin. This might indicate that barriers to entry are not effective at preventing new firms from entering an industry and bidding down profits.

Table 6: Coefficients on the Minimum Efficient Scale

Coefficient	3-digit ANZSIC code
-0.03	12
0.01	222, 241, 276, 284, 294, 451, 453, 471, 511
0.02	218, 226, 253, 256, 282, 283, 285, 421, 422, 473, 523, 862
0.03	254, 292, 423, 461
0.04	212, 412, 472, 611, 785
0.05	13, 424
0.07	574
0.08	425

5.6. Summary

Appendix Table A2 shows that the structure-conduct-performance framework has a significant relationship with the price-cost margin for certain industries, and is indicated by the significant coefficients on the explanatory variables. These include dairy product manufacturing, printing and services to printing, basic chemical manufacturing, photographic and scientific equipment manufacturing, electronic equipment manufacturing, site preparation services, installation trade services, building completion services, machinery and equipment wholesaling, food, drink and tobacco wholesaling, motor vehicle retailing and clubs (hospitality). In contrast, the structure-conduct-performance framework does a poor job in explaining the price-cost margin in the service industries, particularly finance, health, community, cultural, recreational, personal and other. This could indicate that the firms in these industries are too heterogenous for the structure-conduct-performance framework to be of much use, justifying the decision to estimate the regression on an industry-by-industry basis.

6. Conclusion

This paper indicates that market structure variables are important determinants of the price cost margin for just over half of the industries analysed. Although all of the independent variables were significant for only 2 of the 91 industries, this is not a particular cause for concern as it was indeed these very differences that prompted an estimation technique that used a 3-digit ANZSIC classification. Indeed, the difference in parameter estimates across industries questions the validity of results of previous studies that restricted them to be equal and explained industry differences by “shift” (or industry dummy) variables.

Scale economies appear to be important for most entities. The observation that few of these entities also have a positive and significant coefficient on the lagged price cost margin however, indicates that barriers to entry are not effective at preventing new firms from entering industries and bidding down profits. Making a profit in the previous year also boosts the chances of making one in the current year for a large number of industries. Capital intensity, market share and concentration on the other hand, affected the profitability of only a select group of industries.

A policy debate that has arisen in the structure-conduct-performance literature is the extent to which a positive profits-concentration or profits-market share relationship reflects efficient production that requires large-scale operations, or collusion among firms within the industry. In effect, concentration measures market power at the industry level, whereas market share measures market power for an individual firm. Preliminary estimates suggested that both concentration and market share should be included as quadratics, possibly because the average cost curve for individual firms and particular industries are U-shaped. Inclusion of the quadratic term for concentration indicated that—for 11 industries at least—there is a minimum level of concentration required before there is any positive association between concentration and profits. Similarly, only 16 industries experience market share levels above which profitability increases with market share. Although the nature of the data limits the ability to disentangle efficiency effects from collusion, the results suggest that policymakers would need to examine these industries on their merits to determine whether or not concentration—or a large market share—is a good thing.

Firm level heterogeneity has been found to be important in a range of structure-conduct-performance studies (Machin and Van Reenen, 1993, Martin, 1993, Mueller and Raunig, 1999, Ravenscraft, 1983, Shepherd, 1972). The availability of panel data on Australian firms allowed for the control of unobserved individual entity heterogeneity. As a result, it was found that the effectiveness of the structure-conduct-performance framework is a useful tool in helping explain price-cost margins for particular industries, but in other cases the entities are too heterogeneous, thus offsetting any information that may be provided by the structure-conduct-performance framework. It is also evident that the strongest driving forces of price-cost margins are previous realisations of the price-cost margin and the minimum efficient scale.

Appendix: Summary Statistics and Estimation Results

Appendix Table A1: Summary Statistics by 3-Digit ANZSIC

3-Digit ANZSIC Industry	Entities	Price Cost Margin (average)	Concentration
Agriculture			
Horticulture & Fruit Growing (011)	158	61.3	23.8
Grain, Sheep & Beef Cattle Farming (012)	305	81.8	25.5
Dairy Cattle Farming (013)	63	88.2	23.5
Other Crop Growing (016)	25	64.6	37.2
Services to Agriculture (021)	139	36.1	27.2
Mining			
Construction Material Mining (141)	45	60.2	44.8
Manufacturing			
Meat & Meat Product Manufacturing (211)	78	34.5	46.5
Dairy Product Manufacturing (212)	41	35.9	53.1
Other Food Manufacturing (217)	179	42.5	48.3
Beverage & Malt Manufacturing (218)	68	48.4	56.1
Textile Fibre, Yarn & Woven Fabric Manufacturing (221)	38	46.9	47.7
Textile Product Manufacturing (222)	186	48.1	34.5
Clothing Manufacturing (224)	324	47.4	19.1
Footwear Manufacturing (225)	49	46.5	34.0
Leather & Leather Product Manufacturing (226)	53	43.3	42.7
Log Sawmilling & Timber Dressing (231)	119	48.1	38.9
Other Wood Product Manufacturing (232)	212	48.6	35.3
Paper & Paper Product Manufacturing (233)	62	44.8	59.3
Printing & Services to Printing (241)	732	58.4	18.8
Publishing (242)	88	61.3	37.2
Basic Chemical Manufacturing (253)	68	49.7	49.5
Other Chemical Product Manufacturing (254)	229	47.8	46.3
Rubber Product Manufacturing (255)	84	42.8	41.8
Plastic Product Manufacturing (256)	272	50.4	31.1
Glass & Glass Product Manufacturing (261)	86	53.4	59.7
Ceramic Product Manufacturing (262)	57	54.8	58.3
Cement, Lime, Plaster & Concrete Product Manufacturing (263)	144	48.4	57.6
Non-Metallic Mineral Product Manufacturing n.e.c. (264)	30	48.0	61.5
Iron & Steel Manufacturing (271)	142	48.5	57.5
Non-Ferrous Basic Metal Product Manufacturing (273)	40	47.0	59.7
Structural Metal Product Manufacturing (274)	199	43.5	37.9
Sheet Metal Product Manufacturing (275)	179	51.6	26.9
Fabricated Metal Product Manufacturing (276)	463	53.6	37.1
Motor Vehicle & Part Manufacturing (281)	377	40.1	40.0
Other Transport Equipment Manufacturing (282)	92	44.7	51.0
Photographic & Scientific Equipment Manufacturing (283)	178	57.5	35.7
Electronic Equipment Manufacturing (284)	119	47.0	41.7
Electrical Equipment & Appliance Manufacturing (285)	323	45.8	34.0
Industrial Machinery & Equipment Manufacturing (286)	497	46.8	34.9
Prefabricated Building Manufacturing (291)	95	47.7	34.9
Furniture Manufacturing (292)	507	48.0	16.3
Other Manufacturing (294)	827	49.0	27.5
Construction			
Building Construction (411)	312	38.2	16.4
Non-Building Construction (412)	101	44.0	34.0
Site Preparation Services (421)	46	59.6	14.5
Building Structure Services (422)	98	45.4	21.3

3-Digit ANZSIC Industry	Entities	Price Cost Margin (average)	Concentration
Installation Trade Services (423)	1,101	50.9	17.0
Building Completion Services (424)	402	51.6	16.4
Other Construction Services (425)	158	47.7	30.2
Wholesale Trade			
Farm Produce Wholesaling (451)	261	32.7	24.9
Mineral, Metal & Chemical Wholesaling (452)	304	30.1	44.6
Builders supplies Wholesaling (453)	569	33.6	25.7
Machinery & Equipment Wholesaling (461)	1,076	34.9	27.4
Motor Vehicle Wholesaling (462)	611	31.9	25.7
Food, Drink & Tobacco Wholesaling (471)	507	22.9	37.0
Textile, Clothing & Footwear Wholesaling (472)	291	35.6	30.0
Household Good Wholesaling (473)	208	35.5	29.6
Other Wholesaling (479)	1,346	33.5	33.3
Retail Trade			
Supermarket & Grocery Stores (511)	265	20.5	69.3
Specialised Food Retailing (512)	951	36.9	28.5
Department Stores (521)	85	24.8	79.4
Clothing & Soft Good Retailing (522)	783	39.8	31.0
Furniture, Houseware, & Appliance Retailing (523)	1,265	32.4	30.2
Recreational Good Retailing (524)	903	32.1	19.7
Other Personal & Household Good Retailing (525)	2,141	38.5	33.3
Household Equipment Repair Services (526)	191	62.7	26.6
Motor Vehicle Retailing (531)	709	17.2	11.9
Motor Vehicle Services (532)	2,364	39.8	12.9
Accommodation, Cafes & Restaurants			
Accommodation (571)	228	66.0	16.1
Pubs, Taverns & Bars (572)	404	48.4	15.0
Cafes & Restaurants (573)	607	59.2	29.3
Clubs (Hospitality) (574)	175	56.1	10.2
Transport & Storage			
Road Freight Transport (611)	38	55.9	33.0
Other Services to Transport (664)	43	38.7	28.2
Finance & Insurance			
Financial Asset Investors (734)	45	28.4	19.5
Property & Business Services			
Property Operators & Developers (771)	39	44.0	17.8
Machinery & Equipment Hiring & Leasing (774)	39	60.2	32.1
Technical Services (782)	466	53.3	20.5
Computer Services (783)	172	45.6	23.7
Marketing & Business Management Services (785)	189	55.8	16.9
Other Business Services (786)	213	54.2	36.4
Health & Community Services			
Medical & Dental Services (862)	36	71.9	8.5
Other Health Services (863)	205	61.9	33.4
Veterinary Services (864)	46	68.1	7.8
Cultural & Recreational Services			
Film & Video Services (911)	65	63.5	38.6
Radio & Television Services (912)	33	65.1	35.1
Sport (931)	147	60.7	19.1
Other Recreation Services (933)	39	65.4	26.0
Personal & Other Services			
Personal & Household Goods Hiring (951)	76	63.4	22.3
Other Personal Services (952)	524	70.1	27.5
Interest Groups (962)	102	46.0	20.8

Appendix Table A2: Estimation Results by 3-Digit ANZSIC (significant coefficients reported)

	Lagged price-cost margin	Capital intensity	Market share	Market share^2	Concentration	Concentration^2	Minimum efficient scale
Agriculture							
11	-	-	-	-	-	-	-
12	1.53	-	-	-	-	-	-0.03
	(6.12)	-	-	-	-	-	(1.95)
13	1.05	-	-	-	-	-	0.05
	(5.03)	-	-	-	-	-	(1.96)
16	-	0.08	-	-	3.33	-4.12	-
	-	(1.95)	-	-	(3.34)	(3.53)	-
21	-	-	-	-	-0.49	-	-
	-	-	-	-	(1.97)	-	-
Mining							
141	1.15	-	-	-	-	-	-
	(2.34)	-	-	-	-	-	-
Manufacturing							
211	-	-	-	-	-	-	-
212	-	0.11	-10.50	119.13	-1.92	1.79	0.04
	-	(2.01)	(2.44)	(2.39)	(2.71)	(2.93)	(3.02)
217	0.57	-	-	-	-	-	-
	(2.09)	-	-	-	-	-	-
218	0.67	-	-	-	-	-	0.02
	(3.39)	-	-	-	-	-	(2.00)
221	-	-	-	-2.73	-	-	-
	-	-	-	(2.49)	-	-	-
222	-	-	-1.70	2.66	-	-	0.01
	-	-	(2.20)	(2.40)	-	-	(2.49)
224	-	-	-	-	-	-	-
225	-	-	-	-	-	-	-
226	-	-	-11.93	-	-	-	0.02
	-	-	(2.06)	-	-	-	(1.92)
231	-	-	-	-	-	-	-
232	-	-	-	-	-	-	-
233	-	-	-	-	-	-	-
241	0.57	0.02	-	-	0.33	-0.49	0.01
	(4.81)	(2.05)	-	-	(2.25)	(2.10)	(3.25)
242	-	-	-	-	-	-	-
253	-	0.10	-2.70	3.50	-	-	0.02
	-	(2.71)	(3.67)	(3.73)	-	-	(3.17)
254	-	-	-	-	-	-	0.03
	-	-	-	-	-	-	(4.75)
255	0.84	-	-	-	-	-	-
	(5.40)	-	-	-	-	-	-
256	-	-	-	-	-	-	0.02
	-	-	-	-	-	-	(3.18)
261	1.07	-	-	-	-	-	-
	(2.53)	-	-	-	-	-	-
262	-	-	-1.86	4.04	-	-	-
	-	-	(1.97)	(2.16)	-	-	-
263	0.80	-	-	-	-	-	-
	(4.63)	-	-	-	-	-	-

	Lagged price-cost margin	Capital intensity	Market share	Market share^2	Concentration	Concentration^2	Minimum efficient scale
264	-	-	-	-	-	-	-
271	-	-	-	-	-	-	-
273	0.70	-	-	-	0.69	-	-
	(3.57)	-	-	-	(1.99)	-	-
274	-	-	-	-	-	-	-
275	0.89	-	-	-	-	-	-
	(6.82)	-	-	-	-	-	-
276	0.63	-	-	-	-	-	0.01
	(3.38)	-	-	-	-	-	(2.26)
281	0.92	-	-	-	-	-	-
	(3.33)	-	-	-	-	-	-
282	-	-	-	-	-	-	0.02
	-	-	-	-	-	-	(3.47)
283	0.68	-	-	-	-0.46	0.32	0.02
	(5.17)	-	-	-	(2.30)	(2.00)	(2.59)
284	-	-	-14.58	79.50	1.59	-1.76	0.01
	-	-	(3.99)	(3.61)	(5.37)	(5.16)	(2.65)
285	-	-	-1.41	2.69	-	-	0.02
	-	-	(2.43)	(2.35)	-	-	(3.36)
286	1.05	-	-	-	-	-	-
	(4.90)	-	-	-	-	-	-
291	-	-	-	-	-	-	-
292	-	-	-	-	-	-	0.03
	-	-	-	-	-	-	(1.94)
294	0.49	-	-3.18	-	-	-	0.01
	(5.99)	-	(2.19)	-	-	-	(5.61)
Construction							
411	-	0.05	-	-	-	-	-
	-	(3.21)	-	-	-	-	-
412	-	-	-	-	-	-	0.04
	-	-	-	-	-	-	(2.49)
421	-	0.08	-36.11	-	2.50	-	0.02
	-	(3.61)	(1.93)	-	(1.95)	-	(1.99)
422	-	-	-	-	-	-	0.02
	-	-	-	-	-	-	(1.98)
423	-	-	-18.44	241.75	-0.30	-	0.03
	-	-	(2.25)	(2.05)	(2.39)	-	(2.81)
424	-	0.06	-28.00	789.85	-1.70	1.25	0.05
	-	(3.29)	(4.33)	(3.16)	(5.24)	(4.49)	(5.61)
425	-	-	-	-	-	-	0.08
	-	-	-	-	-	-	(1.93)
Wholesale trade							
451	0.51	-	-	-	-	-	0.01
	(1.95)	-	-	-	-	-	(1.92)
452	-	-	-	-	-	-	-
453	0.60	-	-	125.39	-	-	0.01
	(3.08)	-	-	(2.08)	-	-	(2.18)
461	-	0.09	-	-	-0.96	1.03	0.03
	-	(3.22)	-	-	(4.16)	(3.70)	(5.19)
462	0.89	-	-	-	-	-	-
	(7.70)	-	-	-	-	-	-

	Lagged price-cost margin	Capital intensity	Market share	Market share^2	Concentration	Concentration^2	Minimum efficient scale
471	-	0.16	-4.26	28.18	-	-	0.01
	-	(3.70)	(3.41)	(3.05)	-	-	(4.24)
472	-	-	-	-	-	-	0.04
	-	-	-	-	-	-	(3.02)
473	-	-	-1.95	10.86	-	-	0.02
	-	-	(1.91)	(2.65)	-	-	(2.65)
479	0.77	-	-	-	-	-	-
	(2.96)	-	-	-	-	-	-
Retail trade	-						
511	-	-	-	-	-0.46	0.32	0.01
	-	-	-	-	(2.26)	(2.17)	(2.38)
512	0.83	-	-	-	-	-	-
	(2.35)	-	-	-	-	-	-
521	1.65	-	-	-	-	-	-
	(2.40)	-	-	-	-	-	-
522	-	-	-	-	-	-	-
523	-	0.06	-	-	-0.39	-	0.02
	-	(2.74)	-	-	(2.34)	-	(5.70)
524	0.84	-	-	-	-	-	-
	(4.01)	-	-	-	-	-	-
525	0.95	-	-	-	-	-	-
	(3.14)	-	-	-	-	-	-
526	0.87	-	-	-	-	-	-
	(2.34)	-	-	-	-	-	-
531	0.65	-	-2.99	19.60	0.37	-0.43	-
	(2.69)	-	(2.11)	(2.13)	(2.07)	(2.08)	-
532	-	-	-	-	-	-	-
Accommodation, cafes and restaurants							
571	1.03	-	-3.10	28.45	-	-	-
	(4.82)	-	(2.21)	(2.05)	-	-	-
572	-	-	-	-	-	-	-
573	0.67	-	-	-	0.28	-0.46	-
	(3.29)	-	-	-	(3.55)	(3.57)	-
574	-1.34	-	64.96	-2016.42	-	-	0.07
	(3.26)	-	(4.03)	(3.49)	-	-	(5.25)
Transport and storage							
611	-	-	-	-	-	-	0.04
	-	-	-	-	-	-	(2.14)
664	-	-	-	-	-	-	-
Finance and insurance							
734	-	-	-	-	-	-	-
Property and business services							
771	-	-	-	-	-	-	-
774	-	-	-23.49	-	1.34	-	-
	-	-	(2.46)	-	(1.92)	-	-
782	-	0.06	-	-	-	-0.35	-
	-	(2.72)	-	-	-	(2.22)	-
783	0.82	-	-3.19	12.04	-	-	-
	(5.45)	-	(2.08)	(2.21)	-	-	-
785	-	-	-	-	-	-	0.04
	-	-	-	-	-	-	(2.27)

	Lagged price-cost margin	Capital intensity	Market share	Market share^2	Concentration	Concentration^2	Minimum efficient scale
786	1.42	-	-	-	-	-	-
	(5.67)	-	-	-	-	-	-
Health and community services							
862	0.65	-	-	-	-	-	0.02
	(3.94)	-	-	-	-	-	(1.95)
863	1.25	-	-	-	-	-	-
	(2.07)	-	-	-	-	-	-
864	-	-	-	-	-	-	-
Cultural and recreational services							
911	-	-	-	-	-	-	-
912	0.67	-	-	-	-	-	-
	(2.05)	-	-	-	-	-	-
931	0.72	-	-	-	-	-	-
	(3.27)	-	-	-	-	-	-
933	-	-	-	-	-	-	-
Personal and other services							
951	0.68	-	-	-	-	-	-
	(2.24)	-	-	-	-	-	-
952	-	-	-	-	-	-	-
962	-	-	-	-	-	-	-

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