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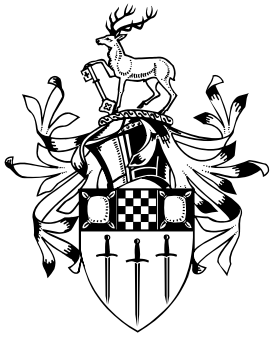

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SHAREHOLDER VALUE OR COMPETITIVE ADVANTAGE? EVIDENCE FROM HURDLE RATES

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Shareholder Value or Competitive Advantage?
Evidence from Hurdle Rates[*]

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Abstract

Economic theory suggests several plausible reasons why firms may employ hurdle rates for capital investment appraisal that differ from discount rates. Using a sample of business units from the PIMS data bank of North American companies we find that hurdle rates are frequently below and also frequently above matched data on discount rates. Using multinomial logit analysis we find that variables representing the opportunity for strategic investment or the motivation for such investment increase the probability of managerial or strategic behaviour. We also find evidence for an irreversibility effect.

JEL codes: G3, L2, L6, E22

Keywords: HURDLE RATE/ INVESTMENT/ STRATEGY/GOVERNANCE/ PIMS DATABASE/ MULTINOMIAL LOGIT

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1. Introduction

> "Increasingly, companies are becoming polarized into two camps: those who consider shareholder value the key to managing the company and those who put their faith in gaining competitive advantage. At companies across the United States there is an intense struggle taking place between those who formulate business strategy and those who seek to value it"
>
> Alfred Rappaport, *Harvard Business Review*, May-June 1992

We aim to establish whether the heterogeneity noted by Rappaport finds support in data on company hurdle rates. If, as suggested, companies are polarised into shareholder oriented businesses and those with managerial autonomy, we should expect to see this reflected in investment appraisal and specifically in the 'wedge' reported in our data between discount rates and hurdle rates. Such heterogeneity may be an important reason why economists have found capital investment so difficult to model and forecast. In this paper we present an analysis of hurdle rates using the PIMS dataset of large industrial firms, mostly US based, for the period up to 1992. We suggest that there is substantial evidence of heterogeneity in the manner in which firms appraise investment opportunities.

There have been surprisingly few direct studies of hurdle rates in capital budgeting. This is despite the wealth of theorizing about such rates - as exemplified by the large literature on managerial 'over-investment' or 'strategic investment' and the recent literature on the 'irreversibility premium' in standard investment appraisal. One possible reason for this inattention is that hurdle rates are generally unrecorded and have to be found by surveys of company managers, so that consistent observation over time is difficult and reported studies are rare. One exception was a survey (of the Fortune 1000 companies) which used a set of reported hurdle rates in manufacturing industry for a particular year and which attempted to explain the considerable variation across the sample (Poterba and Summers 1995).[1] However, despite entering a large range of financial and structural variables the authors failed to obtain any results to explain the diversity in hurdle rates that accorded with prior theory. The one partial exception was that the current ratio (a possible proxy for free cash flow) was found in a bi-variate

[1] Most companies in the sample appeared to use a real hurdle rate much higher than the real cost of capital. Indeed, typically, the hurdle rate was more than 3 percentage points above the real cost of equity but it was both much higher for some companies and it was negative for a substantial proportion – about a quarter of the total.

regression to be correlated with *higher* hurdle rates.[2] The authors report the "striking conclusion…that none of the traditional financial variables that might proxy for risk, like the firm's stock market Beta, correlates with hurdle rates" (p.47).

In this paper we use a range of (mainly non-financial) variables to discriminate between the cases where the wedge between the hurdle rate and the discount rate is positive or negative. Section 2 discusses the theoretical background and establishes some hypotheses. Section 3 describes the nature of the dataset we are using. We then describe the testing framework in section 4, with results presented in Section 5.

2. Why do hurdle rates differ from discount rates?

The Case of a Negative Wedge

The main explanations as to why hurdle rates might lie *below* the discount rate are that a) firms may be able to pursue goals other than that of profit maximisation and/or b) firms may be acting strategically.[3] An important element in the first ('empire building') hypothesis is the existence of managerial autonomy and opportunity. Here, the literature emphasizes the existence of 'free cash flow' (Jensen 1986). Most recently the sensitivity of investment to free cash flow has been noted by Jensen and Fuller (2002) and Henderson and Cool (2003). Managerial empire building at the expense of profitability is not, however, the only explanation of why hurdle rates may lie below the cost of capital. The literature on real options and in particular, expansion options, provides examples of how such behavior can be justified economically.[4] Inter alia, expansion options provide scope for further profit opportunities due to improvements in the firm's *strategic* position. These so-called "platform" investments may be particularly important in cases of new markets and new product innovations where there are clear first mover advantages.

[2] A further bi-variate regression suggested that managers with financial backgrounds may be more inclined towards higher hurdle rates though the direction of causation here is somewhat unclear.

[3] Discretionary behavior by management (in situations of rather weak corporate governance and product market discipline) has been formalized in the literature as an optimal trade-off between the growth and the probability of takeover (Odagiri 1981). Empirical evidence supporting a managerial preference for growth is somewhat inconclusive but Kathuria and Mueller (1995) provides some support.

[4] Specifically, where abandonment is possible, and where there are delivery lags it may be sensible for the firm to initiate projects with negative expected return (Ghemawat 1991, Dixit and Pindyck 1994, Bar-Ilen and Strange 1996, Miller and Folta 2002, Schwartz and Trigeorgis 2001).

The Case of a Positive Wedge

There is also a sizeable literature on the alternative case of a positive wedge, where the hurdle rate contains a premium over the discount rate. Firms face a 'zone of inaction' in respect of the marginal value of capital, q, where it is optimal to keep the capital stock constant even if it differs from its frictionless optimal value (Abel and Eberly 1994; Dixit and Pindyck 1994; Chirinko and Schaller, 2002). Thus firms may be stuck in a position where their investment is not optimal - in the sense that without threshold effects it would be changed - but which in the presence of threshold effects it is not optimal to change. The effect of this modification to standard theory is to allow the hurdle rate to lie above the usual cost of capital rate. Rules of thumb for hurdle rates in excess of the discount rate are derived from real options theory in McDonald (2000)[5].

Empirical Hypotheses:

This brief discussion of why firms may employ hurdle rates that differ from their discount rates, suggests that the empirical analysis needs to consider three main hypotheses:

H1: The existence of a hurdle rate below the discount rates is indicative of a management with some discretionary power or opportunity

However, it is important to note that the existence of discretionary power need not imply "over-investment". To consider this we need to test:

H2: The existence of a hurdle rate below the discount rate suggests the existence not only of opportunity but of strategic incentives or motivation.

Note that if H1 is true but not H2, then this indicates Jensen type "over-investment". If both are true, the low hurdle rate may be explained by managers pursuing strategic objectives.

For the third hypothesis we turn to the sample of firms with a positive wedge where hurdle rates are *above* the discount rate (the ABOVE sample). We set out the hypothesis that:

[5] There are of course other explanations of a positive wedge. These include financial constraint on investment (for a review see Hubbard 1998) or in an agency context where capital rationing is used to prevent over-investment caused by managers signalling their performance (Holmstrom and Costa 1986). Unfortunately, the issue is not clear-cut, however, because there is a subsidiary literature that suggests that risk-loving behaviour may emerge under financial distress and this would reverse the sign of this effect on the hurdle rate (Opler and Titman 1994).

H3: the existence of a hurdle rate higher than the discount rate suggests a profit-maximising sample subject to an irreversibility constraint, implying the importance of risk and irreversibility.

We now briefly describe the data set used to test these hypotheses.

3. The PIMS Dataset

The data source used in this paper is the PIMS (Profit Impact of Marketing Strategy) cross-sectional database of large firms, established in 1972 at Harvard University. The reporting base consists of over 3000 business units mainly based in the US - representing 450 companies – and which are considered to be selling a 'distinct set of products to a well-defined set of customers'. corresponding to narrow market segments at least as fine as the four-digit Standard Industrial Classification (SIC).The PIMS program is described in detail in Buzzell and Gale (1987). The data have been extensively used in applied research (e.g. Clark and Griliches 1984, Ghemawat and Caves 1986, Caves and Ghemawat 1992, Besanko *et al* 2001). The data are prepared by managers of each business unit under detailed guidance from PIMS consultants. The sample period for the cross section covers 1972 to 1992 with the data being collected in five-year blocks.[6] Firms subscribe to PIMS as a way of benchmarking performance in different businesses; a digest of the results in ratio form is returned to firms to allow them to compare indicators such as R&D intensity, capacity utilization, or profitability. Data that are not in ratio form are disguised by being scaled using a constant term specific to each business unit. Of course these data have all the virtues and shortcomings of any survey-based sample; they are direct and consistent in that all variables are collected from the same source. On the other hand, they are only as reliable as the reporting managers choose to be. However, when used in applied work, the data provide strong support for standard economic theories (Driver et al 1996). Furthermore, as the ensuing discussion on the interpretation of hurdle rates and discount rates makes clear, considerable effort was expended in making the questions clear to the respondents.

Most of the variables used in the following analysis are reasonably self-explanatory and are listed and annotated in the Data Appendix. However, we give here the actual PIMS definitions of the terms 'hurdle rate' and 'discount rate', for which the specific instructions relating to their

[6] If there are multiple blocks for any business unit the latest block only is recorded in the sample.

reporting were:

Discount rate: "The discount rate is used in computing the present value of a stream of future income or cash flow. You can think of it also as your opportunity cost of capital (i.e. your company's cost of debt and equity)"

Capital Charge Rate: "In calculating discounted net income what capital-charge rate should be applied to any additional investment that would be required to pursue the various strategy alternatives available to your business. The capital charge rate can be used to simulate financing costs for new investment"

PIMS tells its respondents that "the discount rate indicates the degree to which current income or cash flow is more valuable than future income or cash flow", i.e. it is a conventionally defined weighted average cost of capital (WACC). Similarly, the capital charge rate "indicates the degree to which your business should be encouraged to seek (or be penalized for seeking) additional investment funds". It is clear therefore that the capital charge rate is indeed a "hurdle rate"[7]

Key descriptive statistics of our dataset are reported in the Data Appendix below. In our data 2382 business units reported both hurdle rates and discount rates. Of these 1425 reported that they used hurdle rates that were approximately equal to their discount rates (we refer to these units as the 'EQUAL' sample) 505 units reported using hurdle rates less than the discount rate (the 'BELOW' sample) with the remaining 452 units reporting a positive wedge (the 'ABOVE' sample).

4. Empirical Testing

Under hypotheses H1 and H2, described in section 2, the occurrence of a negative wedge where the hurdle rate is lower then the discount rate (the BELOW sample) is predicted by the opportunity and the motivation to act strategically. On the other hand under H3, the occurrence of a positive wedge (the ABOVE sample), is predicted by a combination of risk and irreversibility under profit maximizing behavior and real options. For emphasis we set this out below:

[7] These interpretations of the discount rate and hurdle rate were confirmed by PIMS in private correspondence.

SAMPLE OBSERVED	*CODE*	*IMPLICATION*	*HYPOTHESIS*	*CONDITIONING VARIABLES*
Hurdle<discount	BELOW	Managerial/ Strategic Behavior	H1/H2	Opportunity/ Opportunity and Strategic Motivation
Hurdle>discount	ABOVE	Profit Maximizing with Irreversibility	H3	Risk and Irreversibility

Clearly we could encounter hybrid cases but as long as this is borne in mind, the dichotomy remains useful as a potential source of heterogeneity across firms. In the empirical analysis that follows, we use a multinomial logit analysis to differentiate the observations in the ABOVE EQUAL and BELOW samples, by conditioning on the opportunity, and on the motivation, to act strategically, as well as on a measure of risk and irreversibility. Note that we use multinomial logit in preference to an ordered logit because variables that predict membership of the BELOW group may not always be expected to predict against membership of the ABOVE group. Further discussion of this point is postponed to the results section.

The opportunity

Not all firms are in a position to maintain (long-run) investments at hurdle rates lower than the discount rate. The corporate governance literature suggests that, in the presence of asymmetric information, a necessary condition for such opportunity is the existence of free cash flow, combined with a lack of product market discipline from end-users and competitors. Proxies for product market discipline available to us from the PIMS dataset and employed in this study were as follows:

- Liquidity [a ranking of business units according to the ratio of cash-flow to sales - v1]
- Lack of market discipline 1 [the % of sales channeled to distribution facility - v35]
- Inverse lack of market discipline 2 [the % of sales channeled to retailer - v37]
- Existence of a barrier to entry in the form of 'lumpy capital' [capacity quantum v454]
- Existence of a barrier to entry in the form of capital intensity [the ratio of fixed capital to sales] v201

Strategic motivation

The incentive to pursue growth should be related to the strategic value of investments. Here we use a variable recording the percentage of sales accounted for by new products so as to capture the innovativeness of the business unit and therefore the value of expansion options. Market share rank is also included to measure the relative potential for gain through expansion, which in the case of small-share firms should neither affect the market price severely nor substitute for existing sales and should thus confer greater strategic advantage. We also include here a dummy variable denoting whether or not major entry into the market has occurred over the reporting period and which may, depending on the nature of the strategic game, encourage firms to 'accommodate' or to respond aggressively and increase capacity. Accordingly, the specific variables included are:

- % sales from new products v302
- market share rank v 72
- major entry v70

Risk factors

Risk should already be accounted for as part of the discount rate in so far as it reflects the equity risk premium. In addition however, the irreversibility premium may be related to market volatility. Hence we include a measure of the industry sales volatility provided in PIMS:

- Industry instability v80

Controls

Since both the hurdle rate and the discount rate were recorded in nominal terms, we also include the discount rate as a control variable. This acts as an indicator of the nominal inflation rate that is known to have varied considerably over the reporting period. It may also reflect the ways in which the tax regime impacts upon the hurdle rate. The discount rate is also needed as a control because at lower levels of the discount rate it is harder for firms to record hurdle rates lower than the discount rate. The final variable used in the statistical analysis is therefore:

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- Discount rate v451

Statistical summaries of these variables for each of the outcomes and the total sample are

reported in the Data Appendix.

5. Results

Given our hypotheses - and the potential for heterogeneity in the reasons for firms to adopt a hurdle rate differing from the discount rate – the multinomial logit represents an appropriate method of analysis. We consider all three outcomes – 'BELOW', 'EQUAL', and 'GREATER' – as discrete choice variables conditioned on our measures of opportunity, strategic motivation, and risk as discussed in the last section.

Table 1 reports the results of four specifications with 'EQUAL' as the comparator group. In the first specification (equation 1.1) we include all the variables discussed in the last section. Equation 1.2 includes both cash-flow and its square (v2), to allow for potential non-linearities in the impact of cash-flow. We found that its inclusion generally improved the diagnostics but had little impact on the reported signs of the other variables. Further diagnostics, reported in an appendix, support this conclusion.

{TABLE 1 ABOUT HERE}

Equations 1.3 and 1.4. provide some robustness checks. As our measure of risk is not recorded for a substantial number of business units, equation 1.3 increases the sample size (from 1514 to 2263) by dropping risk (v80). One noteworthy difference is that market share ranking becomes insignificant for the ABOVE sample. In Equation 1.4 we restrict the sample to the units known to be in manufacturing industry. Again results are stable.

In view of the importance of the cash-flow variable, we also tested for possible endogeneity in a Hausman-Wu type procedure, but the null of exogeneity of this variable could not be rejected at the 5% level. [8]

It is not appropriate to interpret the results of a multinomial logit analysis purely on the basis of the estimated coefficients: it is important also to compute the marginal probabilities. These are reported in Table 2 in the form of the estimated change in probability for each outcome arising

from a unit change in each variable corresponding to equation 1.2 in Table 1. They are evaluated at the means of the variables, except in the case of the dummy variable representing major entry, which was evaluated at zero (i.e. with no major entry).

{TABLE 2 ABOUT HERE}

The results in Table 2 strongly confirm the importance of the opportunity set in distinguishing the BELOW outcome from the EQUAL outcome. Importantly, cash flow appears to facilitate managerial or strategic behavior. Although this cash flow term is non-linear, the overall impact of an increase in cash-flow is nonetheless positive in predicting membership of the BELOW group when evaluated at the mean. Other opportunity set variables include indicators of market discipline, of which the most important influences are the variables representing customer power. For the BELOW group, both the % of sales channeled to a retailer and the % channeled to own distribution facilities are highly significant and oppositely signed in accordance with our expectation. The other opportunity variables representing barriers to entry also predict membership of the BELOW group with the right sign and they are significant at the 1% level (for the capital-sales ratio) and at the 10 % level (for capacity quantum). Moreover the estimated impact of at least some of the variables is reasonably large. This can be seen from Figure 1, where the marginal probability of each variable is multiplied by its respective standard deviation.

{FIGURE 1 ABOUT HERE}

In our preferred specification (equation 1.2), the effect of cash-flow is non-linear and is represented by both cash-flow and its square. It is of interest that the overall impact of cash-flow is subject to a sign reversal over its full range. This is illustrated in Figure 2, which plots the marginal probability of a one-percentage point improvement in cash-flow with other variables held at their mean, and with no major entry. At its maximum, a movement to a higher percentile in the cash-flow ranking increases the probability of membership of the BELOW group by around 0.005. However the impact of the squared term negates this impact beyond the 70^{th} percentile.

{FIGURE 2 ABOUT HERE}

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8. The procedure is described in Smith and Blundell (1986). The additional instruments used were major exit in the previous three years (EXIT) and a variable indicating patent protection (PROP). These are defined in the data

These findings are of some interest as they relate to the continuing controversy regarding the relationship between the sensitivity of investment to cash-flow for constrained and unconstrained firms (Fazzari et al 2000; Kaplan and Zingales 2000; Chirinko and Kalkreuth 2002). Our results appear to indicate that firms in the lower percentiles of cash flow will increase investment as cash flow rises even if the hurdle does not match the discount rate. However cash rich businesses will tend to do the opposite and be reluctant to spend further. We interpret these findings as indicating:

(a) that the opportunity to spend money is an important facilitator of investment for most businesses, but
(b) cash rich businesses may fear over-investment and put in place strict hurdle rates to control expenditure.

Turning now to the set of variables representing strategic motivation, support can be found in Table 2 for strategic behaviour as set out under Hypothesis 2.

A noteworthy feature of the results is that the sign of the new product variable is positive and significant *for both the BELOW and the ABOVE groups* i.e. product innovation encourages strategic investment for some business units and discourages it for others. This heterogeneity, which the multinomial logit technique is designed to capture, probably reflects different approaches by different managers as suggested in our introductory comments in this paper. On the one hand, new product intensity may confer an option to expand that justifies strategic loss-making pilot investments (Folta and O'Brien 2003). This would explain the influence of new product intensity on membership of the BELOW group. On the other hand, new product intensity is also likely to be associated with divisions that attract attention and monitoring from Head Office. These business units may find that have a higher hurdle rate imposed on them than a company-wide cost of capital so that new product intensity would also predict membership of the ABOVE group

A second variable for strategic motivation is the market share rank - an inverse measure of market power. Small-share (high-ranked) firms are more likely (prob<1%) to be members of the BELOW group. While the industrial organization literature cannot unambiguously predict the sign

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appendix.

of the effect of market power on innovation, the results here reflect the original 'replacement' effect (Arrow 1962) where monopolists have less incentive to cannibalize their own products. This is confirmed also in Aghion et al (2002) where less innovation occurs where there is a monopolist with a clear competitive advantage.

The third variable representing strategic motivation is the occurrence of major new entry. This variable predicts in favor of the EQUAL group and against the ABOVE group. Entry appears to produce an aggressive response for companies that are not already in the strategic investment game. The findings here are in accord with Geroski (1995) who cites evidence that new entry stimulates incumbents to increase investment that firms have been holding back (p.1431)

The final set of discriminating variables concerns hypothesis 3 (H3) that non-diversified risk i.e. risk not accounted for in the discount rate, may influence hurdle rates via the role of an irreversibility constraint (Dixit and Pindyck 1994). Risk is measured by instability in the industry growth rate. This variable predicts against membership of the BELOW group and, also, for membership of the ABOVE group (both significant at the 1% level). This provides rather striking evidence in favor of an additional influence from risk in biasing hurdle rates upward. Figure 1 shows that its quantitative impact, while small, is not negligible.

The sole control variable employed is the discount rate which will also proxy the inflation rate. At high inflation rates the motive to use a lower discount rate at the margin is strong for firms who are not tax-exhausted because of the beneficial effect of high inflation on the value of depreciation allowances. It follows that this variable should more properly be regarded as a control rather than differentiating between strategic and profit maximizing behaviour. Given the variance in inflation rates over the time period of the sample, the usefulness of the discount rate as a predictor should not be surprising. As noted earlier, there may also be a further effect in that at low discount rates it will be more difficult to generate hurdles below that discount rate.

6. Summary and Conclusions

In this paper we have looked at the relationship between hurdle rates and discount rates in order to understand the influence of a range of firm characteristics on investment appraisal.

One important finding is that there are a significant number of firms in our data for which reported hurdle rates are below discount rates (the BELOW sample). We argued that this could be explained by managerialism and/or the pursuit of strategic objectives. As Table 2 and Figure 1 suggest, the results are rather stronger in discriminating between the BELOW and EQUAL outcomes than between the ABOVE and EQUAL groups. Nevertheless, both sets of results give rise to interesting interpretations.

Focusing first on the variables that contribute most to distinguishing firms that adopt hurdles lower than the discount rate we identified a set of “opportunity” variables , specifically cash flow and the environment for product market competition. The cash flow effect was non-linear and reversed in sign for very cash-rich firms. These results give some support to the arguments in the literature that emphasize the tendency for managerialism when strong controls are absent on management (though we have no direct variable for corporate governance). However, as noted in the text the significance of the opportunity variables is not a sufficient condition for the managerial hypothesis to be true. Managers may be using their freedom from short-term pressures to pursue strategic long-run aims. To test this we entered a number of other variables representing this motivation, in particular new product intensity, market share rank and recent entry. In the case of the first two of these variables we again established a strong discriminating role, suggesting that managers are strategically focused when presented with greater autonomy. High levels of risk also worked to discriminate against firms choosing hurdles less than the discount rate.

For the sample of firms with hurdles greater than their discount rate, the results were the mirror image of the first group for the variables cash flow and risk. However, the importance of the multinomial logit technique is confirmed by the lack of significance for the remainder of the opportunity variables (and market share rank), and also by the positive significance for new product intensity for both the groups. As outlined in the text this reveals a heterogeneous picture with the effect of new product intensity differing between the groups. Major entry also appears to have a distinct effect: the main significance found for this variable is in predicting against the group with hurdle rates higher than the discount rate as compared to those with equality. We explained this in terms of a competitive effect on businesses that had been holding back marginally profitable developments.

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DATA APPENDIX

Variables and Descriptions

Identifier	Variable	Description
V1	Cash-flow sales rank (1)	Free cash flow expressed as a ratio of sales and ranked inversely (1=lowest)
V2=v1^2	Cash-flow sales squared/10000	As above, squared
v35	% sales channelled to distribution facility (35)	% of sales made to company-owned distribution facilities
v37	% sales channelled to retailer (37)	% of sales made to retailers
v454	capacity quantum (454)	Specifically, the capacity quantum is the "minimum economically efficient amount" by which the standard capacity of the business could be increased, expressed as a percentage of the previous years capacity.
v201	ratio of fixed capital to sales (201)	Gross book value of plant and equipment as a percentage of sales
v302	% sales from new products (302)	Percentage of sales accounted for by products introduced in the last five years
v70	major entry (70)	Entry is major if it accounts for 5% of sales and has taken place within 3 years
v72	market share rank (72)	Rank order (1=highest) of market share of the business unit in its perceived served market
v80	Industry instability (80)	RMSE index of industry sales instability over five years
v451	Discount rate (451)	See definition in text
v452	hurdle rate (452)	See definition in text
Instrument 1	Major exit	Exit is major if it accounts for 5% of sales and has taken place within 3 years
Instrument 2	Proprietary processes	Dummy=1 if process is protected to a significant degree by patent,trade secrets or other proprietary methods

Correlation Matrix for Variables Used – Total Sample

	v1	v2	v35	v37	v454	v201	v302	v70	v72	v80	v451	v452
v1	1.000											
v2	0.969	1.000										
v35	-0.012	-0.010	1.000									
v37	-0.052	-0.068	-0.030	1.000								
v454	-0.035	-0.019	0.013	-0.043	1.000							
v201	-0.127	-0.081	-0.034	-0.126	0.067	1.000						
v302	-0.181	-0.147	0.040	0.012	0.058	-0.091	1.000					
v70	0.012	0.029	0.009	-0.060	0.024	-0.037	0.098	1.000				
v72	-0.254	-0.234	-0.007	0.048	0.094	0.038	0.079	-0.091	1.000			
v80	0.041	0.043	-0.023	0.000	-0.012	0.019	0.024	0.001	0.019	1.000		
v451	0.043	0.045	-0.018	-0.012	0.057	-0.022	-0.020	-0.007	-0.059	-0.045	1.000	
v452	-0.030	-0.019	-0.029	0.035	-0.004	-0.071	-0.001	0.012	-0.035	0.025	0.474	1.000

SUMMARY STATISTICS

TOTAL SAMPLE

Variable	Obs	Mean	Std. Dev.	Min	Max
v1	2382	50.0	28.9	0.1	100.0
v2=v1^2	2382	3335.4	2983.2	0.0	10000.0
v35	2377	4.6	15.2	0.0	100.0
v37	2377	18.5	32.2	0.0	100.0
v454	2308	17.5	21.6	0.0	100.0
v201	2382	45.2	32.8	3.0	170.0
v302	2351	7.8	15.2	0.0	99.0
v70	2368	0.3	0.4	0.0	1.0
v72	2382	2.6	2.1	1.0	10.0
v80	1578	11.4	9.6	0.0	40.0
v451	2382	11.7	3.0	2.0	20.0
v452	2382	11.5	3.0	4.0	20.0

SAMPLE = BELOW

Variable	Obs	Mean	Std. Dev.	Min	Max
V1	505	52.3	27.4	0.6	99.7
V2	505	3481.0	2890.4	0.4	9949.7
V35	504	6.1	17.7	0.0	100.0
V37	504	14.4	27.9	0.0	100.0
V454	499	19.3	22.0	0.0	100.0
V201	505	47.2	32.7	3.0	170.0
V302	502	8.5	16.5	0.0	90.8
V70	504	0.2	0.4	0.0	1.0
V72	505	2.5	1.9	1.0	10.0
V80	374	10.5	8.7	0.0	40.0
V451	505	14.0	2.7	8.0	20.0
V452	505	9.9	1.9	4.0	19.0

SAMPLE =EQUAL

Variable	Obs	Mean	Std. Dev.	Min	Max
V1	1425	50.0	29.0	0.1	100.0
V2	1425	3343.7	3006.0	0.0	10000.0
V35	1423	3.9	13.8	0.0	100.0
V37	1423	19.8	33.5	0.0	100.0
V454	1379	16.7	21.8	0.0	100.0
V201	1425	44.2	32.4	3.0	170.0
V302	1403	6.5	12.9	0.0	99.0
V70	1418	0.3	0.4	0.0	1.0
V72	1425	2.6	2.1	1.0	10.0
V80	893	11.5	9.7	0.0	40.0
V451	1425	11.4	2.7	6.0	20.0
V452	1425	11.4	2.7	6.0	20.0

SAMPLE=ABOVE

Variable	Obs	Mean	Std. Dev.	Min	Max
V1	452	47.5	29.9	0.1	99.9
V2	452	3146.8	3009.6	0.0	9974.9
V35	450	5.1	16.5	0.0	100.0
V37	450	19.2	32.1	0.0	100.0
V454	430	17.7	20.3	0.0	100.0
v201	452	46.0	34.2	3.0	170.0
v302	446	10.9	19.2	0.0	99.0
v70	446	0.2	0.4	0.0	1.0
v72	452	2.7	2.2	1.0	10.0
v80	311	12.2	10.4	0.0	40.0
v451	452	10.0	2.7	2.0	18.0
v452	452	13.3	3.6	5.0	20.0

RESULTS APPENDIX

Additional Statistics for equations 1.1 and 1.2

Equation (see table 1)	1.1	1.2
McFaddens adjusted R^2	0.155	0.162
Adjusted count R^2	0.133	0.142
Maximum likelihood R^2	0.285	0.296
LR test of 1.1 against 1.2:		
Chi2(2) =	23.78	
Prob > Chi2 =	0.0000	
Wald tests of H0:		
All coefficients except intercepts associated with given pair of outcomes are 0.	Prob>chi2	Prob>chi2
v1	0.011	0.000
v2	-	0.000
v35	0.020	0.012
v37	0.030	0.014
v454	0.274	0.187
v201	0.019	0.002
v302	0.000	0.000
v70	0.002	0.005
v72	0.049	0.022
v80	0.027	0.026
v451	0.000	0.000
Small-Hsiao tests of IIA assumption		
H0: odds of pairs of outcome are independent of other alternatives	Prob>chi2	Prob>chi2
Omitted outcome:		
Below	0.440	0.409
Above	0.000	0.399

TABLES

TABLE 1 **Multinomial Logit Estimates (Robust Standard Errors)**

Dependent variable = MLOG **Comparison group is MLOG = equal**

	(1.1)			(1.2)			(1.3) exc. 80			(1.4) Manufacturing only		
Variable	**Coeff.**	**Z**	**Sig**	**Coeff.**	**Z**	**Sig**	**Coeff.**	**Z**	**Sig**	**Coeff.**	**z**	**Sig**
BELOW SAMPLE												
Managerial Opportunity												
Cash-flow sales (1)	0.0054	2.18	**	0.0548	5.11	***	0.0386	4.32	***	0.0658	4.87	***
Cash-flow sales squared	-	-		-0.0005	-4.73	***	-0.0003	-3.96	***	-0.0006	-4.65	***
% sales channelled to distribution facility (35)	0.0119	2.59	***	0.0126	2.79	***	0.0082	2.07	**	0.0210	3.69	***
% sales channelled to retailer (37)	-0.0071	-2.65	***	-0.0079	-2.92	***	-0.0077	-3.72	***	-0.0014	-0.48	
Capacity quantum (454)	0.0052	1.56		0.0062	1.79	*	0.0051	1.93	*	0.0062	1.57	
ratio of fixed capital to sales (201)	0.0055	2.77	***	0.0075	3.58	***	0.0055	3.11	***	0.0082	3.29	***
Managerial Motivation												
% sales from new products (302)	0.0135	2.81	***	0.0162	3.39	***	0.0188	4.69	***	0.0258	4.75	***
Major entry (70)	-0.4086	-2.38	**	-0.3435	-2.01	***	-0.3213	-2.31	**	-0.4666	-2.18	**
Market share rank (72)	0.0900	2.44	**	0.1015	2.74	***	0.0313	1.03		0.1383	3.19	***
Risk												
Industry instability (80)	-0.0155	-2.01	**	-0.0157	-2.03	**	-	-		-0.0339	-3.59	***
Controls												
Discount rate (451)	0.3492	12.05	***	0.3591	12.15	***	0.3139	14.92	***	0.4051	10.76	***
Constant	-5.7786	-13.21	***	-6.9609	-12.91	***	-6.1942	-14.58	***	-7.8236	11.43	***
ABOVE SAMPLE												
Managerial Opportunity												
Cash-flow sales (1)	-0.0038	-1.50		-0.0004	-0.04		-0.0098	-1.20		-0.0050	-0.40	
Cash-flow sales squared	-	-		0.0000	-0.31		0.0001	0.86		0.0000	0.06	
% sales channeled to distribution facility (35)	-0.0019	-0.33		-0.0010	-0.33		0.0031	0.88		-0.0104	-1.34	
% sales channeled to retailer (37)	-0.0010	-0.44		-0.0010	-0.47		-0.0004	-0.22		0.0000	0.00	
Capacity quantum (454)	0.0027	0.81		0.0029	0.87		0.0007	0.26		0.0008	0.20	
ratio of fixed capital to sales (201)	0.0027	1.22		0.0027	1.22			0.11		0.0014	0.48	
Managerial Motivation												
% sales from new products (302)	0.0178	4.15	***	0.0180	4.16	***	0.0002	5.18	***	0.0199	3.69	***
Major entry (70)	-0.4978	-2.92	***	-0.4961	-2.92	***	-0.4885	-3.52	***	-0.4431	-2.18	***
Market share rank (72)	0.0186	0.54		0.0187	0.54		-0.0292	-1.03		0.0426	0.97	
Industry instability (80)	0.0104	1.41		0.0105	1.41		-	-		0.0170	1.93	*
Controls												
Discount rate (451)	-0.4011	-7.49	***	-0.3996	-7.45	***	-0.2526	-7.96	***	-0.4826	-7.32	***
Constant	2.8513	5.05	***	2.7617	2.76	***	1.78203	4.24	***	3.5275	4.57	***
N Obs		1514			1514			2263			1099	
Pseudo R^2		0.17			0.18			0.13			0.21	
Wald	chi2(20)	267.44	***	chi(22)	267.57		chi2(20)	381.11	***	chi2(22)	229.25	
Log likelihood		-1236.9			-1225.0			-1868.3			-847.2	

* = significant at 10% ** = significant at 5% *** = significant at 1%

TABLE 2

Marginal Probabilities:

The impact on probabilities for each outcome of a unit change in the stated variable

Equation (1.2)	**BELOW SAMPLE**				**EQUAL SAMPLE**				**ABOVE SAMPLE**			
	Evaluated at:	marginal probability	z	signif-icance.	evaluated at:	marginal probability	Z	significance.	evaluated at:	marginal probability	z	signif-icance.
Managerial Opportunity												
Cash-flow sales (1)	mean	0.0112	4.45	***	mean	-0.0090	-3.95	***	mean	-0.0022	-2.10	**
Cash-flow sales squared	-	-0.0001	-4.09	***	-	0.0001	3.80	***	-	0.0000	1.42	
% sales channeled to distribution facility (35)	mean	0.0026	2.91	***	mean	-0.0019	-2.00	**	mean	-0.0007	-1.10	
% sales channeled to retailer (37)	mean	-0.0016	-2.86	***	mean	0.0014	2.77	***	mean	0.0002	0.69	
capacity quantum (454)	mean	0.0011	1.68	*	mean	-0.0013	-1.80	*	mean	0.0001	0.27	
ratio of fixed capital to sales (201)	mean	0.0014	3.30	***	mean	-0.0014	-3.38	***	mean	0.0000	0.13	
Managerial Motivation												
% sales from new products (302)	mean	0.0026	2.76	***	mean	-0.0041	-4.17	***	mean	0.0015	2.90	***
major entry (70)	0	-0.0508	-1.63		0	0.0915	2.91	***	0	-0.0407	-2.41	**
market share rank (72)	mean	0.0200	2.74	***	mean	-0.0182	-2.43	**	mean	-0.0018	-0.45	
Risk												
Industry instability (80)	mean	-0.0036	-2.34	**	mean	0.0017	1.17		mean	0.0019	2.12	**
Controls												
Discount rate (451)	mean	0.0890	11.93	***	mean	-0.0272	-3.40	***	mean	-0.0617	-11.11	***

* = significant at 10%

* = significant at 5%

* = significant at 1%

FIGURES

Figure 1
Comparative Impact on Probabilities of a Unit Change in Variables
(Multiplied by standard deviation)

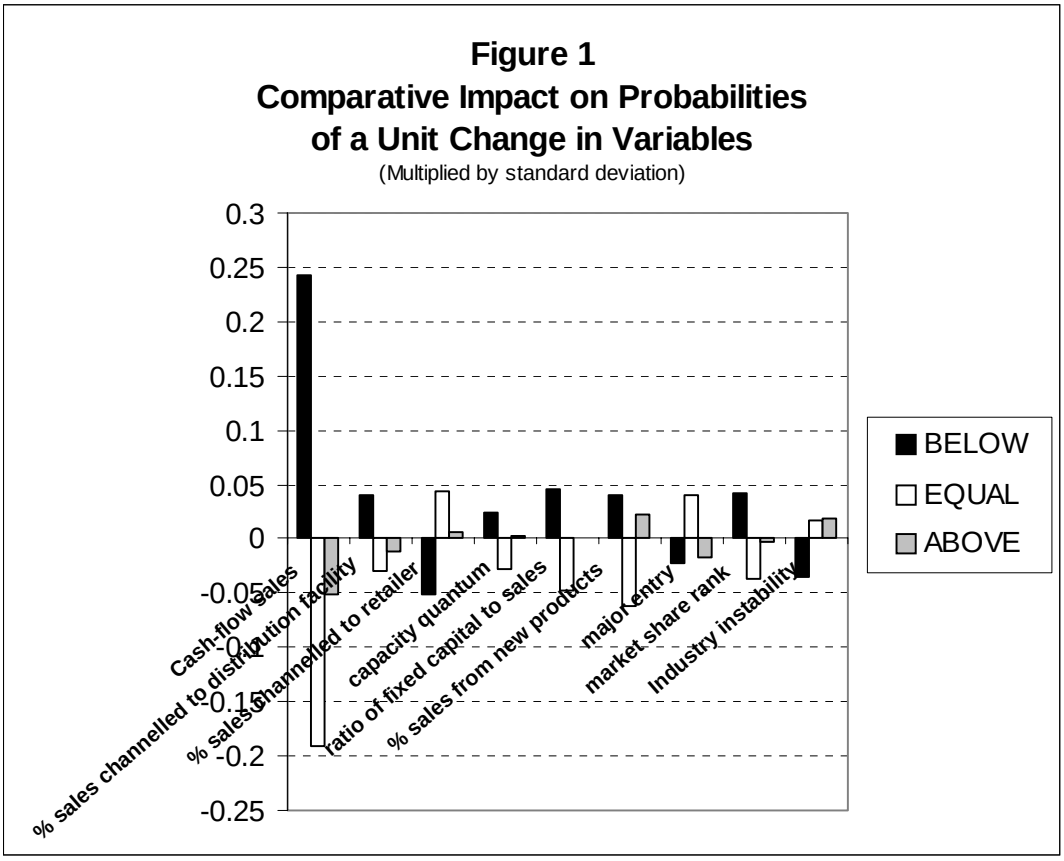

Figure 2
Marginal Probabilities of Outcomes at Different Percentiles of Cash Flow