Modelling the Extent of Financial Reporting Practices amongst Australian Manufacturing SMEs

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ABSTRACT. This paper describes an exploratory study of financial reporting practices amongst small and medium-sized enterprises (SMEs) engaged in manufacturing in Australia. Non-linear principal components analysis is employed in empirical derivation of an overall measure of the comprehensiveness of financial reporting practices undertaken in the SMEs investigated. Non-linear principal components analysis is also used in empirically capturing the business context in terms of enterprise and financial management characteristics. Polytomous logistic regression modelling reveals development orientation, extent of owner-management, technological complexity, degree of reliance upon external financial advice, and the financial reporting climate to be the most significant influences on the extent of financial reporting practices in the SMEs under study. Of the business context factors identified, development orientation and financial reporting climate seem to have greatest impact. The study appears to reinforce the impression that SME growth is a key driver towards more sophisticated financial reporting practices. Alternately, better financial reporting may be viewed as an important enabling factor in realising the growth aspirations of such concerns.

1. Introduction

This paper describes a study involving exploratory modelling of financial reporting practices amongst small and medium-sized enterprises (SMEs) engaged in manufacturing in Australia. The study attempts to extend prior research with similar objectives, including an investigation detailed in a previous paper by the present author and his colleagues (McMahon et al., 1994). Of broad concern is the extent to which, if at all, the financial reporting practices of SMEs change as they experience growth and progress from one stage of development to another. The factors which appear to lead to such changes are of particular interest.

An early attempt to investigate these matters is reported by Hutchinson et al. (1975), Ray (1980a, 1980b), Hutchinson et al. (1981), Ray and Hutchinson (1983, 1985) and Hutchinson and Ray (1986). This study produced evidence on the manner in which financial reporting systems and practices appear to change in a small sample of SMEs as a result of experiencing rapid growth. It also attempted to contrast these circumstances with those in a matched sample of non-growth concerns. For rapid growth SMEs, there was a tendency towards more frequent historical financial reporting as they grew. However, there was no significant difference between this pattern and that for historical financial reporting by the matched sample of non-growth concerns. For rapid growth SMEs, there was also a tendency towards more frequent future-oriented financial reporting as they grew. However, there was a dramatic contrast between this pattern and that for future-oriented financial reporting by the matched sample of non-growth concerns. Non-growth SMEs prepared little more than annual forecasts for profit and loss items.

This research establishes support for the broad proposition that SME growth results in increased financial challenges or problems, and that there is consequently a greater need for careful attention to financial management in general, and financial reporting in particular, if the growing SME is to succeed in survival and performance terms. On the basis of the findings, an empirically supported case is made that improved financial

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control in growing SMEs can and should come about through (*inter alia*) a significant upgrading of their financial reporting and analysis systems:

- In order to monitor financial position and performance, there is a need for timely and relevant financial statements reflecting what has been achieved.
- To effectively plan for the business's future, there is a need for regular forecasted financial statements.

Thus, a more sophisticated financial reporting system is necessary to ensure that an SME's economic resources are used effectively and efficiently in pursuit of its goals. It also follows that there is a particular need in growing SMEs for the skills of financial analysis which will allow financial statements to be read and understood, whether they contain historical or forecast information.

The paper proceeds by first reviewing recently available empirical evidence on modelling of financial reporting practices amongst growing SMEs. The research data and method employed in the study are then briefly described. Empirical derivation of an overall measure of the comprehensiveness of financial reporting practices undertaken in the SMEs investigated is subsequently detailed. Similar empirical derivation of compound measures capturing the business context in terms of enterprise and financial management characteristics is outlined. Thereafter, an attempt is made to ascertain which business context characteristics seem most influential upon the comprehensiveness of financial reporting practices adopted by SMEs in the study sample. The paper closes with a summary of findings and conclusions arising from the research.

2. Previous research

This section of the paper reviews more recently available empirical evidence on modelling of financial reporting practices of growing SMEs. A search of the contemporary English-language literature internationally has revealed just two published empirical studies with a similar focus and method to those of this paper.

An Australian study which attempts to model financial reporting practices in SMEs is that described in Holmes and Nicholls (1989), Holmes et al. (1989) and Holmes et al. (1991), which extends a 1986 study described in Holmes (1987, 1988) and Holmes and Nicholls (1988). The paucity of modelling studies of financial reporting practices in SMEs is noted in Holmes and Nicholls (1989), Holmes et al. (1989) and Holmes et al. (1991). The modelling of financial reporting practices undertaken by Holmes and Nicholls (1989) is based on a three-way classification of financial information prepared or acquired at least annually by their sample of just over 900 Australian SMEs:

- Statutory (ST) – predominantly returns required for government authorities such as the Australian Taxation Office and the Australian Securities Commission.
- Statutory/Budget (SB) – ST plus operational and capital budgeting information.
- Statutory/Budget/Additional (SBA) – SB plus additional financial information such as cash-flow statements, breakeven analysis, production reports, inter-firm comparisons and industry trends.

Employing the classification scheme above, Holmes and Nicholls (1989) use logistic regression to develop an explanatory model from which the probability of an SME preparing or acquiring a particular level of financial information (specifically SBA) can be estimated given the values of certain enterprise and owner-manager characteristics expressed as categorical variables. After testing many possible models involving a variety of independent variables selected by reviewing prior research undertaken by others and through exploratory data analysis, the following model is found through sensitivity analysis to have the best fit (predictive ability) for the data at hand:

$$y = c + \sum_{i=1}^{7} a_i t_i + b_i TR + \sum_{i=1}^{6} d_i l_i + \sum_{i=1}^{5} e_i B_i + \sum_{i=1}^{7} f_i E_i + a \qquad (1)$$

where:

y = natural logarithm of the odds ratio $p/(1-p)$ in which p is the probability that a particular level of financial information (specifically SBA) will be prepared or acquired;

T_i = turnover categories, $i = 1$ to 7;

TR = whether or not the owner-manager has sought management training since entering the enterprise;
I_i = industry categories, i = 1 to 6;
B_i = enterprise age under existing management categories, i = 1 to 5;
E_i = number of employees categories, i = 1 to 2;
a = stochastic disturbance term representing that part of y which is unexplained by the independent variables.

Holmes and Nicholls (1989) report that, during development of the model, certain variables were found not to have a significant influence on the dependent variable, y. These include legal structure, turnover trend, number of years of high school education undertaken by owner-managers, what type of post-secondary qualifications (if any) owner-managers possess, and the number of hours per week owner-managers work.

Holmes et al. (1989) use the same data set and logistic regression method to develop an explanatory model from which the probability of an owner-manager preparing or acquiring future-oriented financial information on profit and loss and cash-flow can be estimated. The explanatory variables investigated are as in Holmes and Nicholls (1989). After testing many possible models involving a variety of independent variables, the model found to have the best fit for the data at hand is as follows:

$$y = c + \sum_{i=1}^{4} g_i S_i + \sum_{i=1}^{6} d_i I_i + u \qquad (2)$$

where

y = natural logarithm of the odds ratio $p/(1-p)$ in which p is the probability that budgeted information will be prepared or acquired;
S_i = legal structure categories; i = 1 to 4;
I_i = industry categories, i = 1 to 6;
u = stochastic disturbance term representing that part of y which is unexplained by the independent variables

Using the same data set and logistic regression method, Holmes et al. (1991) propose and find empirical support for a financial information cycle arising from a modified stage or life-cycle model of SME development. They argue that a model of financial information use in SMEs should incorporate plateaus – static or settling or levelling-off periods – between each major stage of development; and they suggest that such periods might be expected following significant growth, new investment activity, or deterioration in an enterprise's fortunes. Holmes et al. (1991, pp. 43–44) go on to describe the posited financial information cycle as follows:

> Firms which commence and experience a period of significant growth will normally acquire increased information to assist in coping with business decisions associated with a growth period. However, when the business enters a stabilised period the information level will revert to feedback level, although this may be at a higher level than previously . . . This indicates that at 'crisis point' information is sought . . . in one accession or closely timed series of accessions, rather than a slow steady increase in the information prepared or acquired.

Thus, it is claimed that increases in the level of financial information obtained are clustered around particular points in the SME development life-cycle.

The financial information cycle proposed by Holmes et al. (1991) can be represented as in Figure 1 (McMahon et al., 1993, p. 119, Figure 4.2 adapted from Holmes et al., 1991, p. 44, Figure 2). The high level of financial information use in very young enterprises is explained in terms of the critical need for such information in the start-up phase. As SMEs subsequently develop, the level of financial information required decreases as owner-managers retain information initially obtained and acquire skills necessary to manage their enterprises. The level of financial information use increases subsequently when and if an enterprise experiences growth or decline, because of the attendant financial stresses.

Another research study found in the SME literature that extensively overlaps with the present research is that reported by McMahon and Davies (1991a, 1991b, 1992a, 1992b, 1994) and McMahon et al. (1992a, 1992b, 1994). It was part of a two-year investigation of the essential growth characteristics of a non-random convenience sample of just over 100 growing SMEs from a variety of industries situated in North-East England. On the basis of their investigation of correlates with the historical financial reporting practices of these SMEs, McMahon and Davies

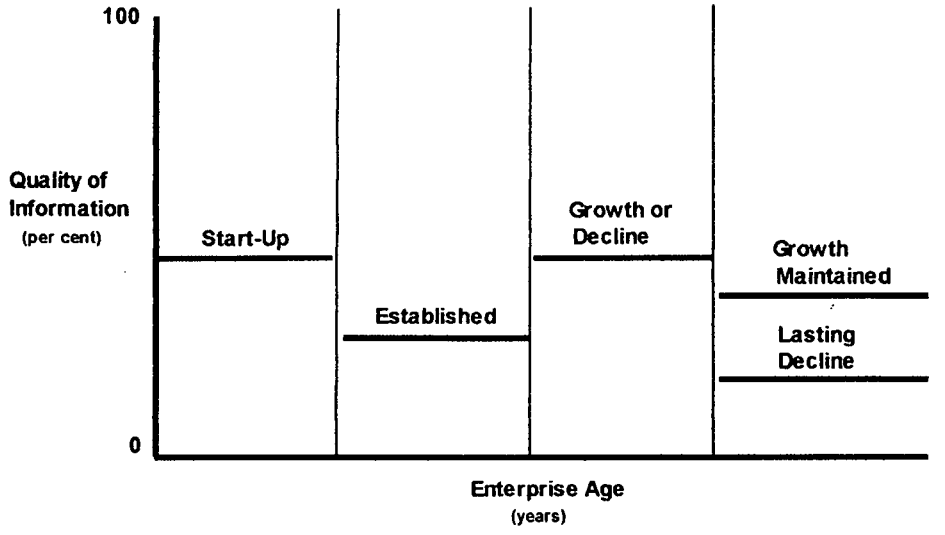

Figure 1. Smaller enterprise financial information cycle.

(1991a, 1991b, 1992a, 1992b, 1994) believe comprehensive historical financial reporting is more likely to be undertaken by SMEs which:

- Are larger in size and older.
- Have more formal organisational structures.
- Use computers, especially in the financial management function.
- Have owner-managers who think in strategic terms and who are willing to undertake more formal strategic planning.
- Have owner-managers who are personally involved in financial management and have some useful experience in this function.
- Employ internal support staff, particularly professionals such as accountants and managers.

McMahon and Davies (1991a, 1991b, 1992a, 1992b, 1994) believe financial ratio analysis based on historical financial statements is more likely to be undertaken by SMEs which:

- Are larger in size.
- Undertake more comprehensive financial reporting.
- Have owner-managers who have some useful experience in financial management.

McMahon et al. (1992a, 1992b, 1994) took the findings above and used them as the basis for exploratory modelling of historical financial reporting practices in growing SMEs. The intention was to systematically identify those factors that determine whether particular historical financial reporting practices are undertaken, and to represent these explanatory factors in an expression that reflects their relative and combined influence on the practices in question. Principally because the dependent financial reporting and financial analysis variables are categorical, logistic regression was selected as the modelling methodology. The polytomous dependent historical financial reporting variable (FSINDEXG) has three levels corresponding to low (designated 1), medium (designated 2) and high (designated 3) in terms of the extent and frequency of financial reporting undertaken. Details of the most parsimonious multivariate logistic regression model with acceptable explanatory power are presented in Table I.

The independent or explanatory variables remaining in this logistic regression model of historical financial reporting practices in SMEs are EMPLOY, the number of equivalent full-time employees; AGEBUS, enterprise age; FINCOMP, whether or not a computer is used in financial management; and STRATEGY, how frequently the owner-manager thinks about his or her enterprise in a strategic manner (measured on 5-point Likert scale ranging from "never" to "a great deal").

Using the information in Table I, McMahon et al. (1992a, 1992b, 1994) interpret the coefficients

TABLE I
Logistic regression model of historical financial reporting

Fitted model	Odds ratio	Bounds of odds ratio[a]		Statistical significance[b]		Derivatives[c]		
		Upper	Lower	Parameter	Fitted model	FSINDEXG		
						1	2	3
Part A:[d]								
3.967				0.040[e]				
–0.015EMPLOY	0.985	1.003	0.967	0.102				
+0.048AGEBUS	1.050	1.109	0.993	0.087[e]				
–0.926FINCOMP	0.396	2.978	0.053	0.368				
–1.144STRATEGY	0.319	0.816	0.124	0.017[e]				
Part B:[d]								
4.881				0.048[e]				
–0.081EMPLOY	0.922	0.997	0.853	0.041[e]		0.000	–0.007	0.007
–0.193AGEBUS	0.824	1.013	0.671	0.067[e]		0.010	–0.019	0.009
–2.641FINCOMP	0.071	0.664	0.008	0.020[e]		–0.036	–0.220	0.256
+0.186STRATEGY	1.204	2.991	0.485	0.689[e]	0.000[e]	–0.132	0.046	0.086

[a] Bounds are 95 per cent confidence limits.
[b] Probability for appropriate significance test. For individual parameters this is a Student's t-test. For fitted model this is a Likelihood Ratio test comparing "constant only" model with fitted model.
[c] Derivatives are for whole model.
[d] Model has two parts, one for each response level of the dependent historical financial reporting variable FSINDEXG. Reference level is FSINDEXG = 3.
[e] Significant at $\alpha = 0.10$ or better.

of the independent variables in their logistic regression model of historical financial reporting practices as follows. Considering EMPLOY first, the odds ratios and derivatives suggest that increasing the size of an enterprise in terms of employment numbers increases the likelihood of historical financial reporting being carried out at the high level. Interestingly, the odds ratios and derivatives for AGEBUS suggest that the likelihood of both the low level and the high level of historical financial reporting increases with enterprise age. In other words, there may be some degree of polarisation in historical financial reporting practices as SMEs get older. The odds ratios and derivatives for FINCOMP suggest that the likelihood of undertaking historical financial reporting at the high level is substantially increased if a computer is available for financial management purposes. However, the confidence bounds for the odds ratios are quite wide, indicating a relatively uncertain outcome. Finally, the odds ratios and derivatives for STRATEGY indicate the likelihood of historical financial reporting at the medium or high level increases with increased strategic thinking on the part of the owner-manager(s). Again, the confidence bounds for the odds ratios are quite wide.

McMahon et al. (1992a, 1992b, 1994) believe the broad implication of their selected logistic regression model is that, as SMEs get larger in employment terms, and survive longer, it becomes more likely that their owner-managers will install historical financial reporting systems that are comprehensive in terms of the number of financial statements obtained and the frequency of their preparation. This may be because the demands on an owner-manager are greater when there are more employees to oversee, and his or her primary role moves towards supervision of the work of others rather than direct hands-on involvement in the operations of the enterprise. It may also be due to greater managerial sophistication acquired by the owner-manager over time through experience and possibly training. Furthermore, it would seem that comprehensive historical financial reporting is more likely where a computer is available to facilitate this, and where the owner-manager has a strong strategic orientation. Thus, the situational

and enabling factors identified in the model combine to explain observed financial reporting practice.

The results of logistic regression modelling carried out by McMahon et al. (1992a, 1992b, 1994) employing a dichotomous dependent variable indicating whether or not financial ratio analysis is in use (styled FRATUSE) are now considered. Details of the most parsimonious multivariate logistic regression model with acceptable explanatory power are presented in Table II.

The independent or explanatory variables remaining in this logistic regression model of financial analysis practice in growing SMEs are FSINDEXF, indicating the comprehensiveness of historical financial reporting practices over a continuous interval from 0 to 5; and OMEXPFM, whether or not the owner-manager has had useful experience in financial management.

Using the information in Table II, McMahon et al. (1992a, 1992b, 1994) interpret the coefficients of the independent variables in their logistic regression model of financial analysis practice as follows. Considering FSINDEXF first, the odds ratio and derivatives imply that increasing the level of historical financial reporting in an SME increases the likelihood that financial ratio analysis will be undertaken. The odds ratio and derivatives for OMEXPFM suggest that providing owner-managers with useful experience in financial management makes use of financial ratio analysis more likely. However, the confidence bounds of the odds ratio are quite wide, implying that the outcome is far from certain. Nevertheless, the confidence interval is skewed to the right.

McMahon et al. (1992a, 1992b, 1994) believe the broad implication of their selected logistic regression model is that merely encouraging owner-managers of SMEs to increase the extent and frequency of historical financial reporting on their businesses is not likely to be as effective a strategy for improving financial management as doing this as well as providing necessary experience so that skills in financial analysis may also be acquired and used. This supports the widely held view that training and/or professional advice could supply much needed leverage to lift the general competency level in financial management amongst SME owner-mangers.

3. Research data and method

A valuable opportunity to address the key research issue in this paper has been provided by the availability, through the federal government's Australian Industrial Property Organisation, of data from an Australian Manufacturing Council study which led to its publication – *Practising Balance: Integrating Best Financial Practice Into Your Business* (Australian Manufacturing Council, 1996). Cross-sectional research for the *Best Financial Practice* study involved a postal survey in late 1995 of a random sample, stratified disproportionately over enterprise size and manufacturing industry categories, of approximately 5,500 Australian manufacturing enterprises that are pre-

TABLE II
Logistic regression model of financial analysis

Fitted model	Odds ratio	Bounds of odds ratio[a]		Statistical significance[b]		Derivatives[c]	
		Upper	Lower	Parameter	Fitted model	FRATUSE	
						0	1
–1.219				0.099			
+0.419FSINDEXF	1.521	2.222	1.041	0.030		–0.092	0.092
+0.898OMEXPFM	2.455	7.071	0.852	0.096	0.026	–0.197	0.197

[a] Bounds are 95 per cent confidence limits.
[b] Probability for appropriate significance test. For individual parameters this is a Student's t-test. For fitted model this is a Likelihood Ratio test comparing "constant only" model with fitted model.
[c] Derivatives are for whole model.
[d] Significant at $\alpha = 0.10$ or better.

dominantly SMEs in employment terms. The survey used a self-administered, structured questionnaire containing 53 essentially closed questions focused on enterprise characteristics and performance, and financial management characteristics and practices. Responses were received from 1,763 enterprises, representing a response rate of 32 per cent. The Australian Manufacturing Council (1996, p. 78) indicates that "Responses were sufficient in each of the 48 cells (industry by size) to be taken as reflecting the full population". Over 1,100 responses were from SMEs with the equivalent of 300 or fewer full-time employees and legally organised as proprietary companies.[1,2] Ultimately, 1,050 responses could be used in this research. Some marginal differences exist between the nature of respondents and non-respondents to the survey, but no significant non-response bias was discovered in relation to the matters presently of interest.

The research instrument produced data for 11 variables reflecting financial reporting practices of respondents to the *Best Financial Practices* survey. In addition, data are available for 25 variables representing enterprise characteristics and 44 variables capturing financial management characteristics. Brief descriptions of the financial reporting variables are provided later in the paper. Full details of the nature and measurement level for the enterprise characteristic and financial management characteristic variables are available from the author. All variables used in this research are categorical (nominal or ordinal) in nature and/or have irregular distributional properties; therefor, non-parametric/distribution free techniques of statistical analysis are employed exclusively. In particular, non-linear principal components analysis is used for dimensional reduction/structural escalation of study variables for financial reporting practices, enterprise characteristics and financial management characteristics; and logistic regression is used in predictive modelling of financial reporting practices.

4. Research findings

4.1. *Preliminary multivariate data analysis*

In an exploratory study such as this, it would be overly ambitious to attempt to separately discover significant associations for each and every financial reporting practice being investigated. Rather, it was considered more appropriate to endeavour to develop an overall indication of the extent or comprehensiveness of the various financial reporting practices undertaken in respondent enterprises. This is certainly the approach taken in comparable studies in the area (such as those reviewed earlier in this paper). Various means were considered for building a rating variable that captures the overall level of financial reporting practices, including essentially naïve scoring of each case in the data file on the basis of values for the key financial reporting practice variables. Ultimately, it was decided that non-linear principal components analysis provided a more sophisticated financial reporting measure.

Thus, non-linear principal components analysis was applied to 11 financial reporting practice variables for respondents to the *Best Financial Practice* survey, briefly described as follows:

- Whether or not an historical balance sheet is available and used by respondent enterprises – nominal study variable HISTBS with three categories reflecting historical financial reporting practices.
- Whether or not an historical profit and loss statement is available and used by respondent enterprises – nominal study variable HISTPL with three categories reflecting historical financial reporting practices.
- Whether or not an historical cash-flow statement is available and used by respondent enterprises – nominal study variable HISTCF with three categories reflecting historical financial reporting practices.
- Frequency of regular use of historical profit and loss statements within respondent enterprises – ordinal study variable FQREVPL with six levels reflecting historical financial reporting practices.
- How frequently the cash position of respondent enterprises is regularly assessed – ordinal study variable CASHPOSN with five levels reflecting historical financial reporting practices.
- Whether or not some future-oriented financial statements are likely to be obtained by respondent enterprises – nominal study variable FORPRTS with two categories reflecting financial budgeting practices.

- Whether or not future-oriented cash-flow statements are likely to be obtained by respondent enterprises – nominal study variable CASHREQ with four categories reflecting cash-flow forecasting practices.
- Horizon for future-oriented cash-flow statements – ordinal study variable CSHRQHOR with four levels reflecting cash-flow forecasting practices.
- Whether or not benchmarking is known about and employed by respondent enterprises – nominal study variable BENCHMRK with 4 categories reflecting possible use of financial ratios in historical financial statement analysis.
- Frequency with which budget comparisons of forecast versus actual results are regularly carried out within respondent enterprises – ordinal study variable FQBUDCOM with six levels reflecting use of such comparisons in historical financial statement analysis.
- Whether or not regular forecast versus actual comparisons for cash-flows are undertaken by respondent enterprises – nominal study variable CFBUDCOM with two categories reflecting use of such comparisons in historical financial statement analysis.

With 1,050 cases and 11 financial reporting practice variables, there are potentially over 95 observations per variable. Even though there are missing values, this ratio appears satisfactory by sample size benchmarks for principal components analysis (Tabachnick and Fidell, 1989; Hair et al., 1995).

In using non-linear principal components analysis to gain an overall indication of the comprehensiveness of financial reporting practices in respondent enterprises, the SPSS statistical software used was forced to produce one principal component only. This single component has an eigenvalue of 0.2432, and thus accounts for about one-quarter of the total variance amongst the financial reporting practice variables. Generally speaking, this is a quite normal explanatory level for a first principal component (Tabachnick and Fidell, 1989; Hair et al., 1995). Loadings of the financial reporting practice variables upon the principal component extracted are revealed in Table III.

Notice that, with the possible exception of CSHRQHOR, all of the financial reporting practice variables load substantially on the single principal component extracted. As the figures in bold indicate, more than one-half of the loadings across the range of financial reporting practices exceed the benchmark of 0.400 (Ford et al., 1986). All but one of the other loadings exceed 0.300. Taking account of the construction of the financial reporting practice variables and the signs of their component loadings, this component appears to capture conveniently, and with some integrity, the overall extent or comprehensiveness of financial reporting practices undertaken by SMEs in the *Best Financial Practice* survey.

TABLE III
Loadings for financial reporting practices

Variable name	Principal component loadings
HISTBS	**–0.679**
HISTPL	**–0.727**
HISTCF	–0.344
FQREVPL	**–0.419**
CASHPOSN	–0.373
FORPRTS	**–0.532**
CASHREQ	**–0.689**
CSHRQHOR	0.219
BENCHMRK	–0.381
FQBUDCOM	**–0.422**
CFBUDCOM	–0.354

Object scores for the principal component extracted were saved to the datafile to form a new continuous study variable FRINDEX reflecting the comprehensiveness of financial reporting practices undertaken by respondent enterprises. FRINDEX has a range from –5.46 to 1.57, and a Kolmogorov-Smirnov one-sample test with Lilliefors correction shows that it is non-normally distributed ($D = 0.129$, df = 1,050, $p < 0.000$). A Kruskal-Wallis one-way analysis of variance reveals that financial reporting practices are more comprehensive in larger enterprises in employment terms ($n = 1{,}050$, $H = 135.554$, df = 4, $p < 0.000$). Furthermore, a Mann-Whitney test suggests a statistically significant difference in the comprehensiveness of financial reporting practices between small enterprises and medium-sized enterprises in the study sample, with these practices being more extensive in medium-sized concerns ($n = 1{,}050$, $U = 18{,}772.000$, $p < 0.000$).

Because of space limitations, dimensional reduction/structural escalation undertaken separately for enterprise characteristic variables and financial management characteristic variables arising from the *Best Financial Practice* survey are not described in detail here. Procedures followed generally parallel those already described for the financial reporting variables, except that solutions were not constrained to a single principal component.[3] Seven principal components extracted in non-linear principal components analysis of the 25 enterprise characteristic variables are interpreted as follows:

- Development orientation (DEVELPOR) –reflecting how forward looking enterprise management is, what degree of commitment there is to growth, including through exporting, and enterprise size in employment terms.
- Enterprise size (EMPLOYS) – reflecting how large an enterprise is in employment terms. Note that employment loads meaningfully on the first principal component; but its loading on the second component is considerably stronger. Ford et al. (1986, p. 306) point out that "it is completely consistent with the common factor model and the principle of simple structure for a variable to have more than one high loading".
- Growth constraints (GRWCONST) – reflecting a contrast or tension between wishing to retain control by avoiding external financing and the pressing need for additional funding beyond that of present owners in order to facilitate business growth.
- Technological complexity (TECHNOLG) – reflecting differences in the complexity of technology between manufacturing concerns.
- Business influence (BUSINFLU) – reflecting a contrast or tension between belief that business success is largely internally influenced and belief that outsiders attitudes and behaviours mainly determine business outcomes.
- Life-style preservation (LIFPRSRV) – reflecting a contrast or tension between external influences and internal desires regarding owners' life-style ambitions.
- Owner-management (OWNERMNG) – reflecting the degree to which owners have retained for themselves the responsibility for management of their concerns.

The emergence and apparent significance of these principal components accords well with the relevant literature; and the principal components collectively account for one-half of the observed variability in the enterprise characteristic variables.

Seven principal components extracted in non-linear principal components analysis of the 44 financial management characteristic variables are interpreted as follows:

- Financial reporting climate (FRCLIMAT) – reflecting how conducive the climate is to financial reporting in terms of financial reporting to financiers, relationships with financiers beyond financial reporting, external scrutiny of financial statements, and the availability of internal financial advice.
- Financing problems (EXFINPRB) – reflecting having experienced difficulties with external financing.
- External financial advice (EXADVICE) – reflecting dependence on outside professionals, usually public accountants, for advice on a range of financial matters.
- Financier reporting burden (FINACCNT) – reflecting the extent of accountability to external financiers through and beyond formal financial reports, possibly without skilled internal financial staff.
- Financial management support (FMSUPPRT) – reflecting the level of satisfaction with available financial management support.
- External funding dependence (EXFINDEP) – reflecting the level of dependence upon external funding.
- External audit (EXTAUDIT) – reflecting the level of external scrutiny of financial statements.

Again, the emergence and apparent significance of these principal components accords well with the relevant literature; and the principal components collectively account for a little over one-half of the observed variability in the financial management characteristic variables.

4.2. *Multivariate predictive modelling*

As indicated earlier in the paper, logistic regression has been selected as the most useful predic-

tive modelling methodology appropriate to the categorical and/or irregularly distributed dependent and independent variables obtained through the *Best Financial Practice* survey. The focus in this sub-section of the paper is on the key study relationship represented as follows:

$$R_m = f(E_s, F_t, R_o) \quad (3)$$

where:

R_m = financial reporting practices, notionally dependent variables;
E_s = enterprise characteristics, notionally independent variables;
F_t = financial management characteristics, notionally independent variables;
R_o = other financial reporting practices, notionally covariates.

Together, the enterprise and financial management characteristics of respondents constitute the business context. The broad intention is to reveal through logistic regression modelling which business context characteristics seem most influential on the comprehensiveness of financial reporting practices adopted by manufacturing SMEs in the study sample.

In order to facilitate logistic regression modelling with the comprehensiveness of financial reporting practices as the dependent variable, the continuous study variable FRINDEX derived using non-linear principal components analysis has been built upon/modified as follows:

- Respondent enterprises have been classified into three groups according to whether they are in the first, second or third tercile of the financial reporting measure FRINDEX. A new ordinal study variable FRGRPT has been formed with three categories corresponding to low, medium and high levels for the comprehensiveness of financial reporting practices.
- The study variable FRGRPT has been converted into two dichotomised study variables FRGRPT1 and FRGRPT2. The first of these new variables indicates whether or not financial reporting practices are at a low level. The second new variable indicates whether or not financial reporting practices are at a high level.

These variable conversions have been undertaken in order to permit polytomous logistic regression to be approximated via two dichotomous logistic regressions. The conversions are such that cumulative logits are obtained which reflect the ordinal nature of the financial reporting practice variable FRGRPT.

Broadly following the recommendations of Hosmer and Lemeshow (1989) and Norusis and SPSS Inc. (1992), the procedure used in logistic regression modelling of financial reporting practices involved:

- For each level of the dependent variable, first building a model with a constant and all 14 enterprise and financial management characteristics as independent variables. Backward stepwise elimination based on the Likelihood Ratio test with an elimination criterion of $\alpha = 0.05$ and a subsequent re-entry criterion of $\alpha = 0.01$ was then used to produce the most parsimonious model with statistically significant parameters for each level of the dependent variable.
- Although approximating polytomous logistic regression in the manner chosen permits models for each level of the dependent variable to include different independent variables, this facility is not available in true polytomous logistic regression. For this reason, and because it produces models that are easier to interpret, independent variables not in the most parsimonious model for both levels of the dependent financial reporting variable were eliminated and the models refitted. Checks were then made that the statistical significance of model parameters and goodness-of-fit of the models were not seriously undermined by the eliminations. This proved to be the case.
- Models were then built with forced entry of the remaining independent variables and backward elimination from inclusion of all possible two-way interactions between the remaining independent variables. The interactions terms proved not to be statistically significant and were, therefore, eliminated automatically *or* were not present in the most parsimonious models for both levels of the dependent financial reporting variable and were, therefore, eliminated manually.

Specifications for the final models obtained through this procedure are presented Table IV.

Notice that all model parameters for both levels of the dependent financial reporting variable are statistically significant, and both models are statistically significant overall.

The logistic regression models presented suggest that the comprehensiveness of financial reporting practices undertaken by respondents to the *Best Financial Practice* survey is mainly influenced by five groupings of explanatory factors:

- Those reflecting development orientation such as how forward looking enterprise management is, what degree of commitment there is to growth, including through exporting, and enterprise size. Thus, while enterprise size in employment terms is not separately included in the logistic regression models for financial reporting practices, this variable does, nevertheless, influence the model through its substantial loading on the principal component representing development orientation. The sign of the coefficient for the variable DEVELPOR in each model is positive, suggesting that the comprehensiveness of financial reporting practices increases with increasing development orientation. This is the direction of influence anticipated for this enterprise characteristic on the basis of the literature.

  Considering the model with FRGRPT1 as the dependent variable, the odds ratio for development orientation suggests the likelihood that financial reporting practices will be at a medium or high level is increased by a multiplicative factor of 1.8657 for each unit increase in the variable DEVELPOR. For the model with FRGRPT2 as the dependent variable, having financial reporting practices at a high level appears 1.8285 times more likely for each unit increase in the variable DEVELPOR. Notice that the 95 per cent confidence intervals for these odds ratios do not include 1.0000 – reinforcing the impression that development orientation genuinely influences the comprehensiveness of financial reporting practices.

- Those reflecting the degree to which owners have retained for themselves responsibility for management of their concerns. The sign of the coefficient for the variable OWNERMNG in each model is negative, suggesting that the comprehensiveness of financial reporting practices necessarily increases with decreasing day-to-day involvement of owner-managers; and is possibly also influenced by the increasing possibility of there being an external director on the Board. Again, this is the direction of influence anticipated for this enterprise characteristic on the basis of the literature.

  Considering the model with FRGRPT1 as the dependent variable, the odds ratio for the degree of owner-management suggests the likelihood that financial reporting practices will be at a medium or high level is decreased by a multiplicative factor of 0.8447 for each unit increase in the variable OWNERMNG. For the model with FRGRPT2 as the dependent variable, having financial reporting practices at a high level appears 0.8137 times less likely for each unit increase in the variable OWNERMNG. Notice that the 95 per cent confidence intervals for these odds ratios do not include 1.0000 – reinforcing the impression that degree of owner-management genuinely influences the comprehensiveness of financial reporting practices.

- Those reflecting differences in the complexity of technology between respondent manufacturing concerns. The sign of the coefficient for the variable TECHNOLG in each model is negative, suggesting that the comprehensiveness of financial reporting practices decreases with increasing technological complexity. This direction of influence is the reverse of that anticipated for this enterprise characteristic on the basis of the literature. The only explanation that can be offered for this finding is the possibility that owner-managers of SMEs utilising advanced technologies tend to rely more on technical indicators of business position and performance, rather than the financial measures which appear in accounting reports.

  Considering the model with FRGRPT1 as the dependent variable, the odds ratio for the complexity of technology suggests the likelihood that financial reporting practices will be at a medium or high level is decreased by a multiplicative factor of 0.6985 for each unit increase in the variable TECHNOLG. For the model with FRGRPT2 as the dependent variable, having financial reporting practices at

a high level appears 0.8148 times less likely for each unit increase in the variable TECHNOLG. Notice that the 95 per cent confidence intervals for these odds ratios do not include 1.0000 – reinforcing the impression that the complexity of technology genuinely influences the comprehensiveness of financial reporting practices.

- Those reflecting the degree of dependence amongst respondent enterprises upon outside professionals, usually public accountants, for advice on a range of financial matters. The sign of the coefficient for the variable EXADVICE in each model is negative, suggesting that the comprehensiveness of financial reporting practices decreases with increasing dependence on external financial advisers. Remembering that smaller enterprises frequently cannot afford to employ their own internal finance staff and, therefore, tend to be more dependent on outside financial advice, this is the direction of influence anticipated for this financial management characteristic on the basis of the literature. Until very recently in Australia, public accountants have been mainly concerned with compliance matters (taxation returns, legislated corporate reporting obligations, etc.) and, because it is often not affordable to their smaller clients, have typically provided very little support in relation to internal financial reporting for financial management purposes.

  Considering the model with FRGRPT1 as the dependent variable, the odds ratio for the degree of dependence upon external financial advice suggests the likelihood that financial reporting practices will be at a medium or high level is decreased by a multiplicative factor of 0.8014 for each unit increase in the variable EXADVICE. For the model with FRGRPT2 as the dependent variable, having financial reporting practices at a high level appears 0.7620 times less likely for each unit increase in the variable EXADVICE. Notice that the 95 per cent confidence intervals for these odds ratios do not include 1.0000 – reinforcing the impression that the degree of dependence upon external financial advice genuinely influences the comprehensiveness of financial reporting practices.

- Those reflecting how conducive the climate in the manufacturing SMEs under study is towards financial reporting for internal financial management purposes. The sign of the coefficient for the variable FRCLIMAT in each model is positive, suggesting that the comprehensiveness of financial reporting practices increases with increasing conduciveness of the financial reporting climate. This is the direction of influence anticipated for this financial management characteristic on the basis of the literature.

  Considering the model with FRGRPT1 as the dependent variable, the odds ratio for conduciveness of the financial reporting climate suggests the likelihood that financial reporting practices will be at a medium or high level is increased by a multiplicative factor of 1.6385 for each unit increase in the variable FRCLIMAT. For the model with FRGRPT2 as the dependent variable, having financial reporting practices at a high level appears 1.9584 times more likely for each unit increase in the variable FRCLIMAT. Notice that the 95 per cent confidence intervals for these odds ratios do not include 1.0000 – reinforcing the impression that conduciveness of the financial reporting climate genuinely influences the comprehensiveness of financial reporting practices.

Of the variable groupings identified, development orientation and financial reporting climate seem to be the most influential upon the comprehensiveness of financial reporting practices of respondent enterprises. However, more parsimonious models including just these two explanatory factors proved to be noticeably inferior to the models presented in Table IV. The recommendation of Hosmer and Lemeshow (1989, p. 111) that "one err in the direction of selecting a relatively rich model following stepwise selection" has been followed.

Attention now turns to how well the models chosen are able to predict the comprehensiveness of financial reporting practices employed by respondents to the *Best Financial Practice* survey given the relevant enterprise and financial management characteristics. In other words, the important consideration is the goodness-of-fit between observed extent of financial reporting practices in the study sample and predictions made using the models. Some summary measures of

TABLE IV
Logistic regression models for financial reporting practices

Dependent variable	Fitted model (with n = 1,050)	Odds ratio	Odds ratio bounds[a]		Statistical significance[b]	
			Lower	Upper	Parameter	Fitted model
FRGRPT1	0.9345				0.0000	
(Low vs	+0.6237DEVELPOR	1.8657	1.5678	2.2204	0.0000	
Medium +	−0.1688OWNERMNG	0.8447	0.7272	0.9811	0.0271	
High)	−0.3588TECHNOLG	0.6985	0.6042	0.8074	0.0000	
	−0.2214EXADVICE	0.8014	0.7036	0.9128	0.0009	
	+0.4938FRCLIMAT	1.6385	1.4274	1.8809	0.0000	0.0000
FRGRPT2	−0.7967				0.0000	
Low +	+0.6035DEVELPOR	1.8285	1.5389	2.1726	0.0000	
Medium	−0.2061OWNERMNG	0.8137	0.7050	0.9392	0.0048	
vs High)	−0.2048TECHNOLG	0.8148	0.7047	0.9421	0.0057	
	−0.2718EXADVICE	0.7620	0.6720	0.8641	0.0000	
	+0.6721FRCLIMAT	1.9548	1.6654	2.3029	0.0000	0.0000

[a] Bounds are 95 per cent confidence limits.
[b] Probability for the appropriate significance test. For individual parameters this is a Wald test. For the fitted model this is a Likelihood Ratio test comparing the "constant only" model with the fitted model.

goodness-of-fit for the logistic regression models are presented in Table V.

The Hosmer and Lemeshow statistic is a chi-square measure calculated for a contingency table in which the rows are categories of the dependent variable and the columns are deciles of probabilities of the various outcomes for the dependent variable (sometimes referred to as "deciles of risk"). If the model being evaluated is a good fit with the data, the observed number of cases in each cell should be approximately equal to the expected number based on the model. A Chi-Square test is carried out with degrees of freedom equal to the number of deciles into which estimated probabilities available from the model fall minus two. The null hypothesis tested is that the observed and expected frequencies are identical, and, therefore, the model being evaluated is a good fit with the data. Clearly, this null hypothesis cannot be rejected for either model in Table V.

The Cox and Snell and Nagelkerke measures in Table V may be loosely viewed as logistic regression counterparts to the well known R^2 statistic in linear regression analysis. It is important to note, however, that the goodness-of-fit they reflect is between two models examined in a Likelihood Ratio test; and not between a model and observed data as is the case in linear regression. These measures always fall between 0 and 1, and they tend to be much lower than the R^2 statistic in linear regression analysis (Steinberg and Colla, 1991). Apparently, a low number does not necessarily imply a poor fit, and values between 0.20 and 0.40 are considered very satisfactory. Because they are susceptible to misinterpretation, Hosmer and Lemeshow (1989) recommend against use of such pseudo-R^2 measures. Nevertheless, it is encouraging to observe that, for both models in Table V, the Cox and Snell and Nagelkerke R^2 measures appear satisfactory.

Another available means for assessing the goodness-of-fit for logistic regression models is

TABLE V
Goodness-of-fit for financial reporting models

Dependent variable	Hosmer and Lemeshow goodness-of-fit test	Cox and Snell R^2	Nagelkerke R^2
FRGRPT1	χ^2 = 6.4012, df = 8, p = 0.6014	0.200	0.278
FRGRPT2	χ^2 = 9.9028, df = 8, p = 0.2719	0.236	0.325

through their classification success. Classification is usually achieved by assigning each case to the dependent variable category for which the estimated probability exceeds 0.5 according to the model being evaluated. The statistics of interest include the proportion of classifications that are correct by dependent variable category, and overall. It is also useful to have some measure of classification success for each dependent variable category showing the gain of the model over a "constant only" model that assigns the same probability, equal to the observed proportion of the total sample in each category, to every case in the data set. Finally, a comparison of the overall classification success with an arbitrary benchmark of 50 per cent correct may be of interest (Peel and Peel, 1988).

Classification success for a logistic regression model can be determined for the original sample from which the model has been developed, for a sample withheld from the original data set, or for an entirely new set of data. On the need for validation of a logistic regression model with data other than that from which it has been developed, Hosmer and Lemeshow (1989, p. 171) comment as follows:

> The reason for considering this type of assessment of model performance is that the fitted model always performs in an optimistic manner on the developmental data set.

In the present exploratory context, classification success has been evaluated only for the original development/learning/modelling sample. No external validation has been undertaken using data from an entirely separate source because such data were not available. This, of course, becomes a limitation of the predictive modelling stage of the research.

Some summary measures of classification success for the logistic regression models in Table IV are presented in Table VI.

Knowing that the statistics presented in Table VI are more than likely optimistic reflections of the reliability of the models chosen, they might nevertheless be described cautiously as fairly encouraging. For both financial reporting outcomes in both models, classification success appears to be some 15 to 20 percentage points better than a "constant only" model which assigns probabilities equal to the observed proportions in the sample to each dependent variable category. Note that the gain is poorest for the least represented categories. Hosmer and Lemeshow (1989, p. 147) observe that:

> Classification is sensitive to the relative sizes of the two component groups and will always favour classification into the larger group, a fact that is also independent of the fit of the model.

Logistic regression is not a technique designed to find an optimal trade-off between Type 1 and Type 2 errors (Ohlson, 1980). For both logistic regression models, the overall classification success noticeably exceeds an arbitrary cut-off of being 50 per cent correct.

5. Summary and conclusions

Polytomous logistic regression modelling, with underpinning from non-linear principal components analysis, has been useful in addressing the primary research issue in this study: discovering which enterprise and financial management characteristics seem to most influence financial reporting practices adopted in Australian manufacturing SMEs. The logistic regression models

TABLE VI
Classification success for financial reporting models

Dependent variable	Financial reporting level	Observed proportion (per cent)	Predicted correctly (per cent)	Gain (percentage points)	Overall predicted correctly (per cent)
FRGRPT1	Low	33.33	48.57	15.24	
	Medium + High	66.67	86.43	19.76	73.81
FRGRPT2	Low + Medium	65.03	87.03	22.00	
	High	34.67	50.00	15.33	74.19

developed for financial reporting practices have the following form:

$$\ln[\pi/(1-\pi)] = 0.9345 + 0.6237\text{DEVELPOR} - 0.1688\text{OWNERMNG} - 0.3588\text{TECHNOLG} - 0.2214\text{EXADVICE} + 0.4938\text{FRCLIMAT} \quad (4)$$

where:

π = probability that financial reporting practices are at a medium or high level.

and:

$$\ln[\pi/(1-\pi)] = 0.7967 + 0.6035\text{DEVELPOR} - 0.2061\text{OWNERMNG} - 0.2048\text{TECHNOLG} - 0.2718\text{EXADVICE} + 0.6721\text{FRCLIMAT} \quad (5)$$

where:

π = probability that financial reporting practices are at a high level.

These logistic regression models provide a convenient and practically useful means of revealing the individual and combined influences of key explanatory factors upon financial reporting practices. The explanatory factors for financial reporting practices that have emerged in the models generally make business sense and sit reasonably well with prior scholarly knowledge in the area. Furthermore, the goodness-of-fit and classification success of the models are encouraging.

Logistic regression modelling reveals that the comprehensiveness of financial reporting practices is mainly impacted by five groupings of explanatory factors:

- Development orientation
- Owner-management
- Technological complexity
- External advice
- Financial reporting climate

Of the variable groupings identified, development orientation and financial reporting climate seem to be most influential upon the comprehensiveness of financial reporting practices of respondent enterprises. This would appear to reinforce the impression that SME growth is a key driver towards more sophisticated financial reporting practices. Alternately, better financial reporting may be viewed as an important enabling factor in realising the growth aspirations of such concerns.

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Notes

[1] Businesses with up to 100 employees are considered to be small, with the remainder being designated as medium-sized.

[2] The focus in this research is on SME growth, and it is more likely that this will be evident in businesses legally organised as proprietary companies (Hughes and Storey, 1994).

[3] Full details of procedures and outcomes of dimensional reduction/structural escalation undertaken separately for enterprise characteristic variables and financial management characteristic variables arising from the *Best Financial Practice* survey are available from the author.

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