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IS ATTACK THE BEST FORM OF DEFENCE?

A COMPETING RISKS ANALYSIS OF ACQUISITION ACTIVITY IN THE UK

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Abstract

The primary purpose of this paper is to investigate whether companies can use acquisition as a strategy to reduce their probability of takeover. A subsidiary issue is whether such a strategy has any impact on their subsequent probability of bankruptcy. The determinants of making an acquisition, being taken over, and bankruptcy are modelled within a competing risks framework using two large samples of UK manufacturing companies. Our results indicate that, *ceteris paribus*, companies which make acquisitions can significantly reduce their conditional probability of being taken over, largely through the impact that acquisition has on corporate size. In this sense, attack, through acquisition, is the best form of defence, against takeover.

JEL Classification: G33, G34, C41

Keywords: Takeovers, Acquisitions, Bankruptcy, Competing Risks

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1. Introduction

The presence of a significant level of takeover activity has long been a feature of the UK economy, with periods of heightened takeover activity alternating with periods of relative calm. Between 1948 and 1970, some 40% of quoted manufacturing companies were taken over; for 1975 to 1990, the figure was 33%.[1] Moreover, both the value and nature of takeover activity has changed over time, with larger companies being increasingly targeted and hostile takeover bids becoming more common (Franks and Mayer, 1996). This suggests that important insights into corporate behaviour and strategy can be gained by an examination of the factors which determine whether firms make acquisitions and/or whether they themselves are acquired.

The purpose of this paper is to examine takeover and acquisition activity in the UK using two large samples of manufacturing companies which together span much of the post-war period. In particular, we investigate two interrelated questions. First, what are the determinants of a company making an acquisition or of being acquired? Companies may also 'exit' *via* bankruptcy, and thus we additionally examine the factors which contribute to a company going bust. The time span of our data allows us to investigate whether the factors which determine these events have changed over time. Second, is a strategy of 'attack', through making acquisitions, a good way for a company to 'defend' itself against either being the

[1] These figures are based on the two datasets used in this study. Takeover booms were recorded in the late 1950s, the late 1960s, the early 1970s, the late 1980s and, more recently, the mid-1990s (Crook, 1993).

target of a successful takeover, or going bankrupt? Alternatively, do those who live by the sword also die by the sword?

The existing literature on the determinants of making an acquisition, being acquired and bankruptcy is characterised by its segmented nature, with individual studies focusing on only one of these three possible 'risks' which a company faces. The interactions between these risks are therefore ignored. In contrast, we approach the above questions within a competing risks framework in which the probability of each risk at time *t* is conditional on the company's history prior to *t*, including any previous acquisitions. Our results indicate that, *ceteris paribus*, firms which acquire reduce their conditional probability of being taken over by one quarter to one third. This large reduction in the probability of being acquired results essentially from the fact that acquisition substantially increases the size of a company, and size has a large influence on the probability of being taken over. The order of this effect is economically important, and may, in itself, increase the attractiveness of making acquisitions as a means of fending off potentially unwanted bids. Firms who acquire also reduce their conditional probability of bankruptcy. However, our results here are less robust, perhaps because of the inherent randomness of corporate failure, and/or the relatively small number of companies in our sample which suffer this fate.

2. Acquisition, Being Acquired and Bankruptcy: Some Literature and Its Limitations

As already noted, existing studies focus on only one of the three possible 'risks' which a company faces. This has the consequence that the possible interactions between these risks are ignored and hence the analysis is far from complete. Despite this limitation, the literature does point to a number of factors which may be important in determining each individual risk and

this literature is summarised in Table 1 which reports the expected signs of commonly specified variables on each of three individual risks.

Surprisingly, there is very little research into the determinants of making an acquisition. Hay and Liu (1998) argue that firms may acquire to use up 'free cash flow' along the lines suggested by Jensen (1986). Alternatively, they could be concerned with growth and, of course, one of the most effective ways of growing quickly is via acquisition (Meeks, 1977). A final possibility is that they may believe that they are picking up assets at a bargain price because the stock market, for some reason, has undervalued the potential target. Early work on the characteristics of UK acquirers over the 1950s and 1960s,[2] some of which employs one of the datasets used here, and finds conflicting results. The methodology employed is usually univariate with the characteristics of acquiring companies being compared either with a matched sample (by industry and year) of non-acquirers, or with companies that are acquired. Usually, acquirers are found to be more profitable (although the difference is not always significant). This finding may reflect the existence of financial constraints and suggest that companies which are more able to generate funds internally are in a better position to make an acquisition. Liquidity may operate in a similar fashion, although its effect has not previously been investigated. The relationship between acquisition and size is unclear. Kumar (1985) argues that, on the one hand, larger firms may be more able to bear the costs of searching for acquisitions and may also be better able to incorporate the new firm, since they are more likely to have a multi-divisional structure. This means that the acquired firm can continue to operate as an almost separate entity. On the other hand, he notes that smaller companies may

[2] See, for example, Utton (1972), Aaronovitch and Sawyer (1975), Singh (1975), Meeks (1977), Cosh *et al.* (1984) and Kumar (1985).

get access to technology by acquisition; larger firms have less need to acquire technology since they are more likely to have their own R&D facilities.

Hay and Liu (1998), using data for the 1970s and 1980s, estimate a probit model of the determinants of acquisition and, in addition to a positive effect from profitability, they also find a positive effect from internal investment and the valuation ratio (market value over assets), and a negative effect from leverage. Internal investment, in principle, could either be a substitute or a complement for investment by acquisition. Evidence of substitutability would be consistent with the existence of financial constraints. A higher valuation ratio makes the issuance of shares to finance the acquisition cheaper and more attractive. Finally, the result for leverage indicates that firms are not misusing 'free cash flow' since they are tying up more cash flow in the form of interest payments on debt, rather than having it available to make acquisitions. Of course, the negative relationship between leverage and the probability of making an acquisition could simply reflect the fact that, in the presence of financial constraints, higher levels of debt leave less cash for investment in acquiring other companies. We cannot distinguish easily between these arguments.[3]

The factors determining whether a company is likely to be acquired have been extensively investigated previously and we have provided surveys elsewhere (Dickerson *et al.* 1997b; 1998a). In this paper, we focus on those factors which are commonly found to determine the probability of a company being taken over. Size is expected to have a negative effect, possibly

[3] Hay and Liu (1998) also investigate the impact of market structure. They include a dummy indicating whether other firms in the industry are acquiring, but, in general, it is not significant. They also split the sample on the basis of whether the industry has a dominant firm structure or is fragmented. The results do not differ much although in the case of dominant firm industries, internal investment and acquisition appear to be substitutes.

because of the existence of capital market imperfections which prevent potential acquirers from obtaining the necessary funds required (Bond and Meghir, 1994; Schiantarelli, 1996). Low profitability is likely to make a company vulnerable to takeover if acquisition acts as a discipline device for poorly performing companies as suggested by the literature on the market for corporate control (Shleifer and Vishny, 1988). Firms with low leverage ratios and high levels of liquidity are likely to be attractive targets to acquirers who have perhaps taken on debt to enable them to purchase the company. However, high liquidity could indicate a lack of investment opportunities and hence render the company less attractive to bidders. Higher dividends either work to retain shareholder loyalty or to persuade them that all 'free cash flow' is being distributed as it should (Jensen, 1986). Finally, a higher level of non-acquisition (internal) investment may signal a company which has good future prospects or it could simply reflect a misuse of 'free cash flow' as managers over-invest to satisfy their own goals for growth rather than maximising shareholders' value. Thus its impact on the probability of being acquired is uncertain.

There is also a large literature on the determinants of company failure.[4] By and large, the articles reflect a desire to provide empirical specifications which can successfully *predict* failure, rather than to understand the causal mechanisms at work. Nonetheless, there is evidence that, as one might expect, poor profitability is associated with an increased risk of bankruptcy. Smaller companies are also more likely to suffer bankruptcy because they are often younger and hence less well-established. A lack of liquidity may signal cashflow

[4] See, for example, Dambolena and Khoury (1980), Zavgren (1985), Gentry *et al.* (1987), Houghton and Woodliff (1987), Barniv and Raveh (1989), Gilbert *et al.* (1990), and Keasey and McGuinness (1990). Most papers investigate corporate failure in the US. However, see also Altman (1984) and the special issue of the *Journal of Banking and Finance*, 1984, vol. 8, for the international evidence.

problems and highly leveraged companies may be more vulnerable to debt-servicing problems, both of which can lead to bankruptcy. Finally, firms which are performing poorly and hence are more likely to fail are probably not investing very much nor paying out high levels of dividends since they are unlikely to have the resources to do so.

3. Data and Methodology

We utilise two datasets in this paper. The first is the Cambridge/DTI Databank of company accounts which comprises a large panel of UK quoted companies for the period 1948-1970 (Goudie *et al*., 1985 and Meeks *et al*., 1988).[5] We restrict attention to companies in the manufacturing sector for comparability with our second dataset which covers UK quoted manufacturing companies for 1975-1990. EXSTAT provides company accounts information which we merge with the London Share Price Dataset (LSPD) for the relevant stock market information for each company, including dividend payments.

The number of companies analysed, and the number and type of 'events' which they experience are shown in Table 2 (we define an event as one of the three 'risks' which can occur - making an acquisition, being acquired and bankruptcy). As might be expected in a financial system in which takeover is prevalent, the number of company exits because of takeover is considerably greater than the number due to bankruptcy. However, it is interesting to note that the proportion of exits attributable to bankruptcy is twice as high in the EXSTAT data as in the Meeks data (73/(323+73)=18.4% *vs* 116/(116+1146)=9.2%). This may reflect

[5] We have described these data and our efforts to check their consistency elsewhere (Dickerson *et al*. 1997a; 1998a).

the deeper recessions that were experienced in the 1970s and 1980s, particularly in the manufacturing sector.

Given our main purpose in this paper, it is of interest to compare the ultimate fate of companies who made at least one acquisition with that of those who never acquired. From the bottom panel of Table 2, it is clear that, in both datasets, being an acquirer was associated with a significantly lower probability of exit from both takeover and bankruptcy. Thus, the raw statistics give some *prima facie* evidence in support of the proposition that attack is indeed a good form of defence.

Of course, we need to investigate whether this result holds once we have undertaken the appropriate multivariate analysis to control for the various factors which also influence the risks of takeover and bankruptcy. These include those identified in the existing literature: company size (log of real net assets); profitability as measured by the rate of return on net assets (operating profits); leverage (long-term loans plus short-term loans); liquidity (net current assets); the ratio of tangible to total assets; internal investment (total investment minus the net assets of the acquired company); and dividends (total dividend payments in the case of the Meeks data; pre-tax dividend yield in the case of EXSTAT). Flow variables are scaled by the average of opening and closing net assets while stock variables are scaled by opening net assets. We also include industry dummies and calendar time dummies to account for sectoral and temporal differences between event rates.

As we have seen above, much of the existing literature focuses on the determinants of a single risk and uses either a comparison of the mean characteristics of the two groups of firms (acquired *vs*. not acquired etc) or logit/probit analysis. In addition, extensive use is made of

artificially constructed matched samples (where matching occurs by industry, year and, possibly, size). This can lead to sample selection biases because the proportion of companies in each category does not reflect that of the population (Palepu, 1986). Our approach is similar to that which we have advocated elsewhere (Dickerson *et al*. 1998a; 1998b). We employ a large sample in which the proportions of companies making acquisitions, being acquired and going bankrupt are not artificially constructed but instead reflect the characteristics of the population from which the sample is drawn. Moreover, instead of focusing on the average determinants of the risk in question, we estimate the hazard functions, that is, the instantaneous probabilities of each of the risks occurring at time *t*, conditional on 'survival' up to *t*. In this way, we try to identify the factors which cause a firm to move into one of the three alternative states (making an acquisition, being acquired or going bankrupt).

Figure 1 illustrates a possible event path for a representative firm in such a framework. A company which is 'born' at time t_0 continues in existence until time t_1 - its first event - when it makes an acquisition. It then continues until time t_2 when it makes another acquisition, and, finally, it is censored at the end of the sample period, t_3. As can be seen, exit by being acquired or bankruptcy is also possible at any event time, hence the 'competing risks' nature of our analysis.[6] Note also that we permit a company which makes an acquisition to continue in the dataset thereafter - that is, companies which acquire have multiple spells.

The continuous time proportional hazard (Cox, 1972) for risk *r* for company *i* can be written as:

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[6] In economics, examples of competing risk models arise most frequently in the context of exit from unemployment or employment into different labour market states (full-time employment, part-time employment, out of the labour force etc) - see, for example, Ham and Rea (1987), Han and Hausman (1990), Lindeboom and Theeuwes (1991) and Narendranathan

$$\theta_{ri}(t) = \theta_{r0}(t)\exp\{X_{ri}(t)'\beta_r\}, \quad r = 1,\ldots,R \tag{1}$$

where $\theta_{ri}(t)$ is the instantaneous probability of risk *r*, conditional on survival to time *t*; $\theta_{r0}(t)$ is the underlying or baseline hazard at time *t*; $X_{ri}(t)$ is a vector of (possibly time-varying) explanatory variables and β_r is a vector of unknown parameters.[7] The underlying baseline hazard $\theta_{r0}(t)$ can be estimated jointly with β_r if it is parametrically specified with respect to duration, and a common specification is the Weibull function which implies a monotonic baseline hazard. However, as is well known, this can lead to severe bias in the estimated β_r, especially for time-varying covariates. Thus, we employ the discrete time analogue of equation (1) (Prentice and Gloeckler, 1978) which allows us to overcome two potential weaknesses of the continuous time version (Jenkins, 1995). Firstly, following Meyer (1990), it allows us to estimate the underlying hazard, $\theta_{r0}(t)$, non-parametrically and this can circumvent the bias that arises from misspecifying the underlying hazard, since it generates a very flexible baseline hazard. Secondly, evidence suggests that the familiar negative duration dependence bias arising from unobserved heterogeneity in duration models can also be mitigated if a sufficiently

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and Stewart (1993). Kalbfleisch and Prentice (1980) and Cox and Oakes (1985) provide useful surveys of competing risks models.

[7] The implication of the proportional hazard specification is that the covariates $X_{ri}(t)$ imply a proportional scaling of the underlying hazard $\theta_{r0}(t)$ rather than affecting its shape. Assuming a unique event at time *t*, the overall hazard is simply the sum of the risks:

$$\theta_i(t) = \sum_{r=1}^{R} \theta_{ri}(t). \tag{2}$$

Thus, estimation of competing risks models is relatively straightforward since this summation carries over immediately to the likelihood function and, hence, the overall likelihood for the competing risks model is additively separable into constituent components, each of which is only a function of the parameters of a risk-specific hazard. Having specified θ_r for each risk-specific hazard, the parameters θ_{r0} and β_r can be estimated by treating the spells finishing for other risks $s = 1,\ldots,R$, $s \neq r$, as censored with respect to the particular risk of interest (see Narendranathan and Stewart, 1991; 1993).

flexible baseline hazard is employed (Manton *et al*. 1986; Han and Hausman, 1990; Dolton and van der Klaauw, 1995).[8]

Given that our time observation intervals are financial years, a completed duration of *t* denotes that the event took place between year *t* and year *t*+1. The probability of an event by time *t*+1, given that it had not occurred by time *t*, is the discrete time (or grouped) proportional hazard given by:

$$\phi_{ri}(t) = 1 - \exp[-\exp\{X_{ri}(t)'\beta_r + \Theta_r(t)\}] \tag{3}$$

where

$$\Theta_r(t) = ln\left[\int_t^{t+1} \theta_{r0}(v)dv\right] \tag{4}$$

Thus the discrete time hazard has an extreme value distribution while $\Theta_r(t)$ yields the underlying hazard at each discrete duration *t*[9].

One further issue of interest is whether the hazards for the different risks are distinct. Tests for the equality, or rather, proportionality[10], of the competing risks are described by

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[8] Narendranathan and Stewart (1993) discuss the difficulties that arise in dealing with unobserved heterogeneity in competing risks models, including the strong assumptions that are typically required. Our evidence is that a non-parametric underlying hazard is indeed sufficient to mitigate the impact of unobserved heterogeneity, at least for the EXSTAT takeover risk (Dickerson *et al*. 1998b), and hence we do not attempt to estimate a parametric mixing distribution for any unobserved individual effects.

[9] We also consider the discrete time equivalent of the Weibull specification for the baseline hazard, such that $\theta_{r0}(t) = \alpha_r t^{\alpha_r - 1}$ in equations (1) and (3).

[10] The *equality* of the risks would require that as many companies make acquisitions as are taken over and as go bankrupt. This is clearly not a sensible nor an interesting hypothesis to test. We are concerned whether the slope coefficients and the baseline hazards are the same up to a factor of proportionality and thus do not constrain the intercepts to be equal (see Narendranathan and Stewart, 1991; 1993).

Narendranathan and Stewart (1991; 1993). Thus we can formally examine whether the influence of the covariates, $X_i(t)$, together with the underlying hazards $\theta_{r0}(t)$, are different for the conditional probability of making an acquisition, for being acquired or for bankruptcy. That is, we test:

$$H_0 : \beta_r = \beta \text{ and } \theta_{0r}(t) = \theta_0(t) \ \forall \ r = 1, \ldots, R . \tag{5}$$

Clearly, this is relevant to answering the questions that we posed in the introduction concerning whether companies can strategically act so as to influence their fate. If the risks are not behaviourally different, then the events are essentially random with respect to the covariates and baseline hazards, with the consequence that companies have little or no influence over their destiny. We also consider a second, weaker, test that the conditional probabilities of the three events are independent of the vector of covariates:

$$H_0' : \beta_r = \beta \ \forall \ r = 1, \ldots, R . \tag{6}$$

while allowing for the underlying hazards to differ for the different events.[11] Arguably, it is only the vector of characteristics that firms can seek to vary, and this test informs us whether such a strategy can have any impact on their eventual fate, or whether the different outcomes are, in effect, incidental with respect to X_r.

A final methodological issue relates to the interpretation of the results in terms of our initial question as to whether attack (acquisition) is the best form of defence (against being acquired and/or against bankruptcy). To answer this question, it is necessary to know not only the *direct* effect of acquisition on the subsequent probability of being acquired/bankruptcy (which

[11] The tests are shown by Narendranathan and Stewart (1991) to involve only the estimation of a single risk model (for the conditional probability of any event at time *t*) together with a simple adjustment factor dependent upon the different event frequencies.

we capture with a dummy variable for any previous acquisition), but also the *indirect* effects which stem from any impact that acquisition may have on the other determinants of company exit. For example, the most obvious consequence of acquisition is an increase in company size which will, *ceteris paribus*, lead to a lowering of the probability of both takeover and bankruptcy.[12] However, acquisition also affects other variables. For example, in Dickerson *et al.* (1997a), we show that, for the Meeks data, having controlled for all other determinants of company performance, acquisition reduces profitability in the long run by 2.9 percentage points per annum. Given that lower profitability is associated with a significantly higher probability of takeover (in both datasets - see, respectively, Dickerson *et al.*, 1998a and 1998b) then the estimated impact of acquisition on the probability of takeover includes all such indirect effects. Similar arguments apply to the other covariates considered above. Thus the *net* impact of acquisition on the subsequent probability of takeover or bankruptcy is the sum of the direct effect and all such indirect effects.

We estimate the net impact of acquisition on the probability of being acquired or bankruptcy by calculating the relative hazard as the ratio of the post-acquisition hazard to the pre-acquisition hazard:

$$\rho_r = \frac{\theta_r^{post-acquisition}}{\theta_r^{pre-acquisition}} \tag{7}$$

[12] Using net assets as our measure of size, the median acquisition in the Meeks (EXSTAT) data increased the size of the acquiring company by 20% (13%). Acquisition size is positively skewed however, and the mean increase in size is larger than the median due to the presence of a number of very large acquisitions.

evaluated for the mean change in the covariates $\overline{\Delta X_r}$ between periods *t*-1 and *t*+1 around an acquisition that occurs at time *t*.[13]

4. Results and Discussion

Estimates of the competing risks models are presented in Tables 3 and 4. Table 3 contains the results for the monotonic Weibull hazard model; Table 4 for the semi-parametric hazard model. In each table, Panel (A) provides the results for the Meeks dataset, while panel (B) contains the EXSTAT results. The three columns in each panel report the coefficients, β_r, for each of the three risks under consideration (making an acquisition, being acquired and bankruptcy respectively). In our discussion of the results, we refer to the semi-parametric specification, although it is clear from the tables that the estimated coefficients are very similar in both specifications.[14]

The first column in each panel reveals that the conditional probability that a company makes an acquisition is significantly positively related to size (the non-linearities implied by the quadratic specification yield an increasing function over the whole sample range), and profitability, although the latter is only significant at 10% for the EXSTAT data. These results are as expected - larger companies inevitably have access to greater funds for acquisition, and the importance of the availability of internal funds for investment of any kind has been noted in previous studies (Schiantarelli, 1996). Larger companies may also have lower costs

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[13] We also experimented with evaluating the change in the average characteristics for the three years before and after an acquisition, and with the differences between acquirers and non-acquirers. Our results are invariant to these alternatives.

[14] A test of the restrictions implied by the monotonic (Weibull) hazard specification is not rejected for the Meeks data ($\chi^2(42)=43.56$ [p=0.40]), while it is for EXSTAT ($\chi^2(34)=69.08$ [p=0.00]).

associated with searching for suitable acquisitions (Cable, 1977; Kumar, 1985). The elasticities of the hazard with respect to size are similar across datasets - calculated at the mean size, a 10% increase in firm size increases the conditional probability of making an acquisition by 7.8% in the Meeks data, and by 5.6% in the EXSTAT data, *ceteris paribus*. There is also evidence that internal investment and investment through acquisition are substitutes - the negative coefficient on internal investment is economically important in that a one standard deviation increase in internal investment reduces the conditional probability of making an acquisition by around 20% in both datasets.[15] Acquisitions are also 'habit-forming' in that, having made at least one acquisition, companies are significantly more likely to make another.[16]

The second column in each panel reveals that the conditional probability of takeover is also strongly related to company size, although the parameter magnitudes here indicate rather different findings for the two periods. In the earlier (Meeks) period, there is a declining probability of takeover with size over the whole sample range, and an elasticity that suggests that a 10% increase in size (at the mean) reduces the conditional probability of takeover by around 4%. In the EXSTAT data, the relationship is bell-shaped, with the maximum at roughly the mean of firm size for our sample, and an elasticity at the mean which is consequently very small (0.02). This suggests that, in the later period, medium-sized companies were more likely to be a target for takeover (although large companies were still relatively secure). This in turn may reflect the fact that, during the 1980s, financing constraints

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[15] This is in contrast to the main findings of Hay and Liu (1998), although, as we argued above, *a priori* the issue of substitutability *vs* complementarity is unclear.

[16] The previous acquisition dummy takes a value of 1 if the company has made an acquisition previously and a value of zero otherwise. We also experimented with interacting this dummy with the duration term in the Weibull specification. In no case is it significant.

were loosened allowing larger firms to be taken over. It is also consistent with the results in the first column which show that profitability was less important for the probability of making an acquisition in the later period - internal funds are less important when the financial system is more liberalised. Low profitability companies were significantly more vulnerable to takeover in accordance with the literature on the market for corporate control where takeover disciplines poorly performing managers (Shleifer and Vishny, 1988); a one standard deviation decrease in profitability increases the takeover hazard by 15% in Meeks and 21% in EXSTAT. A higher level of investment is associated with a significantly lower conditional probability of takeover. Finally, the strongly negative dividend effect in the 1950s and 1960s is not apparent in the 1970s and 1980s.[17]

The final column in each panel presents the results for the conditional probability of bankruptcy. The effect of size on bankruptcy is similar to its effect on takeover - a negative relationship over the sample range for the Meeks data and a bell-shaped relationship for the EXSTAT data - indeed, it is true that some large manufacturing companies failed in the late 1970s and 1980s. However, the dominant result here is, as expected, that companies with poor profitability performance tend to go bust (Keasey and McGuinness, 1990). The coefficient is large in both cases; a 20% fall in profitability (not exceptional given the volatility of profitability) implies an increase in the hazard of bankruptcy of 5.9% (Meeks) and 10.0% (EXSTAT). Little else is significant, either statistically or economically, probably reflecting both the difficulties in predicting corporate failure as well as the relatively low proportion of bankruptcies in our samples.

[17] On investment, dividends and the determinants of takeover, see Dickerson *et al.* (1998a).

A test for the statistical significance of the underlying hazard estimated semi-parametrically is reported in the 'Baseline hazard' row in Table 4; these are only jointly statistically significant for the acquisition hazard in the Meeks data. One complication in interpreting the shape of the estimated underlying hazards is that they conflate duration with time effects for a significant proportion of our companies.[18] In both datasets, many companies are present at the start of our sample period (i.e. they are left censored) and therefore these companies experience time-specific (such as macroeconomic) effects at the same elapsed duration. We investigate this issue in two ways. First, we condition the competing risks estimates on a dummy variable, Start, which takes a value of 1 for all companies which were present at the beginning of the sample. As can be seen, its coefficient is insignificantly different from zero and hence there do not appear to be important cohort effects for those companies which were in existence prior to the beginning of our sample periods. Second, we incorporate a vector of calendar year dummies, which also allow us to investigate whether there are significant macroeconomic effects on the probability of any of the competing risks. For the 1950s/1960s, these reveal that there are highly significant differences in acquisition and takeover rates over time and these are consistent with the aggregate time series patterns in merger activity. For the later period, however, only the probability of being acquired displays significant calendar time variation. However, more importantly, including these calendar time dummies does not detract from the significance of the company-specific determinants of the probability of acquisition, being acquired or bankruptcy. Thus, the three risks have both time-series and cross-sectional dimensions in both datasets.[19]

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[18] Of course, for the companies that are present at the start of the data period, the duration and calendar time effects are collinear.

[19] All equations also include a vector of (2-digit) industry dummies. Sectoral differences in acquisition, takeover and bankruptcy rates can be seen to be evident in the Meeks data, but are

Finally, we consider the central question of whether attack is a good form of defence against takeover or bankruptcy. First, the proportional risks tests, H_0 and H_0' reported at the bottom of Tables 3 and 4 reveal that the determinants of acquisition, being acquired and bankruptcy are very different. This is a necessary condition for companies to be able to act strategically to affect their probability of takeover or bankruptcy since it indicates that differences in company characteristics impact differently upon the risk probabilities.

The necessary and sufficient condition is that the effect of an acquisition is to change a company's characteristics so as to reduce the risk of takeover or bankruptcy. The direct effect from having made a previous acquisition on the probability of being acquired is small and insignificantly different from zero for both datasets, while, for the probability of bankruptcy, the effect is positive for the Meeks data and (weakly) negative for the EXSTAT sample. However, as noted above, we also need to consider the multifarious indirect effects of acquisition on companies' characteristics. Thus, we calculate the relative hazard ρ_r as in equation (7) for the risks of takeover and bankruptcy. Making an acquisition reduces the conditional probability of subsequently being acquired by 24% in the 1950s/60s and by 33% in the 1970s/80s, evaluated at the means. Much of this effect derives from the increase in firm size resulting from acquisition. An additional effect results from the fact that the post-acquisition company is, in effect, a new entity (in that the likely success or otherwise of the merged company is unknown). As such, its elapsed spell duration is zero after the acquisition and, while this is incidental to the company making an acquisition, the effect is to further

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absent in the EXSTAT data. One interpretation is that, in the latter, the three risks were more evenly experienced throughout the whole of the manufacturing sector.

reduce the conditional probability of subsequently being acquired since the takeover hazards are marginally upward sloping in duration.

The impact of making an acquisition on the subsequent probability of bankruptcy is to substantially reduce the probability, by around 75% in both datasets. However, given the small number of companies on which these estimates are based, we would not wish to place too much reliance on these results.

5. Conclusions

Our primary aims have been to investigate the determinants of UK manufacturing companies making acquisitions and being acquired, to see to what extent these had changed over time, and, finally, to establish whether acquisitions could be used as a strategy to reduce the probability of takeover. As a subsidiary issue, we also analysed the determinants of corporate failure. We used a competing risks framework which helps to overcome some of the problems with the previous literature on takeovers, acquisitions and predicting bankruptcy. The results suggest that larger, more profitable firms, tend to take over smaller and less profitable ones, although in the 1980s, there was a tendency for medium-sized companies to be particularly prone to takeover. Investing internally and, to some extent, paying out higher dividends can also protect against takeover. Unsurprisingly, the factors contributing to bankruptcy were, in general, less well-determined.

So can acquisition be used as a strategy to reduce the probability of takeover? Certainly our results suggest this to be the case. Acquisition allows firms to grow quickly, and the resulting impact on size helps to protect them from subsequent takeover (and, to some extent,

bankruptcy). Of course, firms can also grow by investing internally. However, this is less attractive because the growth rates that can be achieved are, not surprisingly, much lower.

This finding is, of course, consistent with the kinds of models in which managers seek to maximise growth. Not only do managers of larger firms have greater prestige and status (and possibly receive higher emoluments), but the results here indicate a further motivation - deriving growth through making an acquisition ensures that the firm is subsequently less liable to be taken over. Managers are aware that one consequence of being acquired is that they are likely to be replaced soon after. Thus in a financial system such as the UK in which takeover is prevalent, managers have a further incentive to achieve growth by acquisition.

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Table 1

The Impact of Selected Variables on the Probability of Each Risk

	Event Type:		
	Acquisition	**Being Acquired**	**Bankruptcy**
Profitability	+	–	–
Size	?	–	–
Liquidity	+	?	–
Leverage	–	–	+
$\frac{\text{Tangible assets}}{\text{Total assets}}$	?	?	?
Investment (internal)	?	?	–
Dividends	–	–	–

Table 2

The Distribution of Events, Acquisition Status and the Fate of Companies

	Meeks data: 1948-1970		**EXSTAT data: 1975-1990**	
A: Number of Companies:	2280		969	
of which:				
those making at least one acquisition	488		143	
of which:				
those making more than one acquisition	227		45	
B: Number of Events:	2024		570	
of which:				
acquisition years	777		180	
being acquired	1146		323	
bankruptcy	116		73	
C: Acquisition Status and Companies' Fate:	*Status*		*Status*	
ultimate fate:	Acquirer	Non-Acquirer	Acquirer	Non-Acquirer
being acquired	25.4%	57.0%	21.7%	35.4%
bankruptcy	2.7%	5.7%	0.7%	8.7%
censored	71.9%	37.2%	77.6%	55.9%

Note:
Our basic data period is the accounting or financial year. Thus the total number of events is not quite equal to the sum of the number of the three separate event types (making an acquisition, being acquired, bankruptcy) because, very occasionally, a company is acquired or goes bust in the same year that it also makes an acquisition. In the Meeks data, this affects 15 companies (14 are taken over while 1 is bankrupt). In the EXSTAT data, only 6 companies are taken over in the same year that they made an acquisition. Additionally, the number of acquisition years is less than the total number of acquisitions in the datasets because in some years, companies make more than one acquisition.

Table 3

Estimates of Competing Risks Model: Weibull Hazard Model

	(A) MEEKS DATA: 1949-70						(B) EXSTAT DATA: 1975-90					
	Event Type:						Event Type:					
	Acquisition		Being Acquired		Bankruptcy		Acquisition		Being Acquired		Bankruptcy	
Log(size)[#]	1.850	(0.284)*	-0.744	(0.236)*	-0.096	(0.777)	2.456	(0.888)*	4.560	(0.826)*	5.166	(1.752)*
Log(size)^{2}[#]	-0.054	(0.012)*	0.018	(0.012)	-0.041	(0.044)	-0.056	(0.024)*	-0.134	(0.024)*	-0.151	(0.052)*
Profitability[#]	2.472	(0.523)*	-1.124	(0.243)*	-1.697	(0.379)*	0.496	(0.302)+	-1.529	(0.343)*	-5.127	(0.488)*
Leverage[#]	0.399	(0.244)+	-0.289	(0.215)	1.201	(0.463)*	-1.061	(0.516)*	-0.038	(0.256)	0.201	(0.359)
Liquidity[#]	0.091	(0.228)	0.243	(0.168)	1.297	(0.439)*	-1.071	(0.474)*	-0.286	(0.295)	-0.610	(0.535)
Tangible assets[#]	-0.210	(0.235)	-0.034	(0.198)	0.582	(0.625)	-2.214	(0.748)*	-2.206	(0.544)*	-0.788	(1.133)
Start[$]	0.027	(0.104)	0.116	(0.094)	-0.073	(0.320)	-0.187	(0.235)	-0.176	(0.166)	0.245	(0.375)
Investment (internal)[#]	-1.557	(0.246)*	-0.407	(0.148)*	-1.207	(0.328)*	-0.988	(0.179)*	-0.490	(0.121)*	-0.244	(0.321)
Dividends[#]	-1.501	(1.328)	-12.090	(1.771)*	-49.172	(7.050)*	-3.995	(3.220)	-0.361	(1.804)	-4.745	(3.521)
Previous acquisition[$#]	0.220	(0.136)	0.027	(0.149)	1.330	(0.487)*	0.601	(0.288)	0.177	(0.273)	-2.291	(1.114)*
Constant	-19.702	(1.734*	-0.346	(1.221)	-1.222	(3.605)	-29.224	(8.216)*	-42.408	(7.025)*	-50.136	(14.592)*
Baseline hazard: Log(t)	-0.290	(0.064)*	0.144	(0.085)+	0.320	(0.307)	-0.156	(0.149)	0.309	(0.150)*	0.118	(0.382)
	Diagnostics						Diagnostics					
Industry effects	45.53	[p=0.00]	59.11	[p=0.00]	20.11	[p=0.03]	15.60	[p=0.21]	15.45	[p=0.35]	17.49	[p=0.23]
Year effects	143.99	[p=0.00]	246.21	[p=0.00]	34.71	[p=0.02]	33.67	[p=0.00]	55.26	[p=0.00]	22.26	[p=0.07]
logL	-7826.96						-2258.32					
No. of companies	2280						969					
No. of observations	30029						8786					
Proportional risks tests:	$H_0 : \chi^2(82)=1191.77$ [p=0.00]						$H_0 : \chi^2(82)=344.98$ [p=0.00]					
	$H_0' : \chi^2(80)=854.73$ [p=0.00]						$H_0' : \chi^2(80)=271.24$ [p=0.00]					

Table 4

Estimates of Competing Risks Model: Semi-Parametric hazard Model

	(A) MEEKS DATA: 1949-70						(B) EXSTAT DATA: 1975-90					
	Event Type:						Event Type:					
	Acquisition		Being Acquired		Bankruptcy		Acquisition		Being Acquired		Bankruptcy	
Log(size)[#]	1.820	(0.285)*	-0.756	(0.237)*	-0.158	(0.782)	2.278	(0.888)*	4.712	(0.833)*	5.046	(1.793)*
Log(size)^{2}[#]	-0.053	(0.012)*	0.019	(0.012)	-0.038	(0.044)	-0.051	(0.024)*	-0.138	(0.024)*	-0.148	(0.054)*
Profitability[#]	2.524	(0.524)*	-1.139	(0.244)*	-1.706	(0.385)*	0.506	(0.297)+	-1.491	(0.343)*	-5.486	(0.537)*
Leverage[#]	0.443	(0.244)+	-0.290	(0.215)	1.166	(0.465)*	-1.094	(0.515)+	-0.031	(0.255)	0.328	(0.374)
Liquidity[#]	0.132	(0.228)	0.246	(0.168)	1.286	(0.438)*	-1.070	(0.479)*	-0.316	(0.298)	-0.421	(0.573)
Tangible assets[#]	-0.228	(0.236)	-0.038	(0.198)	0.529	(0.624)	-2.310	(0.756)*	-2.248	(0.546)*	-0.718	(1.194)
Start[$]	-0.029	(0.112)	0.135	(0.108)	0.115	(0.376)	-0.498	(0.346)	-0.309	(0.198)	0.574	(0.430)
Investment (internal)[#]	-1.551	(0.246)*	-0.397	(0.148)*	-1.236	(0.334)*	-0.988	(0.182)*	-0.488	(0.122)*	-0.278	(0.345)
Dividends[#]	-1.614	(1.326)	-12.046	(1.773)*	-48.917	(7.043)*	-3.986	(3.264)	-0.507	(1.806)	-4.176	(3.507)
Previous acquisition[$#]	0.309	(0.158)*	0.017	(0.160)	1.178	(0.502)*	0.807	(0.210)*	-0.182	(0.223)	-1.965	(1.050)+
Constant	-19.888	(1.685)*	-0.373	(1.320)	-1.558	(3.891)	-26.744	(8.238)*	-41.961	(7.121)*	-51.743	(14.993)*
Baseline hazard:	37.96	[p=0.01]	14.53	[p=0.85]	13.93	[p=0.83]	17.95	[p=0.39]	23.80	[p=0.13]	17.89	[p=0.12]
	Diagnostics						Diagnostics					
Industry effects	45.03	[p=0.00]	59.57	[p=0.00]	20.26	[p=0.03]	15.16	[p=0.23]	15.71	[p=0.33]	16.71	[p=0.27]
Year effects	91.43	[p=0.00]	165.53	[p=0.00]	24.22	[p=0.23]	20.97	[p=0.14]	50.51	[p=0.00]	21.93	[p=0.08]
logL	-7805.18						-2223.78					
No. of companies	2280						969					
No. of observations	30029						8786					
Proportional risks tests:	$H_0 : \chi^2(122)=1209.76$ [p=0.00]						$H_0 : \chi^2(114)=385.13$ [p=0.00]					
	$H_0' : \chi^2(80)=872.80$ [p=0.00]						$H_0' : \chi^2(80)=311.39$ [p=0.00]					

Notes for Tables 3 and 4:

1. Standard errors in parentheses(); p-values in square brackets[].
2. $^{\$}$denotes dummy variable; $^{\#}$denotes time varying covariate.
3. *denotes significant at 5% level; + denotes significant at 10% level.
4. The 'Baseline hazard' row in Table 3 is the monotonic (Weibull) hazard and the reported statistics are the coefficients (standard errors) of the coefficient on Log(t). The 'Baseline hazard' row in Table 4 presents a χ^2 test for the joint significance of the duration specific intercepts for the non-parametric hazard. See text for details.
5. 'Industry effects' and 'Year effects' are χ^2 tests for the joint significance of industry and calendar year dummies respectively. See text for details.
6. The 'Proportional risks tests' are tests for the equality of the parameters across the different risks. See text for details.

Figure 1

Schematic Diagram of Illustrative Sequence of Events