The Effect of Diversification on Firm Performance*

Mark Rogers
Harris Manchester College
The University of Oxford

and

Melbourne Institute of Applied Economic and Social Research
The University of Melbourne

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Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
***Telephone* (03) 8344 3701**
***Fax* (03) 8344 5630**
***Email* melb.inst@iaesr.unimelb.edu.au**
***WWW Address* http://www.melbourneinstitute.com**

Abstract

This paper analyses the association between diversification and firm performance in a sample of up to 1449 large Australian firms (1994 to 1997). Firm performance is measured by profitability and, for quoted firms, market value. Results from the full sample show that more focused firms have higher profitability. This result controls for firm specific effects and other determinants of profitability. However, this association is not found in sub-sample regressions for listed firms. This is true both when either profitability or market value are used as a performance measure. The results may indicate that listed firms may be under closer scrutiny and competitive pressures that ensure, on average, that these firms are at their optimal degree of diversification.

Keywords: diversification, performance, firm.

J.E.L. Classification: L10, L22

Contents

1. Introduction

This paper analyses the effect of diversification on the performance of large Australian firms, where performance is measured by using data on profitability and market value. The measures of diversification are derived from financial data on the different ‘segments’ or markets in which firms operate. The argument that firms may over-diversify is not new. Peters and Waterman (1982) argued that many US firms in the 1960s and 1970s failed to ‘stick to their knitting’ and those that focused on key competencies had higher performance. The issue of focus is also highlighted in the Australian context by Ruthven (1994). It seems difficult to refute the argument that *some* firms may over diversify, if only because strategic mistakes will occur. This paper is not concerned with identifying firms that have diversified too much or too little. Instead the aim is to uncover any evidence of an average relationship between diversification and performance in a large sample of firms.

Why might there be interest in any diversification-performance relationship at an aggregate level? Suppose it was found that more diversified firms, on average, perform better. This would suggest that synergies exist, either on the production or sales side of the firm, which raise profits. Thus, the decision to diversify, made by the managers of the firm, appears to have a rational, profit seeking basis. This might be called the ‘performance’ view of diversification. In contrast, suppose it was found that more focused firms have higher performance. This suggests that, overall, firms somehow over-diversify. This might be called the ‘management discretion’ view. This result lends support for models that highlight the difficulty in aligning the manager’s incentives to that of the shareholders. It might also support a management consultant's oft held view that many firms make strategic errors.

The idea of many firms making the same strategic error so that the results can be found in large sample analysis is, perhaps, difficult to believe. Economists would generally prefer to assume that, on average, firms make optimal decisions, perhaps through a process of trial and error. If, on average, optimal decisions are made, then large sample analysis should uncover no diversification-performance link, with the ‘noise’ created by good and bad strategic decisions being subsumed in the random term in a regression. This argument rests on the assumption that firms optimise the measures of performance used in the analysis. The presence of competitive forces may increase the likelihood of finding no diversification-performance relationship.[1] For example, managers who try to pursue a growth strategy at the expense of profits would feel the threat of takeover or job loss in a competitive environment. If competitive forces are strong, even the performance-based view of diversification is under threat: if diversification synergies exist, other firms are able to compete away rents, either through diversification of their own or other avenues.

These ideas provide some motivation for the subsequent analysis. In short, if Australian firms are profit seeking, and markets are highly competitive, no diversification-performance relationship at the aggregate level is expected to be found. In reality, however, this hypothesis is too general. The analysis needs to be refined to control for other factors that may create performance differences across firms. Equally, the analysis considers listed (quoted) firms separately from other firms, on the basis that listed firms may be subject to greater market forces and scrutiny.

The structure of the paper is as follows. Section 2 considers some of the previous theoretical and empirical research into diversification and performance. Section 3 looks at the data for the analysis, which comes from the IBIS database for the years 1994 to 1997, with up to 1449 firms included in some regressions. Section 4 discusses the empirical model, and section 5 presents the regression results.

2. Background

2.1. Reasons for diversification

A simple way of thinking about the reasons for diversification is to group explanations under two headings: ‘performance’ based arguments, and ‘management discretion’ arguments. The former includes a range of arguments about why more diversified firms may enjoy lower costs or higher profits as the result of synergies in production, distribution, marketing, research or other activities. Essentially, these arguments assume firms make optimal decisions, hence diversified firms should exist due to some advantage. Empirical research has shown, however, that diversified firms do not appear to perform better. Moreover, analysis of merger activity generally finds

[1] This is the argument that firms that choose not to maximise profits will be forced to close, or change strategy, in a competitive market (Alchian, 1950, Friedman, 1953; see Hodgson, 1993, for a critique).

that post-merger firms perform poorly.[2] These results fit more neatly with the management discretion arguments, which assume that managers may have non-performance based objectives, such as the growth of revenue, that lead firms to become diversified.

Many performance-based arguments arise out of the theoretical work on transaction costs (Teece, 1980, 1982, and Williamson, 1975). Transactions cost theory points out that some transactions may be costly to carry out through the market, hence firms may merge (or grow) to internalise these. A basic example is when a machine has multiple outputs and its level of output is high (relative to market size). The firm may choose to diversify into the new market, avoiding the transactions costs of sub-leasing its machine. Other examples include excess capacity in certain ‘know-how’ or ‘competencies’ belonging to the firm (see discussions by Stimpert and Duhaime, 1997, or Dess, *et al*, 1995). Again, the firm could, in theory, sell excess capacity to another firm, however, the very nature of knowledge may make this impossible or costly. These types of issues suggest the existence of a multi-product, or diversified firm, which uses its specific know-how in a number of different markets. Assets such as a distribution system or ‘reputation’ may also provide a rationale to diversify. Lastly, some argue that imperfect external capital markets provide a rationale for firms to diversify, pool cash flows, and self finance new projects. In summary, the presence of transactions costs implies that firms may diversify to exploit certain synergies that are too costly to be exploited via the market mechanism.

Another issue that relates to diversification arises from research into multi-market contact and market power. If two firms compete in more than one market this may influence the nature of competition between the two firms. In particular, firms that compete in more than one market are able to ‘learn’ strategies faster, which may in turn raise profitability.[3] Equally, mutual involvement in more than one market may increase the incentives to cooperate rather than ‘cheat’. These ideas suggest that diversification may be associated with higher profitability, and that a rationale for

2 Martin (1993) states “Empirical evidence suggests that firms involved in mergers suffer reductions in market share and profitability compared with similar firms that are not involved in mergers”.

3 Scott (1993, p.27) states, “in the context of multiperiod games with a 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”.

diversification might be to match the multi-market presence of competitors. Thus, firms may exhibit 'strategic congruence' as they match each other's market presence (Scott, 1993).

Some authors argue that firms may attempt to diversify as a means of reducing risk. Merging with another firm, or diversifying into another industry, can lead to a reduction in risk as long as the profit streams from different activities are not perfectly correlated (where risk is measured by the variance of profit relative to mean profit). In general, an inverse relationship between risk and (mean) profitability might be expected, hence more diversified firms might exhibit lower profits. However, some authors refer to the fact that more diversified firms can access lower cost finance (Scherer, 1980) which reduces their costs and can boost profitability. This argument has links to how financial markets operate: if agents can pool risks by investing in a portfolio of firms, finance costs might not be linked to the extent of diversification. In particular, if the shares of two, currently separate, firms are traded, an investor could achieve any risk reduction independently (by investing in both firms), and there is no need for the two firms to merge *for risk related reasons*. 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).

Management preferences may promote firm growth or other objectives rather than profitability, since diversification allows for faster growth than is possible by increasing market share, or benefiting from demand increases, in a single market (Marris, 1966). This would create a potential conflict with the interests of the shareholders but some argue that some managers have enough discretion to pursue such strategies. Also, some researchers argue that diversification is used as an escape route for firms in declining and low profit industries (Rumelt, 1986).

2.2. Empirical studies on diversification

Empirical studies on diversification use a range of performance measures including accounting based profit measures, Tobin's q (the ratio of market to book value) and share price. Data on diversification are often provided in firms' accounts. These data can be used to construct various metrics, for example the specialisation ratio of the Herfindahl measure (see Table 1). The results from empirical studies are inconclusive

(Lang and Stulz, 1994, p. 1249). Lang and Stulz (1994), in their empirical work on market value and diversification for US firms over 1978 to 1990, find that diversified firms have lower market values than focused firms. This, they suggest, is consistent with the hypothesis that low performing firms tend to diversify to try and improve on performance. However, the result is based on cross sectional associations. When they analyse *changes* in a firm's market value and *changes* in its level of diversification they find no association. Recent Australian empirical work has used the IBIS data base (as does this paper, see section 3). Bosworth *et al* (1997) use data for 1989 to 1994 and a Herfindahl measure of diversification. Using a fixed effects panel estimator, they find that more focused firms have higher profitability. This result uses a sample that excludes loss-making firms.[4] Feeny and Rogers (1999), using simple OLS, again find that more focused firms have higher profitability if the sample excludes loss-making firms.

In some cases researchers augment financial data with case studies to distinguish between 'related' or 'unrelated' diversification (as defined to a firm's core activities or capabilities). This has obvious links to the transaction cost theory with the presumption that only related diversification can be beneficial (Rumelt, 1986). The data available for this study cannot make such distinctions. Instead, basic measures of diversification are analysed to detect aggregate relationships. This, of course, does not deny that some firms may have highly profitable 'related' diversification, but the analysis aims to detect overall relationships across all firms.

Table 1: Empirical measures of diversification

Name	Formula	Description
Herfindahl	$\sum_i \left(S_i / \bar{S} \right)^2$	Sum of squares of segment revenue shares Varies between 0 and 1 (for a fully focused firm)
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.

4 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.

2.3. Other determinants of firm performance

The extent of diversification is only one factor that may influence firm performance. A range of other macroeconomic, industry and firm-level factors are also important. Historically, economists have focused on industry level variables using the structure-conduct-performance (SCP) framework. This stresses the role of industry concentration and a firm's market share, since higher levels of both could be (theoretically) linked to higher profitability. The SCP framework also highlights the role of barriers to entry. High barriers to entry, perhaps caused by high expenditure on advertising or product differentiation, may allow higher profits to be maintained as potential competitors fail to enter the industry.[5] Barriers to entry also include barriers to imports such as tariffs or other forms of protection. Researchers have also investigated whether union power affects firm profitability (MacDonald, 1999, using IBIS data, finds that higher union density reduces profitability). Economists have also modelled the idea of profit persistence, where a 'shock' to a firm's profits may take several years to dissipate (Geroski and Jacquemin, 1988, Goddard and Wilson, 1999).

Case studies on firm performance are common in the management literature. Kay (1993) considers superior firm performance arising from four distinctive capabilities that are both appropriable and sustainable. These capabilities are 'architecture' (the complex, unique set of relationships within and external to a firm), reputation, innovation and strategic assets (e.g. ownership of key resources, monopoly position). The first two capabilities are difficult to measure empirically and, as a result, have been largely absent from many empirical studies.[6] Empirical studies on the link between innovation and performance are more widespread, with R&D, patents or counts of innovation being used as (imperfect) measures of innovativeness (Hall, 1993, Geroski *et al*, 1993, Bosworth and Rogers, 1998). Empirical studies also investigate other possible determinants, for example, ownership structure of the firm (Himmelberg *et al*, 1999), strategic direction (Bart and Baetz, 1998) and size of board (Eisenberg et al, 1998).

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[5] The SCP framework is discussed in more detail in Feeny and Rogers (1999) and in textbooks such as Martin (1993).

[6] Barth et al (1998) do analyse reputation indirectly by using data on brand valuation and market value.

3. Data

The firm-level data for the analysis come from the IBIS database, which contains financial information on medium to large Australian firms. A subset of the firms in the database provides segment-based information on industrial or international diversification. Since the focus of this paper is on diversification, only firms that report segment level data are used in empirical analysis. Australian accounting guidelines suggest that firms should report segment information where there exists a distinct component of the entity's operations which provides products or services to other entities outside the ownership group. The segment data, which are available for the period 1994 to 1997, include revenue, assets and profit. A segment can refer either to activities in a distinct industry, or activities in other countries. To construct the two measures of diversification shown in Table 1, segment information by industrial classification is used. There are concerns over how accurate these measures of diversification. In short, segment accounting data needs to be allocated to a 3-digit ANZSIC industry classification which is based on production similarities not product similarities. This classification procedure is desirable if diversification synergies exist on the production side, but may miss the issue if the synergies relate to, say, marketing. There is little that can be done about this issue in the large sample analysis undertaken here. Equally, there is no attempt to measure the 'relatedness' between industry classifications (i.e. a firm with segments in two separate industries within manufacturing would have the same diversification measures as a firm with one segment in manufacturing and one in the service sector). While it is possible to use the data to form weights for the 'relatedness' of industry codes, the weights used would be subjective; instead it is assumed that all the weights are the same. This is obviously an approximation and makes the empirics *less likely* to find significant associations within the data.

The data set forms an unbalanced panel of 4,388 observations over the period 1994 to 1997 (these data exclude government owned firms). The related balanced panel has 658 firms that appear in each year (2632 observations).

Firm performance is assessed using profitability measures and also market value (for those firms that are quoted on the Australian Stock Exchange). The two profitability measures investigated are the ratio of net profit before tax (NPBT) to total revenue and the ratio of 'earnings before depreciation, interest and tax' (EBDIT) to total income. EBDIT is not directly recorded in the data and is constructed by using the NPBT figure and adding back depreciation and interest expense. The correlation coefficient between these two ratios is 0.75 (unbalanced sample) and 0.73 (balanced sample).[7] Market value data are used as a forward-looking measure of firm performance since, in theory, a firm's market value reflects the expected stream of future profits. Tobin's *q* can be defined as the ratio of market value to book value of assets. Market value is defined as the sum of the total value of ordinary shares issued and long term liabilities.[8] Data on market value are only available from 1995, hence the panel is restricted to 1995 to 1997. The book value of assets includes both tangible and intangible assets. High values of *q* indicate that the firm is expected to generate relatively high profits from its asset base.

Table 2 shows the mean profitability by four categories of diversification. The table shows no clear association between diversification and profitability. In fact, the NPBT to revenue and EBDIT margin show different associations: the mean NPBT appears to rise with specialization whereas the EBDIT margin falls. Lower mean values for Tobin's *q* also tend to be associated with more diversification.

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[7] Theoretically the use of the EBDIT margin is generally preferred since it is closer to the concept of a 'price cost margin'. The EBDIT margin is calculated prior to any payments on borrowed capital, whether financed via interest payments on loans, or financed by retained earnings or equity. In contrast, NPBT has subtracted any interest payments but still includes payments for capital financed by equity or retained earnings. However, the EBDIT margin is prior to depreciation (the cost calculated by accountants for the fall in value of owned assets), whereas if the assets are leased, payments for their services have already been included in expenses. From an applied perspective, since EBDIT is derived, any inaccuracies in the data (eg. if a value for depreciation is omitted) may bias the sample (note that the observations for EBDIT are lower than NPBT due to missing values in the data). McDonald (1999, p.117) suggests that this issue makes NPBT a better measure.

[8] This ignores some types of preference shares and other securities, although the latter – for the market as a whole – are relatively unimportant (1% of entire market). Daily share price data are averaged to find the average market capitalisation over the year. Data are from the Securities Industry Research Centre of the Asia-Pacific, University of Sydney.

Table 2: Mean profitability in percent, by extent of diversification

	Unbalanced panel				Balanced panel			
Diversification	Obs	NPBT/ Revenue (%)	EBDIT/ revenue (%)	q	Obs	NPBT/ Revenue (%)	EBDIT/ revenue (%)	Q
High	486	6.48	9.82	0.65	363	6.80	9.95	0.69
Medium	870	5.94	8.95	0.66	589	6.52	9.50	0.65
Low	1,533	6.82	8.65	0.81	891	7.77	9.09	0.81
Focused	1,499	6.65	8.64	0.71	789	8.28	9.09	0.66

Note: NPBT, EBDIT and q refer to the percentage mean values of the ratios defined in the text. Note that the sample size for *q* is 278 observations for unbalanced and 177 for balanced. High diversification is defined as a specialization ratio(s) less than 0.3, medium as 0.3 <= s <0.5, low as 0.5 <= s <0.7, and focused as s>=0.7.

Table 3 shows mean of the standard deviation of firm level profitability over time by diversification category (i.e. the standard deviation of each firm's profitability is calculated for 1994 to 1997, then the mean across diversification categories is calculated). The balanced panel of firms shows an inverse relationship between diversification and standard deviation: diversified firms appear to have less overtime volatility in profitability. The unbalanced panel does not exhibit this association so clearly: while the 'high' and 'medium' categories of diversification have lower average standard deviations there is not a monotonic relationship. Table 4 summarises the other explanatory variables used in subsequent multivariate regression analysis.

Table 3: Standard deviation of profitability, by extent of diversification

	Unbalanced panel		Balanced panel	
Diversification	Standard deviation of NPBT/ Revenue (%)	Standard deviation of EBDIT/ revenue (%)	Standard deviation of NPBT/ Revenue (%)	Standard deviation of EBDIT/ revenue (%)
High	4.09	3.98	3.33	3.37
Medium	3.41	3.42	3.53	3.58
Low	5.29	5.71	5.54	5.96
Focused	5.30	5.23	5.97	6.00

Note: Figures show mean standard deviation of profitability by diversification category (where s.d. is calculated for each firm over the four year period). High diversification is defined as a specialization ratio(s) less than 0.3. Medium as 0.3 <= s <0.5, low as 0.5 <= s <0.7, and focused as s>=0.7.

Table 4 Variables used in analysis

Variable	Description	Mean	s.d.
Log of Total Assets	Total assets equals book value of tangible plus intangible assets	11.92	1.68
Capital intensity	Ratio of total assets to total revenue defined at parent level (proxy for potential barriers to entry)	1.94	3.78
Gearing	Ratio of long term liabilities to shareholders' funds	2.14	13.79
Market share	Weighted average of segment market shares	0.03	0.06
Concentration ratio	Weighted average of 4-firm concentration ratios faced by segments	0.44	0.15
Specialisation ratio	Ratio of non-core activities to total (core activity defined as segment with highest share of total revenue)	0.63	0.28
Herfindahl ratio	Sum of squares of segment revenue shares	0.58	0.30

Note: Mean and standard deviation are for the unbalanced sample. See Appendix 1 for more details.

4. Regression equation

As discussed in section 2, the determinants of firm performance are complex and a large range of firm characteristics have been theoretically and empirically investigated. Despite the fact that the data do not contain all the relevant variables, the panel nature of the data can be used to control for firm specific factors that are time invariant (for example, unmeasured advertising expenditure or innovation investment, or qualitative variables such as management quality or employee skills). Using *i* to index a firm and *t* a time period, the empirical specification can be written as

$$y_{it} = \lambda y_{it-1} + X_{it}\beta + \alpha_i + \gamma_t + u_{it} \qquad [1]$$

where y_{it} is the performance measure, $\mathbf{X}_{it}$ is a matrix of firm and industry characteristics, β the vector of coefficients, α_i is the firm specific effect, γ_t are time dummies and u_{it} is a random error component. Equation [1] includes the lagged value of the dependent variable which captures the idea that a performance shock may be persistent (if $\lambda \neq 0$).

Estimation of equation [1] is subject to a number of econometric issues. First, should the firm specific effect, α_i, be treated as random or fixed? Second, there is a concern that some of the **X** variables may be endogenous (e.g. that market share and profitability are simultaneously determined) which would again introduce bias in coefficient estimates. Third, if the lagged dependent variable is included, the panel nature of the model means that the standard panel estimators of λ are biased and inconsistent (see Baltagi, 1995, Chapter 8). These issues are dealt with when discussing the results.

5. Regression results

The regression analysis is divided into three sections. Initially, profitability is taken as the dependent variable and random and fixed effect estimators are used. In the second subsection a dynamic panel data estimator is used to allow for the persistence of profitability. Lastly, the market value of the firm is used as the dependent variable, which restricts the sample to quoted firms only.

5.1. Profitability

This section reports on analysis of the complete 4 years of data using random effects (RE) and fixed effects (FE) estimators. The dependent variable is the ratio of NPBT to total revenue. The explanatory variables are as shown in Table 4 and are assumed to be exogenous. In addition, the square of market share is included to allow for non-linearities in the influence of market share (see Feeny and Rogers, 1999). Table 5 shows the results from both RE and FE for a variety of different specifications for the coefficient on the diversification variable. Full results are shown in Appendix 2.[9]

The specifications shown in Table 5 are: (a) full sample, NPBT to revenue as the dependent variable, with the Herfindahl diversification measure (b) excluding profit ratios less than –0.3, (c) excluding negative profits[10], (d) full sample, using the specialisation ratio instead of the Herfindahl, (e) using the EBDIT margin as the dependent variable, (f) the sub sample of quoted firms using the NPBT ratio as the dependent variable (excluding NPBT ratios less than –0.3).

The results in Table 5 suggest that more diversified firms tend to have lower profitability or, equivalently, that more focus raises profitability. The RE estimates are more significant than the FE estimates. Equally, the magnitudes of the coefficients from estimates using the balanced panel tend to be greater. The last set of results

[9] For reference, the coefficients on other explanatory variables are broadly in agreement with prior studies using the IBIS data (see Feeny and Rogers, 1999).

[10] Firms with negative profit firms were excluded in Bosworth *et al* (1997).

refers to the sub sample of firms listed on the Australian stock market and shows less evidence of focus improving profitability – although the coefficient from the RE estimator for the balanced panel is significant (at the 5% level). Further investigation showed that, for the sub-sample of listed firms, excluding all negative profit companies caused no coefficients on diversification to be significant. Similarly, using the EBDIT margin results in all coefficients on diversification being insignificant except that from the RE unbalanced panel.

Table 5: Results for diversification from various random and fixed effects specifications

Specification	Random Effects	Fixed Effects	Random Effects	Fixed Effects
	Unbalanced		Balanced	
Full Sample, Herfindahl	0.023*	0.018	0.047**	0.021
	(2.17)	(1.25)	(3.99)	(1.25)
Exclude d.v. < -0.3, Herfindahl	0.029**	0.021*	0.030**	0.018
	(4.29)	(2.20)	(3.57)	(1.71)
Exclude d.v. < 0, Herfindahl	0.033**	0.025**	0.023**	0.014
	(5.49)	(3.09)	(3.10)	(1.66)
Full sample, specialization ratio	0.021	0.02	0.043**	0.023
	(1.89)	(1.38)	(3.49)	(1.31)
Full sample, EBDIT margin as d.v., Herfindahl	0.038**	0.031*	0.060**	0.037*
	(3.44)	(2.08)	(4.60)	(2.12)
Quoted firms, NPBT as d.v., < -0.3, Herfindahl	0.022	0.018	0.031*	0.021
	(1.48)	(0.82)	(1.94)	(1.02)

Notes: d.v. = dependent variable. Full regressions results in Appendix 2. The t-statistics are shown in brackets under coefficient, a ** indicates significant at the 1% level, a * at the 5% level.

The criteria for selecting the RE or FE model is often based on whether cor(α_i, X) =0. If this is the case the RE estimator is consistent and efficient, if not the RE model is inconsistent. A Hausman test can be used to investigate this issue and, for both the balanced and unbalanced panel, the null hypothesis that cor(α_i, X)=0 cannot be accepted. This suggests that the FE model is preferred. However, the test assumes that the model is free of other misspecifications. In particular, in the current context, measurement error may be an issue. In a simple OLS estimation, the presence of measurement error causes coefficients to be biased towards zero. In the case of a FE estimator, the presence of measurement error will bias the coefficient even further (if the explanatory variable is correlated over time) (Johnston and DiNardo, 1997). Since the diversification variable is constructed from segment information that suffers from a number of limitations, measurement error is a concern (see Appendix 1 for further details). Given this, the coefficient on diversification in the FE regression may be biased towards zero and, in general, the RE model may be preferred.

5.2. Dynamic panel model and instrumental variables

Equation [1] includes a lagged dependent variable to capture the idea of profit persistence after a profit shock. As is well known, the FE and RE estimators are biased in this case since the error term is correlated with the lagged dependent variable. Various consistent estimators are available (see, for example, Baltagi, 1995, Chapter 8), here a generalized method of moments (GMM) estimator is used. Intuitively, the presence of the lagged dependent variable implies the use of instruments. Arellano and Bond (1991) provide a GMM estimator where the number of instruments rises over time (*i.e.* all the lagged values of variables can be used as instruments, not just the previous period value).

The GMM estimator is based on a first difference transformation (which removes the firm specific effects), which means that one time period is lost from the data. In addition, the presence of the lagged dependent variable means that the panel would be reduced by a further year. Given this, additional data on the profitability of IBIS firms for 1992 and 1993 were merged with the four years of data on other variables, allowing a three year panel to be used. Table 6 shows the results from using a balanced panel that excludes firms with high negative NPBT to revenue ratios (firms with ratios less that -0.3).

The first regression in Table 6 assumes all other explanatory variables apart from the lagged dependent variable are exogenous. The second column assumes all the explanatory variables are endogenous. The coefficient on the diversification variable is not significant in either regression. To check this result, various other specifications were tested including: using an unbalanced panel, altering which variables are endogenous, and restricting the sample to non-finance and solely manufacturing firms. These alternative specifications confirmed that the dynamic panel model does not show evidence of an association between diversification and profitability. As in the previous results for the FE estimator, these results may be due to measurement error affecting the results.

The coefficients on lagged profitability are significant only in the first regression. The coefficient's magnitude (0.09) is low in comparison with other studies. Goddard *et al*, 1999, present a summary of previous studies that found the coefficient to be between 0.2 and 0.5; MacDonald, 1999, for Australian manufacturing firms (1984-1993) finds a coefficient of 0.4. However, most of the other studies only consider manufacturing firms. Restricting the sample here to contain only manufacturing firms raises the coefficient to around 0.25. In fact, a sample that excludes only finance firms has a coefficient of around 0.35.

Table 6: Dynamic panel specification

Dependent variable: NPBT / Total revenue (defined as ratio)

Explanatory variable	GMM Exogenous	GMM Endogenous
Lagged dependent variable	0.090	0.081
	(2.47)	(1.45)
Diversification (Herfindahl)	0.012	-0.014
	(1.42)	(-0.47)
Log of assets	0.013	-0.015
	(2.28)	(-0.67)
Capital intensity	-0.005	-0.002
	(-1.21)	(-0.258)
Gearing	-0.000	-0.000
	(-8.83)	(-4.23)
Market share	-0.275	-0.415
	(-3.36)	(-1.34)
Square of market share	0.397	0.672
	(3.21)	(1.30)
Concentration (4 firm)	-0.023	-0.019
	(-1.10)	(-0.33)
Number of firms	537	537
Observations	1611	1611
Sargan test	0.07	0.58
Year dummies	Yes	Yes

Notes: Coefficients and t-statistics are from the 2-step GMM estimator. The ‘exogenous’ column refers to a GMM estimator that assumes all explanatory variables apart from the lagged dependent variable are exogenous. The ‘endogenous’ column assumes that all variables are endogenous. The Sargan test is a test of over-identifying restrictions, with the null hypothesis of the validity of the instruments. Tests on the serial correlation of the errors show no signs of serial correlation (which is essentially for the consistency of the estimators). The estimators are implemented by the OX/DPD software package (Dornik et al, 1999).

5.3. Market value and diversification

Another approach to analysing firm performance is to use data on the share market value of firms. This analysis can only be conducted for those firms that are quoted on the Australian Stock Exchange. As discussed in section 3, data are only available for the 1995 to 1997 period.

The theoretical framework used for this section is based on the Tobin q approach. This approach essentially considers that the market value of the firm is related to the value of tangible and intangible assets. Hall (1998) provides a summary of the theory. In short, most applied studies follow Griliches (1981) in assuming that the market value (V) of the firm is given by

$$V = q(A + \gamma K)^{\sigma} \quad [2]$$

where A is the stock of tangible assets of the firm, K is the stock of intangible assets, q is the 'current market valuation coefficient' of the firm's assets, σ allows for the possibility of non constant returns to scale, and γ is the shadow value of intangible assets to tangible assets (i.e. $\frac{\partial V}{\partial K} \Big/ \frac{\partial V}{\partial A}$).[11] In general, q may vary across firms and time

$$q_{it} = \exp(m_i + d_t + u_{it}) \ , \quad [3]$$

where m_i is a permanent firm effect, d_t is the market effect at time t, and u_{it} is an independently distributed error term. Hence the term q allows for the fact that the market valuation may vary across firms and time, and that there may also be "noise" in such valuations.

Equations [2] and [3] can be rearranged to yield the empirical specification (using the approximation $\log(1+\varepsilon)\approx\varepsilon$)[12]

[11] It might appear that equation [1] is an identity. This would be the case if A and K were measured by their true value – in which case the parameters q, χ and σ would be one. However, the magnitudes of A and K are based on accounting methods which do not necessarily correspond to economic value.

[12] The accuracy of this approximation depends on the value of ε – in this case K/A - being close to zero. This may not be the case for some firms and is, perhaps, increasingly less likely to hold as the role of intangible assets increases.

$$\log V_{it} = m_i + d_t + \sigma \log A_{it} + \sigma\gamma \frac{K_{it}}{A_{it}} + \beta X + u_{it} \qquad [4]$$

where X is any additional explanatory variables. The addition of X is ad hoc, but the existing literature has investigated variables using this method (for example, growth of sales, Hall, 1993, technological appropriability, Cockburn and Griliches, 1988, and diversification, Lang and Stultz, 1994). This is the approach adopted here with the diversification variable entered in addition to year dummies. Intangible assets (*K*) are proxied here by R&D and the book value of intangible assets.

The results shown in Table 7 show that the Herfindahl measure of diversification has no significant association with market value in either RE or FE models, or in balanced or unbalanced samples. The other coefficients in Table 7 are similar to prior results using IBIS data (see Bosworth and Rogers, 1988). To check this result other specifications were tested: the specialization ratio was used instead of the Herfindahl measure; additional explanatory variables were added; the sample was restricted to non-financial and solely manufacturing firms; and firms with negative profits were excluded. None of these alternative specifications provided any support for a significant association of diversification and market value.

The lack of any significant association between market value and diversification is in keeping with Lang and Stultz (1994) who find no link between changes in diversification and market value for US firms. Further the result suggests either (i) that share markets fail to anticipate actual performance differences, or (ii) that no relationship exists for the sub sample of listed firms. The latter is given support from the results in section 5.1 which showed that the link between diversification and profitability was weaker in the sub-sample of listed firms. This, in turn, leads to the possibility that the threat of takeover and, more generally, the increased scrutiny of listed firms forces optimal decisions about diversification.

Table 7: Market value regressions
Dependent variable: log of market value

Explanatory variable	Random Effects	Fixed Effects	Random Effects	Fixed Effects
	Unbalanced		Balanced	
Diversification (Herfindahl)	-0.099	-0.226	-0.039	-0.246
	(-0.80)	(-1.61)	(-0.28)	(-1.63)
Log of tangible assets (A)	0.966	0.592	1.013	0.626
	(32.37)	(6.63)	(33.73)	(6.96)
R&D / A	2.803	0.377	0.992	-1.358
	(2.94)	(0.23)	(0.73)	(-0.83)
Book value of intangibles / A	0.449	0.589	0.356	-0.032
	(3.33)	(3.20)	(2.03)	(-0.10)
Dummy for 1996	-0.103	-0.161	-0.118	-0.2
	(-3.03)	(-4.47)	(-3.27)	(-5.45)
Dummy for 1997	-0.031	-0.081	-0.065	-0.118
	(-1.05)	(-2.66)	(-1.86)	(-3.49)
Observations	278	278	177	177
Hausman test	0.00		0.00	
Industry dummies	Yes		Yes	
R^2 (adjusted)		0.99		0.99

Notes: The Hausman test row shows the probability value from a test of the null that the RE model is correct.

6. Conclusions

This paper has investigated the role of diversification on firm performance using a variety of different samples, estimators and measures of performance. The overall aim is to uncover any evidence on the diversification-performance link in large sample analysis. The measures of diversification used here are general in nature, based on segment reporting in company accounts. Although these types of diversification measures provide an imperfect metric, they are unlikely to introduce any systematic bias into the analysis. As stated in the introduction, if firms are profit seeking, and there is intense competitive, we might expect to find no relationship between diversification and performance.

Using profitability as the measure of performance, random effects (RE) and fixed effects (FE) estimators tended to find that more focused firms had higher profitability in the full sample of firms. This result was strengthened when firms with negative profits are excluded from the analysis. However, this relationship is largely non-existent for the sub-sample of firms listed on the Australian stock market.

While the FE and RE models control for firm specific effects they do not control for possible endogeneity of the explanatory variables, or allow for dynamic adjustment of profitability after a profit shock. These issues were tackled in section 5.2. The results were inconclusive, with no significant coefficients on the measure of diversification. How important might the potential endogeneity between diversification and profitability be? High profit firms might have the funds to diversify, however, the literature also claims that low profitability firms may diversify to obtain greater profit potential. Thus, the impact of profits on diversification is unclear. Moreover, these feedbacks are likely to occur over time rather than contemporaneously. These considerations imply that the basic FE and RE models, which assume exogeneity, can still be valued. Moreover, the inconclusive results from the dynamic panel models may point to measurement error being a problem and not endogeneity.

Section 5.3 uses the market value of the firm as a performance measure. Market value is an indication of the expected future profits of a firm, hence it is potentially a useful measure. Random and fixed effects models using market value fail to find any link between diversification and market value. Care should be taken in interpreting this result since market value, by definition, reflects the expectations of the market. The presumption that the market is correct in its expectations may be questioned. Equally, the market may incorporate expected changes to diversification in advance, hence an empirical analysis on the contemporaneous changes (over a year) of market value and actual diversification shows no association. Lastly, it may be quoted firms are under closer scrutiny and a greater threat from competitive forces (including takeover), hence sub-optimal diversification strategies are short lived.

In summary, the finding that it is only in the full sample that more focused firms are more profitable suggests three possible explanations: (a) low profitability firms diversify in search of higher profits (with profits suffering further as this strategy is undertaken), (b) firms view diversification as a means to reduce risk and accept lower mean profitability as a result, or (c) management preferences for growth or other objectives cause some firms to diversify. The lack of any diversification-performance association in the market value regressions, and the weaker diversification-profitability association found in the sub-sample of listed firms, indicates that the management of quoted firms may be under more scrutiny or competitive pressures, hence it may be that (c) is more likely.

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Appendix 1 Definitions

Variable	Description
Market share	Weighted average of segment market shares
Concentration ratio	Weighted average of 4-firm concentration ratios faced by segments
Herfindahl diversification	Herfindahl diversification measure based on segment data (defined in Table 1)
Specialisation ratio	Ratio of non-core activities to total (core activity defined as segment with highest share of total revenue)

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. 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. In summary, the diversification measures are the best that can be constructed from the data, however, measurement error is likely to occur for a number of reasons: subjectivity in accounting for segments by firms and their auditors, subjective allocation of ANZSIC classification by IBIS staff, the fact that ANZSIC classifications are not a perfect indicator of 'markets', and the process of creating 'economic segments'.

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 Regressions results from alternative specifications (section 5.1)

Specification	(a) NPBT full sample				(b) Excludes negative NPBT ratios				(c) Excludes NPBT ratios < -0.3			
Explanatory variable	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed
	Unbalanced		Balanced		Unbalanced		Balanced		Unbalanced		Balanced	
Diversification	0.023	0.018	0.047	0.021	0.033	0.025	0.023	0.014	0.029	0.021	0.03	0.018
	(2.17)	(1.25)	(3.99)	(1.25)	(5.49)	(3.09)	(3.10)	(1.66)	(4.29)	(2.20)	(3.57)	(1.71)
Log of assets	0.026	0.077	0.035	0.077	0.011	0.001	0.008	-0.007	0.014	0.006	0.011	0.002
	(7.58)	(8.40)	(9.50)	(6.94)	(5.47)	(0.13)	(2.39)	(-1.17)	(6.49)	(0.97)	(3.68)	(0.30)
Capital intensity	-0.013	-0.028	-0.022	-0.037	0.002	0.004	0.004	0.004	0.002	0.003	0.005	0.002
	(-12.30)	(-17.93)	(-14.57)	(-20.98)	(3.10)	(3.41)	(3.69)	(2.84)	(2.70)	(1.83)	(3.56)	(1.21)
Gearing	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(-1.67)	(-1.39)	(-1.43)	(-1.25)	(-2.52)	(-0.33)	(-1.01)	(0.77)	(-3.18)	(-1.65)	(-2.04)	(-1.16)
Market share	-0.426	-0.385	-0.782	-0.443	-0.316	-0.189	-0.252	-0.141	-0.339	-0.225	-0.273	-0.146
	(-3.32)	(-2.29)	(-5.61)	(-2.23)	(-4.45)	(-2.06)	(-2.54)	(-1.26)	(-4.20)	(-2.03)	(-2.81)	(-1.21)
Square of market share	0.689	0.626	1.092	0.733	0.453	0.280	0.394	0.260	0.531	0.372	0.428	0.295
	(2.87)	(2.23)	(4.22)	(2.28)	(3.50)	(1.85)	(1.96)	(1.17)	(3.46)	(2.00)	(2.55)	(1.54)
Concentration (4 firm)	-0.044	-0.061	-0.057	-0.120	-0.031	-0.033	-0.052	-0.055	-0.042	-0.043	-0.058	-0.067
	(-1.71)	(-1.89)	(-1.94)	(-3.10)	(-2.11)	(-1.78)	(-2.91)	(-2.79)	(-2.58)	(-2.02)	(-2.83)	(-2.78)
Number of observations	4388	4388	2632	2632	3778	3778	1796	1796	4349	4349	2488	2488
Industry Dummies / Year dummies	Yes/Yes	No/Yes	Yes/Yes	No/Yes	Yes/Yes	No/Yes	Yes/Yes	No/Yes	Yes/Yes	No/Yes	Yes/Yes	No/Yes
Hausman Test	0.00		0.00		0.00		0.00		0.48		0.00	
R-sq (adjusted)		0.58		0.52	--	0.80	--	0.88		0.68		0.73

Appendix 2 Regressions results from alternative specifications (section 5.1)

Specification	**(d)** Specialisation ratio				**(e)** EBDIT margin as d.v.				(f) Quoted firms only, NPBT, exc. <-0.3			
Explanatory variable	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed	Random	Fixed
	Unbalanced		Balanced		Unbalanced		Balanced		Unbalanced		Balanced	
Diversification	0.021	0.020	0.043	0.023	0.038	0.031	0.060	0.037	0.022	0.018	0.031	0.021
	(1.89)	(1.38)	(3.49)	(1.31)	(3.44)	(2.08)	(4.60)	(2.12)	(1.48)	(0.82)	(1.94)	(1.02)
Log of assets	0.026	0.077	0.034	0.077	0.029	0.096	0.040	0.091	0.005	-0.003	0.005	0.008
	(7.51)	(8.41)	(9.30)	(6.94)	(8.24)	(10.40)	(9.43)	(8.00)	(0.97)	(-0.20)	(1.01)	(0.62)
Capital intensity	-0.013	-0.028	-0.021	-0.037	-0.013	-0.036	-0.031	-0.041	0.035	0.024	0.031	0.018
	(-12.26)	(-17.95)	(-14.52)	(-21.00)	(-11.70)	(-21.99)	(-19.80)	(-22.67)	(13.21)	(4.85)	(10.37)	(3.64)
Gearing	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.019	-0.013	-0.016	-0.006
	(-1.66)	(-1.39)	(-1.43)	(-1.24)	(-0.87)	(-0.34)	(-0.25)	(-0.08)	(-9.86)	(-4.02)	(-6.99)	(-1.70)
Market share	-0.417	-0.386	-0.760	-0.442	-0.367	-0.428	-0.690	-0.440	-0.161	-0.381	-0.262	-0.406
	(-3.26)	(-2.30)	(-5.47)	(-2.23)	(-2.79)	(-2.50)	(-4.51)	(-2.14)	(-1.05)	(-1.81)	(-1.62)	(-1.92)
Square of market share	0.677	0.625	1.065	0.730	0.625	0.687	0.935	0.751	0.296	0.578	0.404	0.576
	(2.82)	(2.22)	(4.11)	(2.28)	(2.54)	(2.42)	(3.45)	(2.29)	(1.19)	(1.90)	(1.66)	(2.01)
Concentration (4 firm)	-0.044	-0.061	-0.059	-0.120	-0.043	-0.078	-0.093	-0.143	-0.087	-0.036	-0.056	-0.016
	(-1.71)	(-1.91)	(-1.99)	(-3.10)	(-1.61)	(-2.34)	(-2.86)	(-3.55)	(-2.48)	(-0.76)	(-1.50)	(-0.34)
Number of observations	4388	4388	2632	2632	4265	4265	2597	2597	1231	1231	932	932
Industry Dummies / Year dummies	Yes/Yes	No/Yes	Yes/Yes	No/Yes	Yes/Yes	No/Yes	Yes/Yes	No/Yes	Yes/Yes	No/Yes	Yes/Yes	No/Yes
Hausman Test	0.00		0.00		0.00		0.00		0.00		0.00	
R-sq (adjusted)	--	0.58	--	0.52	--	0.68	--	0.67		0.71		0.73

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