

A Probit Analysis of the Changes in the Financial Characteristics of Newly Quoted Small Firms, 1970–73 and 1980–83

Graham C. Hall
Patrick J. Hutchinson

ABSTRACT. An important reason for the establishment of the UK Unlisted Securities Market was to provide capital for promising small firms. This paper makes two comparisons: a) between selected financial characteristics of a sample of small firms that took advantage of this opportunity and a sample of firms that did not; and b) between any differences in these characteristics and those between a sample of small firms that were floated on the Stock Market between 1970–73 and a sample of small firms that remained unfloat. Probit was employed. The results suggest floated firms were on average more profitable and faster growing, though with the latter relationship not particularly strong. There was little significant difference in gearing or liquidity. The owners of floated firms were prepared to take less remuneration than average during the 1970s but not during the 1980s.

Introduction

The effectiveness of the Capital Market at meeting the needs of small firms has long been the subject of debate (see Hall, 1988, and Stanworth and Gray, 1991, for recent reviews of the literature). The Macmillan Committee of Inquiry into Finance and Industry in the UK (1931) gave rise to the now familiar term “finance gap” to describe the situation where a small firm had grown to a stage

where it had made maximum use of sources of short-term finance but was unable to acquire long term finance through flotation on the Stock Market. This issue was further addressed by the Bolton (1971) and Wilson (1979) Committees. Barriers to entry onto the Stock Exchange were the high fixed costs of achieving a listing, various disclosure regulations and the requirement that 25% of the shares of a quoted company should be in public hands.

Awareness of these barriers, in particular that they had actually increased in height (Peat, Marwick and Mitchell, 1985) for the small, fast growing firms that, *ceteris paribus*, are most in need of long-term financing, was a major reason for the Stock Exchange establishing, in 1980, a three tier market covering listed and unlisted securities. A second reason was the general decrease in new listings in the mid-1970s, particularly by small firms, which accompanied the recession in equity prices (Buckland and Davis, 1989). The Unlisted Securities Market (USM) was positioned between the official “main board” on the one hand and, on the other, the procedure by which occasional bargains are matched by brokers under Stock Exchange Rule 163. To enter the USM a company must normally have been trading for at least five years and provide financial information for five years (or for the period of trading if less). Securities traded are not formally listed on the Stock Exchange. Transactions are either matched in-house by the company’s stockbroker or negotiated with another stockbroker. These requirements are less onerous and more flexible than for official listing and cheaper, since most

Final version accepted on June 1, 1992

Manchester Business School
University of Manchester
Booth St. W.
Manchester M15 6PB
England

and

University of New England
Australia

entries to the USM are by placings, which do not require underwriting or public advertising. In addition, entrants to the USM are not required to make 25% of their equity publicly available; 10% is the minimum adopted by convention.¹

This paper examines how the financial characteristics of small firms entering the USM between 1980 and 1983 inclusive differed from those that remained unfloats and compares these differences with those between firms of similar size floated on the official list and those remaining unfloats between 1970 and 1973. Previous studies of the financial characteristics of small firms have tended to concentrate either on the phenomenon concerning the relative returns on large and small firms known as the "Small Firms Effect" (Keim, 1983; Levis, 1985; Reinganum, 1982; Roll, 1981; Schultz, 1983); or the effects of size on the costs of new issues of equity (Archer and Faerber, 1966; Davis and Yeomans, 1976; Merrett, Howe and Newbould, 1967; Stoll and Curley, 1970; Vaughan, Grinyer and Birley, 1977), or on the effects of size on profitability, and other financial characteristics (Anderson, 1967; Gupta, 1969; Singh and Whittington, 1968; Walker and Petty, 1978; Whittington, 1971). The most pertinent study to our own is by Buckland and Davis, (1989), who used contingency tests to compare some of the characteristics of the total population of firms entering the USM in its first five years with the total population gaining official listing during the same period.

Given that a major reason for establishing the USM was to provide equity for small firms, especially those with a track-record of growth, it would seem useful to explore what sort of small firms have, in fact, attempted to benefit from the new opportunities represented by access to the USM and to compare these firms with those of similar size that gained official listing in a period before the establishment of the USM. The period, 1970–73, was chosen because the slump² in floatations between then and the early 1980s would have severely restricted our sampling frame.

Specifically, this paper will:

- compare some selected financial characteristics of a sample of small firms that achieved flotation on the USM with a sample of small firms that remained private

- establish the relative importance of these characteristics in increasing the probability that such firms would be floated on the USM
- compare the differences between the financial characteristics of small firms floated on the USM, and remaining private 1980–83, with those between small firms floated on the Stock Market and remaining private between 1970 and 1973.

Using probit regressions, separate comparisons have been undertaken between floated and non-floated companies in the year of the formers' flotation and in each of the four preceding years.

Choice of samples

Data were collected on four samples, each with thirty firms. The first was drawn from the population of firms that achieved flotation on the USM during 1980–83, the second that were floated on the Stock Market, 1970–73, and the other two represented control groups of companies which, during these respective periods, remained private.

One hundred and eighty-five companies were floated on the USM between 1980 and 1983. Since this study employed financial data, a decision was made to eliminate companies with unusual financial characteristics, namely mining and oil exploration, financial services, property, construction and subsidiaries of overseas companies. This left one hundred and twenty firms.

Invoking the Bolton Committee's (1971) definition of a small firm — that it should be earning at 1971 prices under two hundred thousand pounds in revenue — reduced the sample of companies floated on the USM to thirty companies. Clearly, whilst an important reason for establishing the USM was to serve as a vehicle for increasing the supply of equity to small firms, the latter represents only a small minority of its entrants. The sample of firms floated between 1970 and 1973 was drawn from the same industrial sectors and, in real terms, the same size range. The control groups for both periods were matched by size, industrial sector and age. The last is important because there are both a priori and empirical (Storey *et al.* 1987) reasons for supposing both that flotation will, on the whole, be limited to companies that are neither very new nor very long established and that, in

turn, financial profiles may be loosely related to age. Indeed, in both periods the floated companies were typically in their teens or early twenties. It might also be of interest to note that in both periods most of the floated firms were drawn from the South of England followed, in roughly equal numbers, from the North and Midlands. Flotations by firms from Scotland, Wales and Northern Ireland were very much a rarity.

Choice of variables

Growth

It would seem self-evident that small firms enjoying a high rate of growth are the most likely to seek an injection of equity capital to fund future growth. We have measured growth by the proportionate increase in the book value of total assets over the year prior to flotation.

Changes in sales, the measurement of which is less susceptible than that of the value of assets, to the idiosyncrasies of accounting measurement, would have been a preferable measure of size but this was not always provided in company accounts of the control group firms.

Profitability

We would hypothesise that the firms most likely to seek flotation would be those whose owners believed that lack of capital was currently acting as a constraint on their achieving their full earning potential. It would seem reasonable to assume, furthermore, that it would be the Capital Market's expectations of future earnings which would be an important influence on whether a company's attempt to achieve flotation proved successful. We have surrogated both owners' and the Capital Market's expectations of earnings by the book value of profits before interest and tax as a percentage of the book value of total assets in each relevant year.

Gearing

One aspect of the finance gap confronting small firms which was discussed by the Macmillan (1931), Bolton (1971) and Wilson (1979) Committees was their lack of opportunity to raise

equity. If they were unable to overcome the barriers around full listing, they faced little alternative, given the absence until the 1980s of any significant venture capital industry, to raising fresh equity from friends and relatives. The Wilson Committee, in particular, underlined the shortage of such "Aunt Agathas", as it christened them.

As a consequence one would expect small firms to incur higher than average levels of gearing. The evidence on this is mixed with respect to small firms in general but would appear stronger with respect to small firms that are rapidly growing (Bolton, 1971, and Ray and Hutchinson, 1983). This reliance on debt, in turn, leads to the cost of debt rising (Gupta, 1969), in particular from the fear of insolvency. Hence, growing small firms might be expected to join the USM not only to gain injections of equity capital but to increase their attractiveness to potential lenders. Gearing has been defined as the book value of debt as a percentage of the book value of total assets.

Liquidity

A second aspect of the finance gap discussed by the Macmillan (1931), Radcliffe (1959), Bolton (1971) and Wilson (1979) Committees was the limited availability to small firms of long term loans. These would clearly have provided them with more flexibility in the management of their cash-flow. There is also evidence (Rhobson Rhodes, 1983a, 1983b, 1984) that, even within the limited scope offered by short-term loans, bank-managers display a singular lack of sympathy for the problems faced by the owners of small firms. The result is that they might be expected to face severe problems in achieving an optimal degree of liquidity, especially if they are attempting to increase the size of their firms. Flotation on the USM would represent a means of redressing the balance. Liquidity is measured as the book value of net working capital as a percentage of the book value of total assets.

Distribution

Directors of a small firm must choose the proportion of its profits that they will distribute as their remuneration — the payment of dividends was a rarity within our samples — and the proportion

they will leave as equity. One might expect that the directors of growing small firms, confronted by the problems of funding the growth, will be more likely than others to display a temporary sacrifice in the level of their immediate benefits from remuneration, in the hope of achieving a higher level in the benefits from the long-term growth in the value of their equity. Not surprisingly, the second most commonly cited first reason provided in prospectus for joining the USM (17% against 23% for "capital market access") was "cash for shareholders" (Buckland and Davis, 1989). This variable is defined as directors' remuneration as a percentage of the book value of total assets.

All data were acquired from the company accounts maintained at Companies House and have been collected on the year of flotation, T, and on the four previous years.

Method

Standardisation

All of the variables have been standardised and the relative strengths of their relationships with flotation established through the application of probit. We considered standardisation to be important because we would theorise that the Capital Market is more likely to be influenced in its assessment of a company's suitability for flotation by its performance relative to other companies of similar size operating at the same time. This is analogous to the model of the formulation of Capital Market expectations suggested by Hall and Stark (1986) in their study of the changes that have taken place over time in the characteristics of corporate failures. The model is based on the assumption that the Capital Market will evaluate, for instance, a company's rate of growth as high, or level of gearing as potentially dangerous, by reference to what in some sense is the norm at that time.

Each variable Y_{ij} has been standardised to give a new variable X_{ij} by

$$X_{ij} = (Y_{ij} - M_{i70})/(V_{i70})^{0.5} \quad j = 1 \text{ to } 60 \\ = (Y_{ij} - M_{i80})/(V_{i80})^{0.5} \quad j = 61 \text{ to } 120$$

where M_{i70} and M_{i80} are the means of the variable Y_i over the j companies that floated and remained private during the early 1970s and 1980s respectively and V_{i70} and V_{i80} their variances. The formulae for these measures is provided in Ap-

pendix I. They include the average ratio of the number of small firms floated per period to the total number of small firms in operation. This is contingent upon how the small firm sector is measured. As this is beset with problems, both theoretical and empirical, we have run all our probit regressions separately with the assumed rate of floated to non-floated companies of 0.05/0.95, 0.01/0.99 and 0.001/0.999. Whilst the last was employed in the regressions, the results of which are provided in Table 1, the value of coefficients is not significantly affected by the choice of weighting.

The use of probit

Whilst the standardisation of variables can be justified on theoretical grounds it also facilitates the estimation of changes between periods in the relative importance of the variables in our model.

Consider a set of standardised variables X_i , $i = 1$ to n which are hypothesised to be explanatory variables of small firms gaining flotation. The probability of flotation by the j th firm is given by

$$P_j = \int_{-\infty}^w (1/\sqrt{2\pi}) \exp(-t^2/2) dt \quad (1)$$

where

$$w = \beta_0 + \sum_{i=1}^n \beta_i X_{ij} \quad (2)$$

The X_{ij} 's are the set of variables associated with the j th firm.

This is the probit model. The parameters β_i , $i = 0, 1 \dots n$ are then estimated using maximum likelihood with ex post observations of flotation and non-flotation (flotation = 1, non-flotation = 0). Dropping the second subscript and differentiating equation (1) with respect to X_i :

$$\partial P / \partial X_i = \beta_i (1/\sqrt{2\pi}) \exp(-w^2/2) \quad (3)$$

The partial differential at the mean values for the sample simplifies to

$$\partial P / \partial X_i = \beta_i (1/\sqrt{2\pi}) \exp(-\beta_i^2/2) \quad (4)$$

Thus, when evaluated for the average firm, the marginal probabilities depend solely upon β_i and β_0 . If β_0 does not change significantly between periods, a significant change in β_i is an indication

TABLE I
Probit coefficients (dependant variable = 1 if company floated, and = 0 if company remains unfloated)

	T-4	T-3	T-2	T-1	T
Constant	-3.2937 (-2.52)	-0.9646 (-2.92)	-1.6499 (-2.89)	-2.6190 (-2.38)	-0.4840 (-1.80)
Constant dummy	1.8261 (1.31)	0.6471 (1.70)	-1.4667 (-1.05)	0.4778 (0.37)	0.3118 (0.96)
Change in total assets	1.4229 (1.50)	0.4695 (1.72)	0.4954 (1.53)	2.1090 (1.60)	0.3873 (1.51)
Change in total assets dummy	-0.8036 (-0.78)	0.1068 (0.30)	2.6051 (2.31)	-0.5265 (-0.37)	0.01580 (0.49)
Net working capital/total assets	-0.6123 (-1.44)	-0.2438 (-0.99)	-0.2687 (-0.89)	-0.3015 (-0.97)	0.1545 (0.92)
NWC/total assets dummy	-0.6274 (-1.68)	0.2000 (0.65)	0.7770 (1.50)	0.2199 (0.52)	-0.1128 (-0.43)
Total debt/total assets	0.0725 (0.23)	0.2062 (0.77)	-0.1531 (-0.51)	0.1586 (0.46)	0.1987 (0.78)
Total debt/total assets dummy	-0.1513 (-0.37)	-0.3821 (-1.21)	-0.2791 (-0.62)	-0.7640 (-1.60)	-0.0465 (-0.15)
Earnings before int&tax/total assets	1.0327 (2.22)	0.6920 (2.40)	1.1406 (3.52)	0.9457 (2.2)	0.4662 (2.2)
EBIT/total assets dummy	-0.4829 (-0.97)	-0.4743 (-1.50)	0.4351 (0.66)	0.6130 (0.96)	-0.2648 (-1.05)
Directors' remuneration/total assets	-3.5326 (-2.21)	-1.720 (-2.02)	-1.8722 (-2.14)	-2.6081 (-1.61)	-0.7972 (-2.23)
Directors remun./total assets dummy	2.1224 (1.25)	1.2133 (2.01)	0.7244 (0.64)	2.6909 (1.62)	0.7353 (1.95)
	R ² = 0.20	R ² = 0.23	R ² = 0.46	R ² = 0.47	R ² = 0.47

Numbers in brackets refer to *t* statistics 1.66 Represents the critical value at 0.05% significance on a one tailed test, 1.98 at 0.025 significance.

of a significant change between periods in the marginal probability with respect to a given variable and, therefore, in importance of that variable in affecting the likelihood of flotation. Even where β_0 has changed the impact on changes in coefficients of $\exp(-\beta_{070}^2/2) \pm (-\beta_{080}^2/2)$ where β_{070} and β_{080} are the constant terms in the 1970s and 1980s, is likely to be trivial. Indeed, our results will show that in the one equation where the change on β_0 would appear statistically significant, it could not account for more than a small proportion of the changes in the coefficients on the X_i 's.

The model

We employed:

$$w = \beta_0 + \sum \beta_i X_{ij} + \alpha_0 D_j + \sum \alpha_i D_j X_{ij}$$

to estimate the probability of flotation by the *j*th

firm in period *t* using, separately, data referring to the year of flotation and each of the preceding four years ($T - N, N = 0, 1 \dots 4$)

- and *i* = 1 = denotes standardised growth
- i* = 2 = denotes standardised liquidity
- i* = 3 = denotes standardised gearing
- i* = 4 = denotes standardised profitability
- i* = 5 = denotes standardised directors' remuneration

D_j is a constant dummy = 1 if the *j*th company belongs to the latter period and zero otherwise.

It should be emphasised that a statistically significant coefficient on an interactive dummy reflects a change between periods in the impact on the probability of achieving flotation resulting from moving from the average value of the variable in each period. Whilst less amenable to interpretation than the impact of absolute changes, it results from our contention that, when evaluating a company's performance, the Capital Market will

adopt as its reference point for each pertinent financial variable what is the norm for that period.

Results

(A) In the year of flotation, and in each of the four preceding years, small firms that achieved flotation in either the early 1970s or 1980s were more likely than small firms that remained private to have enjoyed higher than average year-on-year growth in the value of their assets. However, as this hypothesis would be rejected at a 5% level of significance, the relationship is clearly not very strong. Inspection of the data confirms the presence of outlying high growth firms that remained private and low growth firms that were floated.

(B) Apart from a spurt of growth in $t-2$ apparently experienced by small firms achieving flotation during the 1980s, the relationship of growth to flotation did not change between periods.

(C) Profitability was strongly related to the probability of flotation but its importance, as reflected by the size of its coefficient, would appear to have dropped in the year of flotation. Again the strength of its relationship with the probability of achieving flotation would not appear to have changed between periods, apart from a suggestion of a drop in relative profitability in $t-3$ by firms joining the USM.

(D) Pooling the data for both periods would suggest a strong negative relationship between the probability of flotation and the proportion of the book value of assets realised as directors' remuneration with the impact of this variable falling in the year of flotation. However, the approximately equal, but positive values, statistically significant at the commonly accepted levels, of the coefficients on the interactive dummies relating to three of the five years considered would suggest the history of self-denial by the owners of small firms that were to achieve full listing during the 1970s was not repeated by the owners of small firms that were to join the USM during the 1980s.

(E) Between $T-3$ and T inclusive small firms would not appear to have had lower net working capital, than was average for their period, suggesting lack of liquidity was not a powerful motive for going public. Interestingly, whilst, when the data is pooled, floated firms in $T-4$ were apparently not statistically different from non-floated in terms of

liquidity, the values of the coefficient and t statistic on the interactive dummy would suggest that firms floated during the 1980s showed some signs of illiquidity four years prior to flotation.

(F) The results provide no reason for supposing a high level of gearing to be a factor influencing the decision to float in either period.

(G) It should be noted that the degree of explanatory power suggested by the modified R^2 (Amemiya, 1981) was surprisingly high given the multiplicity of factors that could influence an owners' decision as to whether to go public.

Commentary

We believe that all of our results provide fresh insights into the workings of the Capital Market. Whilst it is not surprising that earning above average profits increases the probability of achieving flotation the consistency of the strength of the relationship between periods, and in spite of the institutional differences between full listing and the USM, would not be intuitively obvious. Similarly one might not have expected the effect on the probability of achieving flotation from moving from the average rate of growth to have remained constant, especially as the relationship would not appear to be overwhelmingly strong.

The apparent lack of relationship between both liquidity and gearing and probability of flotation should clearly not pass without comment. Whilst all of the criticisms of the effectiveness of the Capital Market at meeting the needs of small companies may be well founded, they are not reflected by any obvious attempt by the owners of such companies to redress the balance through flotation.

Lastly, it is important to note the very marked change that has apparently occurred in the willingness of owners of small firms to enjoy lower levels of remuneration in the build up to their companies achieving flotation. Self-sacrifice by entrepreneurs would appear a feature of the 1970s but to be absent during the 1980s.

Acknowledgement

We would like to gratefully acknowledge the comments on an earlier draft by Andy Stark, the participants at the European Finance Association

Conference held in Istanbul in 1988 and by three anonymous referees.

Notes

¹ Though by 1985 a significant minority of entrants had issued over 30% of their equity (Buckland and Davis, 1989).

² In the early 1970s new domestic flotations ran at over a hundred a year, in 1976/77 these had fallen to 19, and in 1979/80 were still only 47 (*London Stock Exchange Annual Fact Book*, 1981).

References

- Amemiya, T., 1981, 'Qualitative Response Models: A Survey', *Journal of Economic Literature* **XIX**(4), 1483–1536.
- Anderson, T. A., 1967, 'The Effect of Size on Profits in Manufacturing Industries', in I. Pfeffes (ed.), *The Financing of Small Businesses*, New York: Macmillan.
- Archer, S. H. and L. G. Faerber, 1966, 'Firm Size and the Cost of Externally Secured Equity and Capital', *Journal of Finance* **XXI**, 69–83.
- Bolton, J. A., 1971, *Report of the Committee of Inquiry on Small Firms*, CMND 4811, London: HMSO.
- Buckland, R. and E. W. Davis, 1989, *The Unlisted Securities Market*, Oxford: Clarendon.
- Davis, E. W. and S. Pointon, 1984, *Finance and the Firm*, Oxford: University Press.
- Davis, E. W. and K. A. Yeomans, 1976, 'Market Discount on New Issues of Equity: The Influence of Firm Size, Method of Issue and Market Volatility', *Journal of Business Finance & Accounting* **3**(4), 27–42.
- Gupta, M. C., 1969, 'The Effects of Size, Growth and Industry on the Financial Structure of Manufacturing Companies', *Journal of Finance* **24**(3), 517–529.
- Hall, G. C., 1988, 'Financial Barriers to Growth', in J. Barber, S. Metcalfe and M. Porteous (eds.), *Barriers to Growth*, London: Croom Helm.
- Hall, G. C. and A. Stark, 1986, 'Bankruptcy Risk and the Effect of Conservative Policy from 1979–81', *International Journal of Industrial Organisation* **4**(3), 317–332.
- Hutchinson, P. J., I. Meric and G. Meric, 1988, 'The Financial Characteristics of Small Firms which Achieve Quotation on the UK Unlisted Securities Market', *Journal of Business Finance & Accounting* **12**(1), 9–19.
- Ingram, F. J. and E. L. Frazier, 1982, 'Alternative Multivariate Tests in Limited Dependent Variable Models: an Empirical Assessment', *Journal of Financial and Quantitative Analysis* **XVII**(2), 227–240.
- Keim, D. B., 1983, 'Size Related Anomalies and Stock Return Seasonality', *Journal of Financial Economics* **12**(1), 13–32.
- Levis, M., 1985, 'Are Small Firms Big Performers?', *The Investment Analyst*, No. 76, 21–27.
- Macmillan, 1931, *Report of the Committee on Finance and Industry* CMD 3897, London: HMSO.
- Merrett, A. J., M. Howe and G. D. Newbould, 1967, *Equity Issues and the London Capital Market*, London: Longmans.
- Peat, Marwick and Mitchell, 1985, *Entering the Unlisted Securities Market*, London.
- Radcliffe, 1959, *Report of the Committee on the Working of the Monetary System*, CMND 827, London: HMSO.
- Ray, G. H. and P. J. Hutchinson, 1983, *The Financing and Financial Control of Small Enterprise Development*, Aldershot, Gower.
- Reinganum, M. R., 1982, 'A Direct Test of Roll's Conjecture on the Firm Size Effect', *Journal of Finance* **37**(1), 27–35.
- Rhobson Rhodes, 1983a, *An Analysis of Some Early Claims Under the Small Business Loan Guarantee Scheme*, London: DTI.
- Rhobson Rhodes, 1983b, *A Study of Business Loan Guarantee Scheme — Commentary on a Telephone Survey of Borrowers*, London: DTI.
- Rhobson Rhodes, 1984, *A Study of Business and Finance Under the Small Business Loan Guarantee Scheme*, London: DTI.
- Roll, R., 1981, 'A Possible Explanation of the Small Firm Effect', *Journal of Finance* **36** (4), 879–888.
- Schulz, G. W., 1983, 'Size and Stock Returns and Other Empirical Irregularities', *Journal of Financial Economics* **12**(1), 3–12.
- Singh, A. and G. Whittington, 1968, *Growth, Profitability and Valuation*, Cambridge: Cambridge University Press.
- Stanworth, John and Gray Colin (eds), *Bolton 20 Years On*, London: Paul Chapman, 1991.
- Stoll, H. R. and A. J. Curley, 1970, 'Small Business and the New Issues Market for Equities', *Journal of Financial and Quantitative Analysis* **5**(3), 309–322.
- Storey, D., K. Keasey, R. Watson and P. Wynarczyk, 1987, *The Performance of Small Firms*, London: Croom Helm.
- Taffler, R. J., 1984, 'Empirical Models for the Monitoring of UK Corporations', *Journal of Banking and Finance* **8**(2), 199–227.
- Vaughan, G. C., P. H. Grinyer and S. J. Birley, 1977, *From Private to Public*, Cambridge: Woodhead-Faulkner.
- Walker, E. W. and J. W. Petty, 1978, 'Financial Differences between Large and Small Firms', *Financial Management* **7**(4), 61–68.
- Weston, J. F. and E. F. Brigham, 1978, *Managerial Finance*, 6th Ed., Hinsdale: Dryden Press.
- Whittington, G., 1971, *The Prediction of Profitability and Other Studies of Company Behaviour*, Cambridge: Cambridge University Press.
- Wilson, Lord, 1979, *Committee to Review the Functioning of Financial Institutions: Interim Report*, CMND 7503, London: HMSO.

Appendix 1

Standardising the variables was arithmetically straightforward. Let $j = 1$ to 30 be the companies achieving flotation during the 1970s and $j = 31$ to 60 a control group of companies that, within the same period, remained private. Similarly, 61 to 90 denotes floated companies during the 1980s and 91 to 120 non-floated companies. We then define

$$M_{if70} = \left(\sum_{j=1}^{30} Y_{ij} \right) / 30 \quad (\text{A1})$$

$$M_{ip70} = \left(\sum_{j=31}^{60} Y_{ij} \right) / 30 \quad (\text{A2})$$

$$M_{if80} = \left(\sum_{j=61}^{90} Y_{ij} \right) / 30 \quad (\text{A3})$$

$$M_{ip80} = \left(\sum_{j=91}^{120} Y_{ij} \right) / 30 \quad (\text{A4})$$

Where M_{if70} , M_{ip70} , M_{if80} , and M_{ip80} are the means of the variable Y_{ij} over the companies that floated during the 1970s, remained private during the 1970s, floated over the 1980s and remained private during this period, respectively.

Estimates of the population means for each variable Y_{ij} for the two periods separately, denoted by M_{i70} and M_{i80} , are formed by

$$M_{i70} = P_{f70} M_{if70} + (1 - P_{f70}) M_{ip70} \quad (\text{A5})$$

and

$$M_{i80} = P_{f80} M_{if80} + (1 - P_{f80}) M_{ip80} \quad (\text{A6})$$

where P_{f70} and P_{f80} are the average ratio of the number of firms floated per annum to the total number of small firms operating during the two periods.

To calculate the population variance for each variable for the early 1970s and 1980s, denoted by V_{i70} and V_{i80} ,

$$V_{i70} = P_{f70} V_{if70} + (1 - P_{f70}) V_{ip70} + \frac{P_{f70} (M_{if70} - M_{i70})^2 + (1 - P_{f70}) (M_{ip70} - M_{i70})^2}{1} \quad (\text{A7})$$

$$V_{i80} = P_{f80} V_{if80} + (1 - P_{f80}) V_{ip80} + \frac{P_{f80} (M_{if80} - M_{i80})^2 + (1 - P_{f80}) (M_{ip80} - M_{i80})^2}{1} \quad (\text{A8})$$

We can then standardise each variable Y_{ij} to give a new variable X_{ij} by

$$\begin{aligned} X_{ij} &= (Y_{ij} - M_{i70}) / (V_{i70})^{0.5} \quad j = 1 \text{ to } 60 \\ &= (Y_{ij} - M_{i80}) / (V_{i80})^{0.5} \quad j = 61 \text{ to } 120 \end{aligned} \quad (\text{A9})$$

The appropriate measure of P_{f70} and P_{f80} will be contingent upon how the small firm sector is measured. We have run all our probit regressions separately with the assumed ratio of floated to non-floated companies of 0.05/0.95, 0.01/0.99 and 0.001/0.999. The value of the coefficients is not significantly effected by the choice of weighting.

Copyright of Small Business Economics is the property of Kluwer Academic Publishing / Business and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.