Market Share, Concentration and Diversification in Firm Profitability *

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Abstract

This paper provides a review of the role of market share, concentration and diversification in firm performance. An empirical analysis of the profitability of 722 large Australian firms for the period 1993 to 1996 is also undertaken. Using simple regression techniques the analysis suggests that industry concentration (as proxied by the 4-firm concentration ratio) has a positive influence on profitability. The market share of a firm does not appear to have any significant linear association with profitability, however, a non-monotonic relationship is found to be significant. This suggests that as market share increases to around 30% (of a 3-digit ANZSIC industry) profitability *declines*. When market share increases above 30% profitability rises, although only 9 firms in our sample have market shares above 30%. The extent of diversification appears to have little influence on profitability although, when loss making firms are excluded from the analysis, more focused firms do appear to have higher profitability.

Key words: market share, concentration, diversification, firm profitability

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1. Introduction

This paper provides an exploratory analysis of the effect of market share, concentration and diversification on the profitability of large Australian firms. The theoretical background of the relationship between these variables and firm profitability is discussed, together with a review of previous empirical findings. Basic regression analysis is applied to a panel of 722 large Australian firms to investigate the relationship between market share, concentration and diversification with profitability.

The empirical economic literature on firm performance has focused heavily on the role of industry concentration and market share. The potential influence of these two variables on firm performance arises directly from the economic theory of the firm and the Structure Conduct Performance (SCP) paradigm. The paradigm suggests that the performance of a firm depends upon its conduct which, in turn, depends upon the market in which it operates. Section 2 discusses the theoretical background to the concentration-profitability relationship before discussing the empirical evidence for Australia. Evidence from single-equation, simultaneous-equation and time-series studies are discussed which show a lack of conclusive evidence to support a positive concentration-profitability relationship for Australia.

Section 3 provides a discussion of the theoretical background to the market share-profitability relationship. Research from the 1970s suggest that a positive market share-profitability underlies the positive concentration-profitability relationship found empirically. The theoretical background to market share distinguishes dynamic factors from static factors. Dynamic factors are factors which lead to improved firm efficiency and thus higher market share. Static factors are factors which reinforce efficiency advantages once a large market share has been achieved. The empirical evidence on market share and profitability is also presented in this section. Generally a positive relationship is found, although this is not the case for the one Australian study investigating this issue.

An issue in empirical work on firm performance is that most large firms do not operate in a single, well defined market as the basic theory assumes. This naturally leads us to consider the issue of diversification and, in particular, how the level of diversification may influence firm performance. This is the subject of section 4 which reviews both the theoretical issues

and empirical evidence on diversification and firm performance. The theory focuses on the role of transaction costs in firm diversification but also discusses the roles of efficiency and risk. The empirical evidence is also discussed which provides no solid conclusions on the effect of diversification on firm profitability.

Section 5 of the paper contains a discussion of the data (a panel of 722 large Australian firms for 1993 to 1996) and some bivariate analysis. Section 6 contains some preliminary multivariate analysis. Section 7 concludes.

2. Concentration and profitability

The structure-conduct-performance (SCP) paradigm suggests that greater market concentration leads to a greater degree of collusion which, in turn, leads to a higher level of industry profits. Up to the 1970's there was general agreement that concentration and profits were positively related. However, during the 1970's new interpretations of the evidence started to emerge which argued that it is a firm's market share rather than industry concentration which leads to higher rates of return. The remainder of this section is structured as follows. Initially, we overview the theoretical background of why higher concentration may lead to higher rates of return. A review of empirical evidence of the concentration-performance link is then presented.

Theoretical background

In the basic model of oligopoly the profitability of a firm *i* is given by

$$\frac{(P - MC_i)}{P} = \frac{s_i}{e}\left[1 + \frac{dQ_i}{dq_i}\right] \qquad [1]$$

where *P* is price, *MC* is marginal cost, *e* is the market elasticity of demand, s_i is firm *i*'s market share, q_i is firm *i*'s output, and Q_i is industry output excluding firm *i*'s production. This equation is derived from assuming the firm maximises profit (see Scherer and Ross, 1990, p.227, for a full discussion). The derivative dQ_i / dq_i is called a firm's *conjectural variation* (i.e. the output reactions of its rivals to the firm's own output change). In the Cournot model, the effect of a change in output by one firm on industry output is assumed to

be one for one, since other firms output is unchanged (hence $dQ_i / dq_i = 1$). This means a firm's profits is related to its market share and the elasticity of demand. Aggregating this relationship to the industry level (i.e. form the weighted (by s_i) sum of all firms' profits) yields,

$$\frac{(P - \overline{MC})}{P} = \frac{H}{e} \quad , \qquad [2]$$

where $\overline{MC}$ is the weighted average of the sellers' marginal costs, and H is the Herfindahl-Hirschman concentration index ($\sum s_i^2$). This equation can provide justification for the hypothesis that high concentration leads to greater monopoly power and thus higher profits.

If the conjectural variation term is negative, then the firm expects its rivals to at least partially offset changes in its output. If $dQ_i / dq_i = -1$ the right hand side of equation [1] is zero and price falls to marginal cost, the competitive equilibrium. In the other extreme, if all of a firm's output changes are matched by other firms, the situation could be viewed as one of complete collusion. Complete collusion suggests that $dQ_i / dq_i = Q_i / q_i$ (in words, when firm *i* increases its output all other firms increase their output by an amount proportional to initial market shares). Given complete collusion, the term $1+Q_i/q_i$ can be re-written as $1/s_i$, hence the price-cost margin reduces to $1/e$, the monopoly situation. These two extremes – perfect competition (no collusion) and monopoly (complete collusion) – indicate that the level of collusion can also affect profitability. In general, economists tend to assume that higher levels of concentration imply higher collusion. This provides a rationale for including concentration in a firm-level empirical specification.

The word 'collusion' does not necessarily imply that firms have explicitly entered into any agreement to maintain high profits. Instead, the industries equilibrium may have developed over time into an apparently collusive situation. Game theoretical approaches to industrial organisation suggest that the equilibrium reached in repeated games may appear to be collusive even though no 'conversation' has occurred.[1] Basu (1993, Chapter 12) provides a

[1] Basu (1993, p.151) states, "Most of the repeated-game models show how collusive outcomes can occur under subgame perfection or sequential equilibrium, that is, these outcomes occur without the need for "conversation"

summary of these issues and notes that the equilibrium reached depends on such factors as the discount rate and the ability of firms to monitor other firm's actions.

An additional complicating factor is that the models discussed above ignore the role of barriers to entry in an industry. Hay and Morris (1990, p.224) state "even if concentration is a necessary condition for higher profitability, it is probably not sufficient. If there are few or no barriers to entry, then we would expect supernormal profits to be competed away by new entrants". The influence of barriers to entry are difficult to empirically capture both because there are a wide variety of possible barriers and also since, ultimately, the barrier is unobserved (i.e. the size of the barrier is related to the expectation a potential entrant has about the post-entry equilibrium in the market, see Geroski, 1991, Chapter 5, for a discussion of this issue).

Empirical evidence

The belief that higher industry concentration leads to greater profitability is supported by a large quantity of early empirical evidence which found the relationship to be weak but statistically significant.[2] However, evidence from Australian studies indicates the relationship is much weaker than found in the bulk of the literature. Australian studies testing the profit-concentration relationship are rather sparse in comparison to other countries and focus on the manufacturing sector due to the availability of data. Tucker (1977) carried out the only Australian study of non-manufacturing data. He found that for Australian retailing the relationship between concentration and the price-cost margin was negative and insignificant. Generally, Australian studies have been single-equation studies based on cross-sectional data. There have been a few simultaneous equation studies but to our knowledge, there has been only one time series study of profitability using Australian data (McDonald, 1999). The three types of study are discussed in turn. A more detailed discussion of the previous Australian literature can be found in Bhattacharya and Bloch, 1995.

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or, for that matter, without "smoking-gun evidence" of cartel-like behaviour. As the idea of perfection suggests, such collusive outcomes occur through each firm acting in its self-interest".

[2] See Weiss (1974) and Vernon (1972) for reviews of previous studies.

Single-equation studies

A positive concentration-profitability relationship for Australia has been found in two studies by Round (1978, 1980a) Round (1978) included foreign competition variables in a study of industry performance. In a study using industry price cost margins and variables at a 3 digit ASIC level of aggregation he found concentration to be positively and significantly associated with profitability. He also found that a high proportion of the explanatory power from his model is from the foreign competition variables. Round (1980a) found the concentration-profitability relationship to be positive at a three and four digit level of aggregation (although at the four digit level the relationship weakens and becomes statistically insignificant). In another study, Round (1983), it was found that concentration is progressively - though weakly – associated with the average profit margins of 147 four-digit manufacturing industries.

Other studies have found the relationship to be sensitive to specification of the dependent variable. Round (1976a), in an industry level study, tested the relationship for Australian manufacturing industries at the ASIC 3 digit level for the period 1968/9 – 1972/73. He found sales based measures of profitability to be consistently, positively and significantly linked with concentration, although the relationship weakened when the capital intensity of industries was taken into account. For capital based measures of profitability, Round found negative relationships between profitability and concentration and thus remained uncommitted as to whether a unique, one-directional relationship existed between concentration and profitability in Australian manufacturing. Phillips (1978) highlights the sensitivity of the concentration-profitability relationship to the measure of the dependent variable used. Phillips used a sample of 99 ASIC 4 digit manufacturing industries for 1968 to 1969. A positive and significant concentration-profitability relationship was found for the sales based measure of profitability, while the profits to funds employed showed an inverse relationship with concentration.

Further studies also fail to find conclusive proof of a positive concentration-profitability relationship for Australian industries. Round (1976b) applied multiple regression analysis, again using ASIC 3-digit data to identify relationships between industry price cost margins and profitability. He found that most of his explanatory variables had similar effects on industry margins as those found by other overseas studies. However, the effect of

concentration on industry margins could not be determined due to the problem of multicollinearity. Parry (1978) used 4 digit ASIC data for Australian manufacturing industries over the period 1972 to 1973 for a monograph. Price cost margins were used as the dependent variable and even though a positive profit-concentration relationship is found, the coefficient on concentration was not significant.

Simultaneous-equation studies

Round (1980b) was one of the first to use a simultaneous equation approach to explain industry performance. He used variables at the four digit level for manufacturing 1968/9 – 1972/3 and found a high tariff may reduce profits by causing inefficiency but also that concentration was insignificant in determining industry profitability.

Dixon (1987) examined simultaneity among concentration, margins and advertising using 3SLS estimation. His sample contained 12 domestic consumer goods industries. Dixon found that the coefficient of the adjusted concentration ratio to be insignificant and negative in the profit equation.

In contrast, Ratnayake (1990) found results to support a positive concentration-profitability association for Australian industries for 1984/85. In his doctoral thesis, he used a 2SLS simultaneous equation model with trade and structure, conduct performance measures variables at a four digit level of aggregation.

Time series studies

Only one time-series study has been carried out using Australian data. McDonald (1999) used the IBIS firm level dataset over the period 1984-93 to estimate dynamic profitability models over the business cycle. He found that industry concentration is positively related to firm profit margins. Further, profit margins were found to be pro-cyclical in concentrated industries but counter-cyclical in less concentrated industries.

The lack of conclusive evidence to support the positive concentration-profitability relationship for Australia, in comparison to other overseas countries, could be due to a number of reasons. First, testing the concentration–profitability relationship is complex and subject to a wide range of statistical pitfalls (see Phillips 1974, Bhattacharya and Bloch

1997). Different model specifications and the inclusion of different sets of explanatory variables can produce very different results. A second reason may simply be that Australian firms and industries have different characteristics, such as protection from overseas competition by high tariffs, high transport costs and relatively high concentration in the manufacturing sector. The previous studies have used data from the 1960's and 1970's. The 1980's and 1990's have seen significant changes to the Australian economy, most notably the lowering of tariff barriers and the opening up of the economy to greater competition. This issue, and the small number of existing Australian studies, suggest it is worthwhile re-visiting the concentration-profitability issue. Of course, an alternative explanation for the lack of evidence in Australia for a positive concentration–profitability relationship may be that such a relationship does not exist. Indeed, some evidence since the 1970s suggests that it is market share, not concentration, which leads to higher rates of return. It is this issue which we now address.

3. Market share and profitability

The potential role of market share in determining profitability is discussed by Brozen (1971) and Demsetz (1973). They, and other economists, suggest that a positive relationship between profits and market share at a firm level will imply a positive profit-concentration relationship at the industry level, even if high concentration does not lead to collusion and therefore does not effect conduct. Scherer and Ross (1990) explain this result as follows: (1) highly concentrated industries have high profits due to individual firms having high market shares, and (2) large firm profits are assigned greater weight in calculating industry profitability.

Theoretical background

Given that a positive market share-profitability relationship will lead to a positive concentration-profitability relationship, possibly without any collusion, we need to investigate how market share and profit are linked. One argument is that a firm obtains a larger market shares due to efficiency advantages. There have been a variety of reasons suggested for why firms with large market shares may be more efficient. For our purposes it is useful to distinguish between dynamic factors (which lead to better efficiency and, via this, higher market share) and static factors (which *reinforce* efficiency advantages once a large market share has been achieved).

Dynamic efficiency advantages may arise from some characteristics of the firm, such as research and development (R&D) intensity, management quality, and a skilled labour force. For example, R&D focused on process technology may lead to lower cost techniques and allow firms to increase their market share by producing a given quantity at a lower cost than its rivals. Another source of efficiency may derive from a firm's ability to learn from experience. In particular, some firms have greater experience in certain types of production and/or have a greater ability to learn (Malerba, 1992).

If a firm achieves a large market share (and implicitly a large - relatively to industry - firm size) there are additional reasons why efficiency advantages may be reinforced. Economies of scale can occur in cost components such as capital, marketing or research and development. These factors may maintain or extend efficiency advantages gained through some dynamic process. In the case of R&D, static factors may reinforce dynamic advantages. For example, a high market share may imply a firm has a greater likelihood of benefiting from process inventions, thus raising R&D intensity. Higher R&D intensity may result in more process inventions and larger market share (i.e. there is a feedback between static and dynamic factors).

These ideas suggest that the positive empirical concentration-profit link can result from competition in which the most efficient firms gain higher profits and larger market shares. This 'efficient structure' argument is associated with the work of McGee (1971) and Demsetz (1972, 1974). To reiterate, these firms will have more weight in the industry profit average, yielding the concentration-profit relationship at the industry level. Demsetz held that if small firms in concentrated industries have a similar level of profitability to large firms the SCP paradigm would hold (i.e. according to the simple SCP paradigm, collusion within an industry sets a price from which all firms can benefit from). However, if there was no correlation between concentration and profitability for small firms, one could conclude that large firms derive higher profits due to superior efficiency. The empirical work of Demsetz has generally supported his predictions.

An alternative viewpoint is that the higher profits of some firms is linked to greater market power. This market power implies firms can charge higher prices and therefore reap greater profits for a *given level* of costs. If market power and market share are positively related, this would explain the higher profits of firms with high market share but not how high market

share was obtained. Firms may obtain larger market share through the dynamic efficiency factors mentioned above. Similarly, previous advertising expenditures or brand development may have led to a position of market dominance. It is also possible that higher market share may lead to greater profitability due to buyers presuming that there is less risk in dealing with a market leader, or firms having greater bargaining power over customers and suppliers.

The various arguments above demonstrate the complexity of the market share-profitability link, partly because of the combination of dynamic and static factors. Given this it is worthwhile summarising the views of some key papers. Scherer and Ross (1990) provide two explanations for profit-firm size differences in a market. The first is that the market is in a state of short run disequilibria and that in the long run the smaller firms will expand to obtain equally low costs and subsequently bid down prices. The second explanation is the existence of barriers to fringe firm expansion or low cost entrants. This will allow the larger firms to gain and maintain high market shares and profits even in the long run. High levels of sunk costs, advertising or research and development expenditures can all be classed as barriers to entry.

Mancke (1974) offers another explanation for firm size differentials which incorporates the Gibrat process[3]. Mancke postulates that all firms within a market start from an identical position and each firm reinvests profits into business opportunities. Even though each firm faces the same distribution of investment payoffs, some firms will be more fortunate than others in realising cost saving innovations and new products. It is these firms, which, over time will grow at a faster pace and become more profitable. A positive market share-profitability relationship will exist, this time due to luck, not some inherent dynamic efficiency or economies of scale. Caves and Porter (1977) tested Mancke's hypothesis by distinguishing between high and low turbulent environments in which firms operate. The hypothesis would hold if profitability was higher for those firms operating in highly turbulent conditions where profits could more readily arise from chance events. The authors found that for their study, increases in market share were not the result of a Gibrat-like process. Instead

[3] Gibrat's law of proportionate effect (Gibrat 1931) states that the probability of a given proportionate change in size during a specified period is the same for all firms in a given industry – regardless of size at the beginning of the period.

it appeared that increases in firm market share are the result of product differentiation and business strategy, rather than the result of chance events.

Lastly, there is a view that large firms (and implicitly large market shares) may have lower efficiency (and possibly lower profits). This relates to the X-inefficiency literature, also termed technical inefficiency or organisational slack. X-inefficiency is believed to be a function of market power where competitive pressures are weakened and total costs are no longer minimised. Economists supporting this view would certainly not advocate that firms gain larger market shares through superior efficiency and an alternative explanation is required. X-inefficiency may also imply that the profit-market share relationship is non-monotonic instead of linear.

Empirical evidence

Australian evidence for profitability and market share is very sparse due to the lack of appropriate firm level data. McDonald (1999) failed to find a positive market share profitability relationship although the result is somewhat sensitive to the econometric specification in his study using the IBIS dataset.

Ravenscraft (1983) carried out one of the first major studies which found price-cost margins to be positively associated with firm market share, while, if anything, negatively associated with seller concentration[4]. Branch and Gale (1982) calculated a series of regressions using PIMS data and found that market share, not concentration, is the primary structural determinant of profitability. They also found that differences in relative prices appeared to be due to greater perceived product quality of the higher share firms and that relative costs fall as market share increases. They concluded that lower costs through economies of scale, rather than higher prices, are responsible for higher profitability being associated with greater market share.

Schmalensee (1989) found that although market share is strongly correlated with profits in samples of U.S. firms that include many industries, this is not the case for particular manufacturing industries. He suggests that the positive market share profitability relationship

found in many studies is due to results being dominated by a small number of industries with unusually strong positive relations between share and profitability. This proposition is supported by results from Schmalensee (1987), intra-industry studies of the UK by Clarke, Davies and Waterson (1984) and studies by Ross (1986) and Kessides (1987).

Studies carried out since the 1970s have generally found that market share is positively and significantly associated with higher rates of return and this effect dominates any concentration profitability relationship. However, as both efficiency and oligopolistic coordination (as a result of concentration) effect profitability to some extent, the task is to find the relative explanatory power of each effect. An interaction term (i.e. the product of market share and concentration) can be included in regressions to test this idea.

4. Diversification and profitability

The nature and extent of firm diversification, and its association with firm performance, provide a series of complex issues for economic analysis. Diversification can be defined as 'an increase in the heterogeneity of output from the point of view of the number of markets served by that output'.[5] The neoclassical theory of the firm considers that the firm produces a single product, hence its output is homogeneous and the issue of diversification is unexplained. In fact, (pure) neoclassical theory, in assuming zero transaction costs, cannot explain why some activities are organised within a firm, while others are routed through the market (see Demsetz, 1997, Chapter 1, for a discussion). In the previous section much of the discussion implicitly assumed that the firm operates in a single market. In reality, a substantial proportion of large Australian firms operate in multiple industries. This situation suggests that we consider the role of diversification. The next sub-section discusses some of the theoretical issues and is followed by an empirical review.

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[4] Ross (1986) used Ravenscraft's sample and found a positive profit market share relationship for consumer goods industries but no relationship between profit and market share for producer good industries.

[5] Taken from Teece (1980, p.224) and originally taken from Gort (1962).

Theoretical background

The importance of transaction costs in explaining a firm's boundaries has been developed by Teece (1980, 1982) and Williamson (1975). To understand the issues it is useful to consider a simple example. Consider two products *x* and *y* where the cost of producing the products is given by C(*x*, *y*). If the two products are produced by two separate firms then the total cost is C(*x*, 0) + C(0, *y*). If this is greater than C(*x*, *y*) it suggests, at first glance, that the two products should be produced by a single (diversified) firm. Teece (1980) argues, however, that this 'efficiency-based' theory of diversification is not sufficient to explain diversification. This is because the ability to achieve costs C(x,y) is based on the technology of production and does not, necessarily, prevent two firms obtaining this cost via the market system. Teece gives the example of an orchard which also has land available for grazing sheep. The joint cost of producing both fruit and sheep together is lower than if the sheep are reared elsewhere. However, in theory, there is no reason why a market contract between two firms can not arrive at the joint production outcome (i.e. the orchardist rents the grazing land to the sheep farmer). Hence, any theory of the diversified firm must consider why certain types of joint production cannot be efficiently organised through the market.

The transactions cost theory suggests a number of situations in which the marketization of joint production may be problematic and, thereby, imply the existence of diversified firms. A first example is when a physical asset has multiple outputs and its level of output is high (relative to market size). Given this, a firm may find itself operating a machine (e.g. a metal press) with spare capacity to produce an additional output (e.g. cooking pots in addition to hub caps). One solution would be to sell the rights to use the machine to another firm (this retains each firm's "focus", or specialisation, by using a market transaction). This may have substantial transactions costs (e.g. disputes concerning the repair of the machine). Alternatively, the firm may choose to diversify into the new market, avoiding the transactions costs and utilising the spare capacity, although this may imply additional costs associated with selling in a new market.

Other types of assets which may imply diversification are so-called 'know-how' or 'competencies'. These relate to the experience a firm has accumulated in areas such as management, marketing, design and the like. Certain know-how or competencies may be relevant to the production of other goods. If this is the case, and the firm has spare

capacity of these assets, a potential reason for diversification exists. Again, the firm could sell these assets to another firm, however, the very nature of knowledge may make this impossible or costly. One reason why market transactions in knowledge are difficult, is disclosure. Knowledge may have to be disclosed prior to the sale – and disclosure implies the buyer-to-be has already received the value – hence lack of trust between agents may prevent a market transaction. Similarly, if the successful exchange of knowledge implies a process of joint discussions, whose exact nature is difficult to predict in advance, the market contract to organise this process may be highly complex and costly to write. These types of issues suggest the existence of a multi-product or diversified firm which can benefit from internal flows of knowledge.

The transaction cost idea can be thought of as the fundamental concept behind a number of reasons frequently used in justifying diversification, such as 'complementary assets', 'economies of scale' or 'transfers of key competencies' (see discussions by Stimpert and Duhaime, 1997, or Dess et al, 1995). For example, a distribution system for a firm's products is often cited as a complementary asset (i.e. a firm can use it to distribute more than one product, implying a rationale for diversification into more than one product). In this case the central issue is why the use of the distribution system cannot be organsised through the market. Another example, is a firm's reputation or image, which can be considered as an firm specific asset. Such an asset may provide an advantage in entering other markets and, in particular, since it is unlikely that 'reputation' can be sold through the market, a rational for diversification. An example of this is the Virgin group in the UK which has diversified from retailing, to airlines and financial services.

The transaction costs viewpoint therefore provides a rich framework for thinking about diversification. In particular, it makes us consider which firm characteristics may be central to a diversified firm (e.g. R&D, management, entrepreneurship, distribution, marketing). As Wernerfelt and Montgomery (1988) note, firms which diversify would be expected to have 'excess capacity' of these characteristics. The transactions cost approach also focuses attention on the potential failures of the market system to organise these resources.

However, there are other rationales for diversification that move outside this framework. Some authors note that firms may attempt to diversify as a means of reducing risk. Merging

two firms can lead to a reduction in risk (as measured by the variance of returns[6]). However, if the shares of both firms are traded, an investor could achieve this risk reduction independently (by investing in both firms). It is not clear, therefore, why a firm should pursue a diversification strategy on these grounds. Indeed, it may be that firms interfere with the ability of investors to balance their portfolios optimally by undertaking this type of diversification (see Bosworth et al, 1997, p.6).

A further argument is that a larger firm has the opportunity to utilise internal capital markets (i.e. generate funds from one business to invest in another, or balance cash flows to avoid short term borrowings) which may promote diversification. This argument assumes that internal capital markets are more efficient than external capital markets, possibility due to the difficulties in supplying information. This argument could therefore be considered in a transactions cost framework (i.e. can the market or the firm more efficiently allocate finance). Whether the internal finance argument is true, and how great the associated cost savings are, is to a large extent an empirical question. It may be, for example, that a highly oligopolistic finance sector with high lending margins would promote large, diversified firms; whereas the introduction of more competition in the finance sector would reduce interest margins and move firms to a more focused strategy.

A further set of issues that relate to diversification arise from research into multimarket contact and market power. Essentially, this research is concerned with the issue that if two firms compete in more than one market this may influence the nature of competition between the two firms. The nature of competition between firms in an oligopolistic market is difficult to predict since there may be a number of equilibrium strategies that can be followed.[7] One argument is that firms which compete in more than one market are able to 'learn' strategies

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[6] For example, consider two firms that both have a mean return of \$q and variances σ_1^2 and σ_2^2. The merged firm has return 2q with variance $\sigma_{12}^2 = \sigma_1^2 + \sigma_2^2 + 2r\sigma_1\sigma_2$ where r is the coefficient of correlation between the two profit streams. As long as r<1 the variance of returns of the merged firm is lower (in proportion to average returns) than considering the two firms in isolation. For example, suppose σ_1^2 equals σ_2^2, then the merged firm, if *r*=1, would have a s.d. of $2\sigma_1$ and mean return of 2q, hence the coefficient of variation (s.d./mean) is equal for both merged and separate firms. This example is taken from Teece (1982, p.41, footnote 2).

[7] For a survey of these issues see, for example, Basu (1993).

faster, which may in turn raise profitability.[8] Equally, mutual involvement in more than one market may increase the incentives to cooperate rather than 'cheat'.[9] These ideas suggest that diversification may be associated with higher profitability, and that a rationale for diversification might be to match the multimarket presence of competitors. This suggests that firms may exhibit 'strategic congruence' (Scott, 1993) as they match each others market presence. This is not to say that the other reasons for diversification may not also be present. Note, however, that the 'strategic congruence' view suggests that market power may increase (a socially undesirable outcome) while the previous arguments, which are largely based on efficiency gains, imply a social gain.

Finally, there are other reasons why diversification may be pursued by firms. First, management preferences may promote firm growth rather than profitability (and diversification allows the possibility of much faster growth than is possible by increasing market share, or benefiting from demand increases, in a single market). This would create a potential conflict with the interests of the shareholders but history suggests that some managers are able to pursue such strategies. Second, government policy with regard to corporate taxation may stimulate diversification (e.g. if losses from one firm can be used to offset profits in another there may be an incentive to merge, or if sales taxes are in place there may be an advantage in vertical integration). Third, some researchers argue that diversification is used as an escape route for firms in declining and low profit industries.[10]

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[8] Scott (1993, p.27) states, "in the context of multiperiod games with symmetry of sellers, multimarket contact can facilitate achieving a modus vivendi for coordination that allows sellers to play a favourable (from their perspective) noncooperative equilibrium in the multiperiod game".

[9] Again, Scott (1993, p.27) summarises this view as "..multimarket contact can, be means of pooling on the conglomerates' incentive constraints across markets in which they meet, allow the attaining of "cooperative" outcomes in noncooperative games where the incentive to cheat would undermine those outcomes in the absence of the multimarket contact and the behaviour it induces". This is an argument associated with Bernheim and Whinston (1990). See also Evans and Kessides (1994) for a discussion and a study of multimarket contact in the US airline industry.

[10] This argument is associated with Rumelt (1986 (1974)) who states "for a great many firms, diversification is the means employed to escape from declining prospects in their original business area" (quoted in Stimpert and Duhaime, 1997, p.563).

Empirical evidence

This section provides a summary of some of the measures of diversification and a short review of some empirical findings. With regard to the latter, the empirical literature on diversification and firm performance has drawn no firm conclusions. Grant et al (1988) state:

> despite a burgeoning empirical literature, no consensus has emerged as to the impact of diversification on performance – indeed, recent studies have increased the inconsistencies between the findings of different researchers (Grant et al, 1988, p.771).

A more recent paper by Dess et al (1995) also reaches a similar conclusion. Both of these papers contain reviews of the previous empirical literature (with a focus on those in the management literature). Lang and Stulz (1994), in an article in the *Journal of Political Economy*, reach the same conclusion:

> Although there is a substantial literature that compares the performance of diversified firms and specialized firms, this literature has not reached a decisive conclusion (Lang and Stulz, 1994, p.1249).

These conclusions are, perhaps, unsurprising given that the theoretical arguments suggest that the impact of diversification depends on the specific firm, industry and economic circumstances.[11] Hence, empirical studies that use different firm samples, from different time periods and countries, might be expected to find different results. It should also be noted that the performance measures used vary across studies. Accounting based profit measures, Tobin's q (the ratio of market to book value) and share performance measures have all been used.

An important issue is that diversification can be 'related' or 'unrelated' to a firm's core activities or capabilities. Authors suggest that related diversification can be beneficial while unrelated diversification is not, hence, the variable used to measure diversification is important. The problems of defining diversification are discussed in some of the early studies on diversification (e.g. Gort, 1962, Rumelt, 1974 (reprinted 1986), Berry, 1975). Rumelt

[11] For empirical studies on the determinants of diversification see Caves et al (1980, Chapter 10) and Rondi et al (1996).

(1986) for example develops a classification based on four types of companies – single business, dominant business, related business and unrelated business – each of which implies a different level of diversification and which have various sub-classifications. One of the sub-classifications for diversified firms is those 'constrained' in their diversification strategy (i.e. firms which diversified by "building on some particular strength, skills, or resource associated with the original … activity" (Rumelt, 1986, p.32). Rumelt finds that the diversification sub-classifications are important in understanding the diversification-performance link and, in particular, that dominant-constrained and related-constrained firms perform the best.

The above issues suggest that the measures of diversification used are important. There is a trade-off here between (relatively) easily calculated measures based on published accounts (which can be calculated for a large sample of firms), and in-depth measures that require specific knowledge of the operations of firms. The empirics below use accounting data from the IBIS data base to derive diversification measures, hence the focus is on the 'large sample' measures. A previous empirical study that also used the IBIS data (for 1989 to 1994) is Bosworth et al (1997). Using a fixed effects panel estimate, they find that more focused firms have higher profitability, with diversification being proxied by a Herfindahl measure (see Table 1) and profit measured by the EBDIT margin (see Appendix 1 for definition).

The IBIS data base contains data on firms' segment, or lines of business, information. A simple measure of diversification is the count of the number of segments. Since some segments may operate in the same industrial classification this can be modified to include only the number of unique industry codes. Such measures take no account of the shares of revenue accounted for by each segment. One method that does is the percentage of revenue from core activities (also called the specialisation ratio). This, however, places no weight on the fact that non-core activities may be in a single industry, or spread over a large number of industries. An alternative is to use a Herfindahl based measure, which varies between 0 and 1 (for a fully focused firm). Finally, the Herfindahl measure makes no adjustment for the relatedness of activities (i.e. if a firm has two segments with 50% revenue in each, the Herfindahl measure is the same for whether the two segments are in, say, manufacturing or one is in manufacturing and the other in finance). This factor has led to the use of a weighted index, which places a weight on how similar the segment's industry is to the core activity.

The weights used are often based on whether the segment has a different 4-digit code but the same 3-digit code as the core activity (weight is one), or different 3-digit codes but the same 2-digit code (weight is two), etc[12]. The various measures of diversification used are summarised in Table 1.

Table 1 Empirical measures of diversification

Name	Formula	Description
Segment count	N	Number of industries over which segments are spread.
Core revenue	$S_{i-\max} / \bar{S}$	% of revenue in core industry, where $S_{i-\max}$ is the segment with highest revenue for the firm and $\bar{S}$ is the sum of segment's revenues.
Herfindahl	$\sum_i [S_i / \bar{S}]^2$	Sum of squares of segment revenue shares
Weighted	$\sum_i D_{ci} [S_i / \bar{S}]^2$	D_{ci} is a measure of the distance between core activity and segment i's activity.

Note: Share based measures can also be calculated using employment or assets.

5. Data and bivariate analysis

The dependent variable for the analysis is the ratio of 'earnings before depreciation, interest and tax' (EBDIT) to total revenue. This ratio is used for three reasons: (1) it is the closest to the theoretically preferred price-cost margin that we can obtain from the IBIS data set, (2) many other empirical studies in the applied industrial organisation literature use the price-cost margin, and (3) our previous analysis on the IBIS data suggests that the EBDIT margin has

[12] This can be further modified to include bilateral weights between all segment's activities rather than just base the index on the distance from the core activity. This index – the concentric index – is equal to $\sum_j s_j \sum_i s_i d_{ij}$ where s is the revenue share and d_{ij} is the distance between segments i and j. Caves et al (1980, p.198) discuss these measures in more detail.

less 'noise' than either return on assets or return on shareholders' funds (Feeny and Rogers, 1999).[13]

Table 2 contains summary statistics for the panel of 722 firms for the period 1993 to 1996 (full definitions of the variables are in Appendix 1). These statistics are based on average values for a firm over the four year period. The advantage of this averaging is that it removes year-on-year volatility. The disadvantage is that we lose potentially useful information on year-on-year changes in, say, profits for a firm. It should be noted, however, that there is likely to be substantial "noise" in the year-on-year changes, which implies panel analysis could be misleading. This type of noise could be due to changes in accounting procedures between years that do not reflect real changes in a firm's activities.[14]

A further issue is how to define market share and concentration for diversified firms. Sections 2 and 3 above have highlighted the fact that the economic theory of firm profitability is centred on the market environment. Diversified firms operate in a number of markets and, in all likelihood, face different market shares and concentration in each. Our solution to this issue is to construct market share and concentration measures from segment level financial information. Australian accounting standards require diversified firms to report segment performance information. Here we use this segment information to construct market shares and concentration ratios at the 3 digit ANZSIC industry level (the industry classifications are allocate by IBIS). Each segment within a firm therefore has a market share and concentration ratio. A weighted average of the firm's segment values is then calculated, with the revenue shares of segments used as weights.

Table 2 shows that the mean EBDIT margin is 11% with a standard deviation of 12%. Note that the range of average profit margins is large, from –54% to 75%, despite the fact that the data are averaged over a four year period. Looking at the market share summary statistics, and also the histogram of market share in Appendix 1, we note that the distribution is highly

[13] Specifically, the concern is that the return on assets and return on shareholders' funds have high variance due, for example, to variations in accounting practice (e.g. depreciation) and financing choices (e.g. leasing rather than owning assets).

[14] For example, in our inspection of the data, it appeared that substantial changes in the diversification measures can arise from changes in segment reporting procedures. How the segment structure is reported, and allocated to

skewed. Most firms have a low (weighted) market share (less than 2%), but a few firms have high market shares, with Telstra having the highest share (81%). A similar, although less pronounced, situation occurs for the Herfindahl measure of concentration. The 4-firm concentration ratio also has some right hand skewness. Looking at the diversification measures, the specialisation ratio shows that the majority of firms have about 50% of their revenue derived from their core activity. Naturally, there are some firms that are fully focused (a specialisation ratio of 100%), while the least focused firm – by this measure – has 93% of total revenue from non-core activities.

Table 2 Summary Statistics for Variables

Variable (Average 1993-96)	Mean	Median	sd	Min	Max
EBDIT margin (%)	10.97	8.17	11.72	-54.40	75.07
Market share (%)	4.04	1.66	7.03	0.08	80.58
Concentration ratio (%)	0.45	0.44	0.16	0.19	0.98
Herfindahl concentration	0.11	0.09	0.08	0.02	0.68
Herfindahl diversification	0.52	0.47	0.27	0.06	1.00
Specialisation ratio (%)	56.97	50.00	24.93	7.23	100.00
Capital intensity (%)	107.66	63.86	164.28	3.19	2012.55

Note: see Appendix 1 for full definitions of variables

ANZSIC classifications by IBIS, appears in some instances to introduce dramatic year-on-year changes in diversification, market share and concentration that appear unrealistic.

Table 3 Profitability by industry

Industry	No. of firms	Mean (%)	Median (%)	St. dev. (%)
Agriculture, Forestry and Fishing	9	4.92	3.15	4.22
Mining	59	24.52	24.37	19.95
Manufacturing	295	11.17	10.02	7.58
Electricity, Gas and Water Supply	4	29.97	25.99	15.19
Construction	19	7.05	3.32	14.72
Wholesale Trade	165	4.39	3.52	4.5
Retail Trade	44	5.8	3.78	8.38
Accomodation, Cafes and Restaurants	7	14.46	17.3	11.7
Transport and Storage	32	15.14	9.12	18.24
Communication Services	8	12.45	6.88	23.78
Property and Business Services	45	14.22	12.98	11.58
Education	1	8.96	8.96	
Health and Community Services	7	12.75	15.14	5.68
Cultural and Recreational Services	18	20.89	20.73	10.48
Personal and Other Services	9	11.05	6.03	10.03
All	722	10.97	8.17	11.72

Table 3 shows a breakdown of profitability by sector. Part of the reason for the substantial differences between sectors is the use of EBDIT margin, since this is profit before distributions to capital; hence highly capital intensive industries will show higher EBDIT margins.

As a precursor to further analysis, Table 4 shows a set of cross-tabulations. Each cross-tabulation has categorised firms into either ‘high’ or ‘low’ profitability. A firm is in the high category if its profitability is above the median value for the sample. Each of the cross-tabulations investigates the relationship with one of the (explanatory) variables listed in Table 1. Again, a firm is classified into a ‘high’ or ‘low’ category based on the full sample median. Each cell in the cross-tab table shows the number of firms in each sub-category (i.e. for market share there are 199 firms with ‘high’ market share and ‘high’ profitability). In addition, below this number is the percentage that the number represents of the total number of firms in the column (i.e. 199 out of 361 corresponds to 55%, which is greater than the ‘expected’ percentage of 50% if there was no market share-profit link).

Pearsons chi squared was calculated to test the hypothesis that the rows and columns in the tables are independent. The values for chi squared are as follows. For profit and market

share (7.58), profit and 4 firm concentration (38.2), profit and Herfindahl concentration (38.2), profit and Herfindahl diversification (18.0), and for profit and the specialisation ratio (11.9). These values indicate that profits are not independent of market share, concentration and diversification at a 99% level of confidence.

Table 4: Cross-tabulations of profit versus explanatory variables

Market share

Profit margin	High	Low	Total
High	199	162	361
	55.12	44.88	50
Low	162	199	361
	44.88	55.12	50
Total	361	361	722
	100	100	100

Herfindahl diversification

Profit margin	Focused	Diversified	Total
High	152	209	361
	42.11	57.89	50
Low	209	152	361
	57.89	42.11	50
Total	361	361	722
	100	100	100

Concentration ratio

Profit margin	High	Low	Total
High	222	139	361
	61.5	38.5	50
Low	139	222	361
	38.5	61.5	50
Total	361	361	722
	100	100	100

Specialisation ratio

Profit margin	Focused	Diversified	Total
High	182	179	361
	44.39	57.37	50
Low	228	133	361
	55.61	42.63	50
Total	410	312	722
	100	100	100

Herfindahl concentration

Profit margin	High	Low	Total
High	222	139	361
	61.5	38.5	50
Low	139	222	361
	38.5	61.5	50
Total	361	361	722
	100	100	100

The results in Table 4 suggest that firms with higher market shares are more profitable, equally firms that operate in industries which are more concentrated also appear to have

higher profits. Diversified firms appear to have higher profits, whether diversification is measures by either the specialisation ratio or a Herfindahl measure. Unfortunately, this type of bivariate analysis is unlikely to be very robust since we are not controlling for other factors. In particular, we have noted that there are substantial profitability differences between industries. Equally, it would be interesting to control for firm size (since firm size and market share and concentration are positively correlated). Another method of understanding the data is to plot graphs of the profit margin with the variables. This is done in Appendix 2. The general impression of these graphs is that the variance overwhelms any potential correlation between them. This suggests the use of multivariate analysis to control for a number of factors.

6. Preliminary multivariate analysis

In this section we provide some initial analysis using multivariate regressions. The analysis is restricted to simple regression techniques and uses only a core set of explanatory variables. As such, the analysis should be viewed as exploratory.[15]

Table 5 shows the first set of (baseline) regressions. All regressions have a set of 2-digit industry level dummies included to account for industry differences (e.g. in risk). In addition, the regressions contain two control variables: a capital intensity variable to control for the fact that our profit measure is taken prior to capital distributions, and the log of total assets (even though the log of total assets is included as an explanatory variable, the other coefficients are still constrained to be independent of firm size). Both of these variables have positive and significant coefficients. In regression [1], the market share, the 4-firm concentration ratio and the specialisation ratio are also included as explanatory variables. The results show that the capital intensity variable is highly significant (it also has considerable explanatory power; when included as the sole explanator the R^2 is 0.17). The coefficient on market share is not significant, while the coefficient on concentration is positive and significant (at 10% level). The coefficient on the specialisation ratio is negative and not significant.

[15] This paper is part of a larger research project that will use more sophisticated econometrics on these data.

Regression [2] includes the square of market share as an additional explanator. This regression has significant coefficients on both market share and the square of market share. This implies a non-monotonic relationship between market share and profit, specifically, when market share is at low values (less than 30%) the relationship is negative. Once market share increases past 30% the relationship is positive. This non-monotonic relationship, however, must be evaluated in the knowledge that only 9 firms in our sample have market shares above 30%. In other words, for almost all firms in the sample a small increase in market share is associated with a fall in profitability. This result does not agree with our theory and is difficult to explain. A possibility is that firms with smaller market shares have other characteristics that raise profitability (e.g. flexibility in production and marketing). However, the regressions already control for firm size (albeit proxied solely by the log of assets) so we cannot state that smaller firms have more flexibility and higher profits. One avenue of future work is to conduct analysis at the segment level, since our method of weighting market shares into a parent level average market share may be influencing the result.

Regression [3] excludes negative average EBDIT margins from the regression. A rationale for excluding negative values is that our theory is not intended to explain the level of negative profits. In addition, we may argue that the 32 firms that have negative average profit margins (over four years) are likely to be substantially different from a 'normal' firm (i.e. they are start up firms, or firms that are in the process of being closed). The regression results show that most coefficients become more significant and the R^2 for the regression has increased to 0.55. In particular, the coefficient on the specialisation ratio is positive and significant. This supports the results of Bosworth et al (1997) who find more focused firms have higher profitability.[16]

[16] Although Bosworth et al (1997) do not explicitly state that they omit loss making firms, it appears that a double log specification is used which would effectively remove any negative profit ratios.

Table 5 Baseline regressions

Dependent variable: average profit margin

Explanatory variable	R1	R2	R3
Log(total assets)	0.016	0.02	0.016
	(3.60)	(4.27)	(4.01)
Market share	-0.072	-0.432	-0.447
	(-0.65)	(-2.96)	(-3.60)
Square of Market share		0.709	0.649
		(2.90)	(3.36)
4-firm concentration ratio	0.088	0.113	0.171
	(1.75)	(2.29)	(4.33)
Specialisation ratio	0.004	0.01	0.031
	(0.26)	(0.55)	(2.11)
Capital intensity	0.017	0.016	0.018
	(2.73)	(2.54)	(2.96)
R^2	0.43	0.43	0.55
Observations :	722	722	690

Notes: The t-statistics in brackets are based on White's robust standard errors. All regressions include a set of industry dummies at the 2-digit ANZSIC level (and are significant as a group in each regression at the 1% level). The above regressions show the results on the 4-firm concentration ratio and the specialisation ratio. Both concentration and diversification also have a Herfindahl based measure (see Appendix 1). When the Herfindahl concentration measure is used the coefficient is positive but not significant in all regressions except for R3. The coefficient on the Herfindahl measure of diversification is positive in all regressions but only significant in R3.

Table 6 investigates whether the above results vary by size of firm. This is done since some of the arguments concerning the role of market share and concentration apply more to large firms than small firms. The log of total assets is already included as an explanatory variable, however, this still constrains the other coefficients to be independent of firm size. Table 6 relaxes this by running sub-sample regressions for firms (a) over $100 million (b) over $250 million and (c) over $500 million total revenue. The results again show the non-monotonic market share association and that the specialisation ratio has a positive but insignificant coefficient. Both capital intensity and concentration have positive and significant coefficients. Moreover, the magnitude of the coefficient on concentration increases as the sample is restricted to larger firms.

Note also that the coefficient on capital intensity rises with firm size also suggesting that depreciation and interest payments are relatively more important for large firms.

Table 6 Regressions for three year averages

Dependent variable: average profit margin

Explanatory variable	R4 > $100 mill.	R5 > $250 mill.	R6 > $500 mill.
Log(total assets)	0.024 (5.03)	0.023 (3.31)	0.027 (3.09)
Market share	-0.525 (-3.98)	-0.536 (-3.83)	-0.65 (-3.80)
Square of Market share	0.758 (2.98)	0.662 (3.41)	0.691 (3.24)
4-firm concentration ratio	0.166 (2.99)	0.177 (2.92)	0.252 (2.73)
Specialisation ratio	0.011 (0.54)	0.025 (1.26)	0.035 (1.12)
Capital intensity	0.014 (2.73)	0.029 (4.04)	0.042 (2.13)
R^2	0.56	0.73	0.77
Observations	502	282	156

Notes: The t-statistics in brackets are based on White's robust standard errors. All regressions include a set of industry dummies at the 2-digit ANZSIC level (and are significant as a group in each regression at the 1% level). The above regressions show the results on the 4-firm concentration ratio and the specialisation ratio. When the Herfindahl concentration measure is used its coefficient is positive and significant in all regressions (although only at 15% level in R4). The coefficient on the Herfindahl measure of diversification is positive in all regressions but only significant in R5.

Table 7 contains separate regressions for various sectors. Overall, the results show that coefficient estimates can vary dramatically between sectors. These results suggest that our set of explanatory variables appear unlikely to capture all the differences in market structure and firm characteristics. This, perhaps, is unsurprising as the analysis has deliberately chosen a parsimonious set of explanatory variables. There is little Australian literature to relate these results back to, however, the insignificant coefficient on concentration in the Retail sector regression supports Tucker (1977), while the positive influence of concentration in the manufacturing sector supports the early study by Round (1976).

Table 7 Regressions for three year averages

Dependent variable: average profit margin

Explanatory variable	R7 Manufact-uring	R8 Mining	R9 Wholesale Trade	R10 Retail	R11 Others
Log(total assets)	0.011	0.038	0.006	0.003	0.047
	(2.54)	(0.92)	(1.15)	(0.29)	(3.01)
Market share	-0.448	-1.512	-0.589	0.383	-0.555
	(-2.67)	(-0.54)	(-1.31)	(0.76)	(-1.42)
Square of Market share	0.999	1.758	2.523	-0.829	0.572
	(2.69)	(0.29)	(1.34)	(-0.87)	(1.53)
4-firm concentration ratio	0.083	0.732	0.082	-0.045	0.27
	(2.13)	(0.79)	(1.64)	(-0.33)	(1.57)
Specialisation ratio	-0.011	-0.201	-0.008	-0.099	0.096
	(-0.54)	(-1.16)	(-0.59)	(-1.89)	(1.52)
Capital intensity	0.072	-0.016	0.037	0.018	0.009
	(5.07)	(-0.81)	(2.26)	(12.84)	(1.01)
R^2	0.43	0.23	0.18	0.55	0.41
Observations :	295	59	165	44	159

Notes: The t-statistics in brackets are based on White's robust standard errors. All regressions include a set of industry dummies at the 2-digit ANZSIC level (and are significant as a group in each regression at the 5% level in regressions R7, R8 and R11). The above regressions show the results on the 4-firm concentration ratio and the specialisation ratio. The Herfindahl measures of concentration and diversification show a similar pattern of results to those above.

7. Conclusions

This paper has provided a review of the theoretical and empirical literature on market share, concentration and diversification and how these affect firm performance. This is followed by an analysis of these factors in a data set of large Australian firms. This type of empirical analysis on Australian data is relatively uncommon. This is one justification for this paper's focus on reviewing the issues and providing exploratory analysis only.

As has been stressed, the results of the multivariate analysis should be viewed as preliminary. This said, the general thrust of the results is that concentration (at least proxied by the 4-

firm concentration ratio) has a positive association with firm profitability. The effect of market share is non-monotonic. This said, it appears that for almost all firms in the sample an increase in market share would reduce profitability. This is a result at odds with our theory and requires further investigation. The level of diversification appears to play no strong role, except in the case where we exclude loss-making firms. In this case, more focused firms appear to have higher profits.

A number of areas for future investigation are clear. For example, we have not investigated threshold or non-monotonic effects for concentration, or the possibility of an interactive effect with market share. The literature reviews in earlier sections noted that this can be an important issue. Equally, the limited set of explanatory variables used needs to be augmented. Hay and Morris (1991) stress that it is barriers to entry as well as concentration that affect profitability. Hence, additional variables should be included to proxy barriers to entry and these can be interacted with the concentration measures. Ravenscraft (1983) includes R&D and advertising intensities as further controls for profitability (since he argues that these reflect different investment strategies by firms which may have different profit outcomes). In addition to improving on the set of explanatory variables, there is also the need to use the panel nature of the data. Panel data models can control, to some extent, for unobserved firm-specific characteristics which can be an important advantage. These areas set the agenda for future research.

Appendix 1 Definitions

Variable (Average 1993-96)	Description
Profit margin (%)	Earnings before depreciation interest and tax / total revenue
Market share (%)	Weighted average of segment market shares
Concentration ratio	Weighted average of 4-firm concentration ratios faced by segments
Herfindahl concentration	Weighted average of Herfindahl concentration ratios faced by segments
Herfindahl diversification	Weighted average of Herfindahl diversification ratios faced by segments
Specialisation ratio (%)	% of non-core activities (core activity defined as segment with highest share of total revenue)
Capital intensity (%)	Total assets / revenue defined at parent level

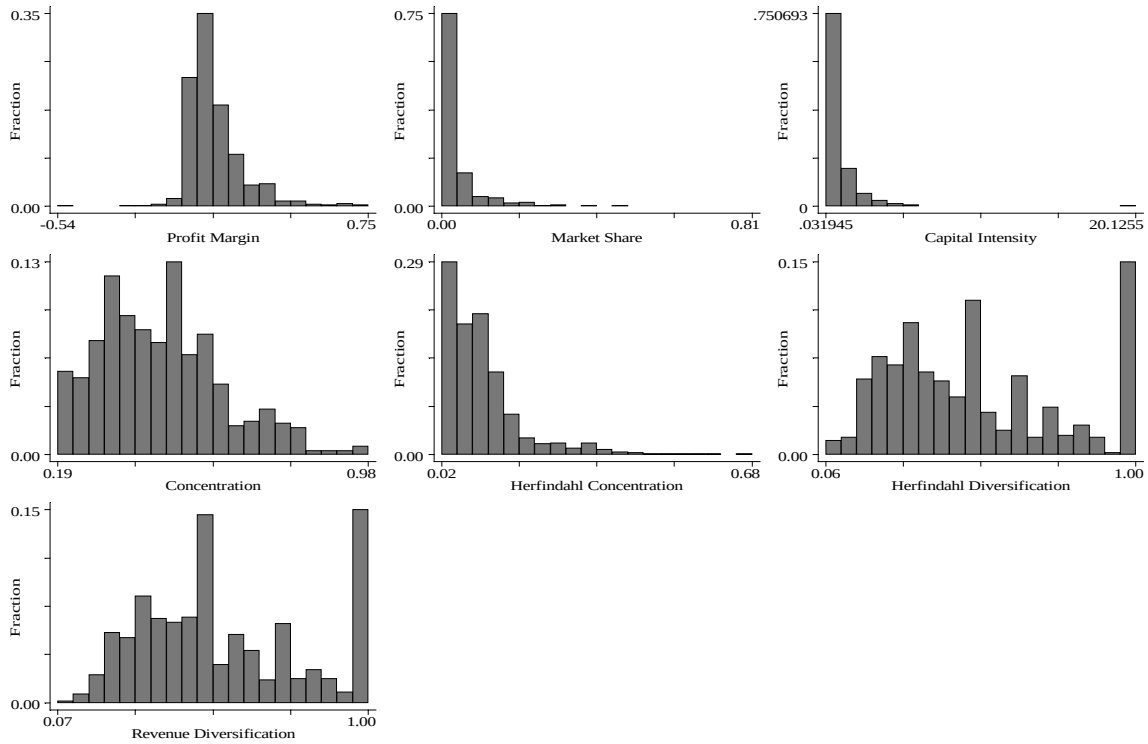
Defining segments

A 'segment' is defined as operations within a 3-digit ANZSIC code. For example, there are situations where a firm has two or more segments that are assigned (by IBIS) the same 3-digit ANZSIC code. In these cases the segment revenues are added together to form a 'psuedo-segment' or 'economic-segment'. Equally, in a number of cases IBIS allocates more than one 3-digit ANZSIC code to a segment. In these cases the revenue of the segment is evenly split between the ANZSIC codes. While this is no doubt incorrect in many cases, it seems better than arbitrarily assigning all revenue to one ANZSIC code. This procedure accounts for the 'peaks' in the some of histograms below (i.e. there are a number of cases where a single segment is reported which has two ANZSIC codes hence we split revenue equally between them). Segment reporting procedures for Australia are given in the AASB Accounting Standards Handbook. Essentially, these suggest that firms report segments where there exists a distinct component of the entity's operations which provides products or services to other entities outside the ownership group. Each industry segment, together with a description of the products and services from which each segment earns revenue, must be disclosed if the entity operates in more than one industry.

Weights

A 'weighted average' of segment data means that the revenue shares of segments were used as weights e.g. for a firm its weighted concentration = $\sum_i \left[S_{ij} / \overline{S} \right] C_j^{4\,firm}$ where S_{ij} is segment *i*, $\overline{S}$ is the sum of segments' revenues, *j* is the 3-digit ANZSIC code of the segment, and $C_j^{4\,firm}$ is the concentration measure for industry *j*.

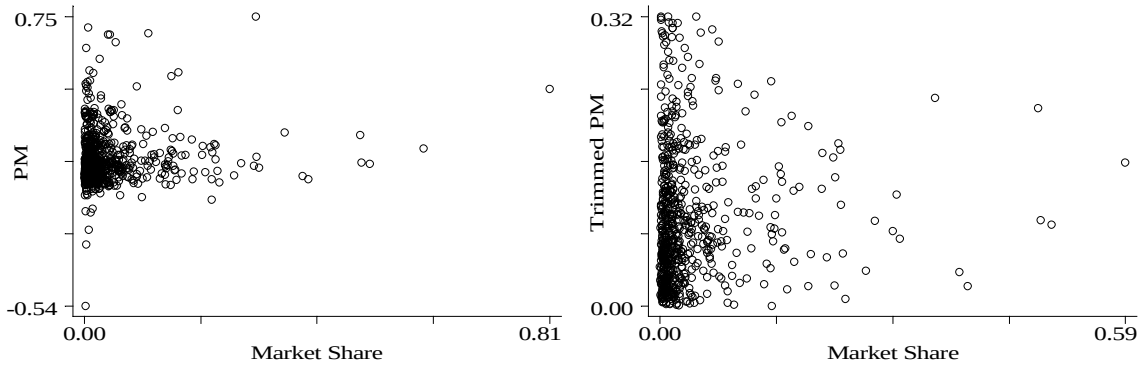
Appendix 2 Histograms



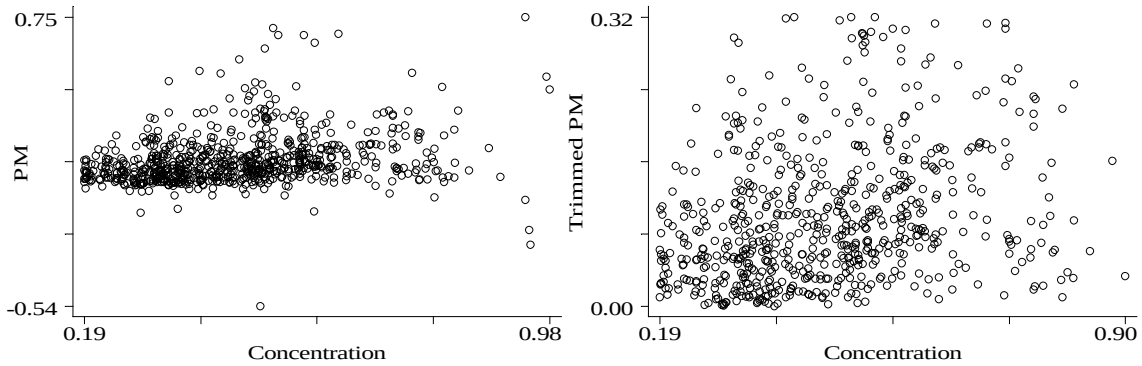
Appendix 3 Plots against EBDIT margin (PM)

Each explanatory variable has two graphs against the EBDIT profit margin (PM). The left hand plot is the full sample, the right hand plot trims both distributions at the 5th and 95th percentile.

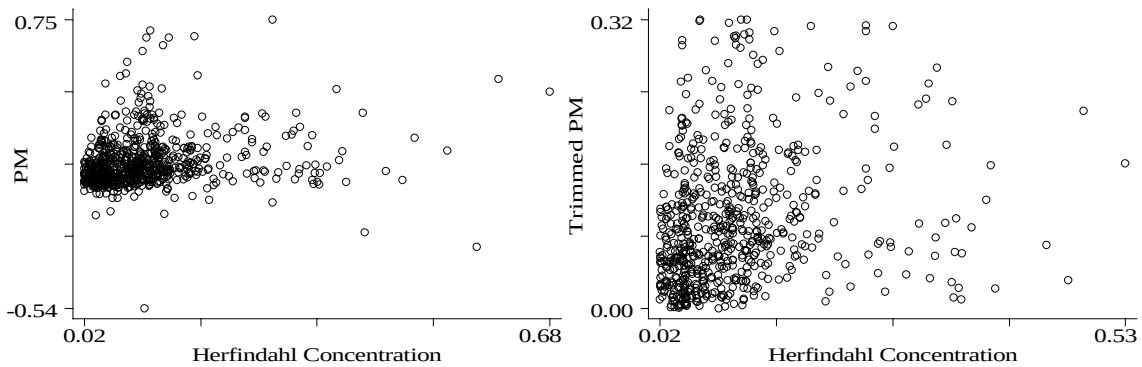
Market share



Concentration (4-firm)

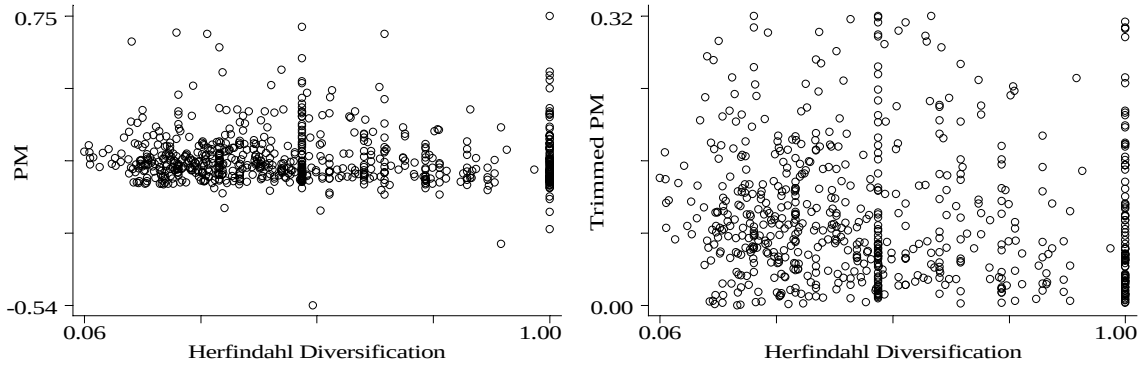


Concentration (Herfindahl)

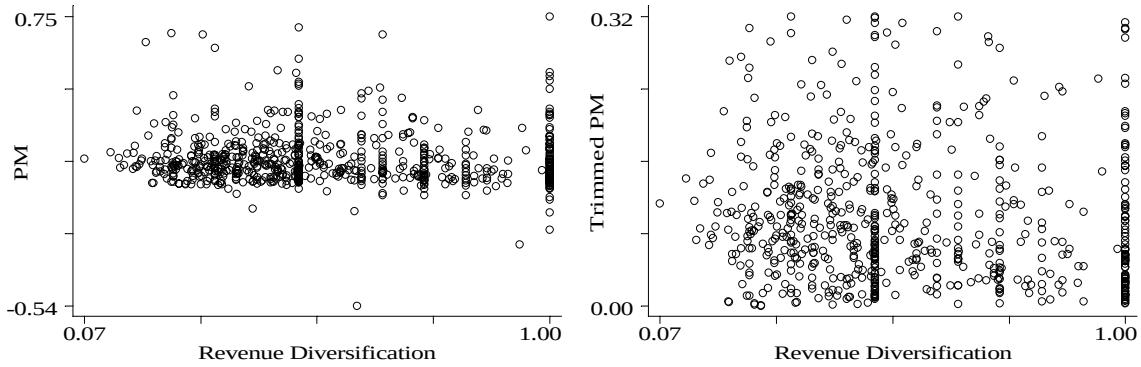


Appendix 3 cont.

Diversification (Herfindahl)



Diversification (specialisation ratio)



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