THE DRIVERS OF MERGER WAVES

By

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Abstract: A reduced form hazard rate model of merger timing, estimated using a uniquely constructed 1990 – 2004 UK panel data set, shows clear correlations between the observed wave like pattern of merger activity and both exogenous and endogenous drivers with firm characteristics acting as intermediaries.

Key words: hazard models, M&A waves, M&A timing

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1. Introduction

We report estimates of an encompassing reduced form hazard rate model of merger timing in the UK, exploring the relative importance in generating merger waves of both external (non strategic) factors such as macroeconomic cycles (Shleifer and Vishny, 2003) and other (strategic) factors that may endogenously generate cyclical patterns (Fridolfsson and Stennek, 2005). The paper adds to the literature (see Toxvaerd, 2008) in terms of sample, empirical method and simultaneous consideration of different determinants.

All firms (i = 1..n) are assumed risk neutral, aim to maximize shareholder wealth and are potential takeover targets. The probability of a target being acquired in the small interval $t, t+dt$, conditional on not having being acquired by time t, the hazard rate, $h_i(t)$, is hypothesised in a reduced form to be:

$$h_i(t) = Pr[Z_i(t) \geq 1+ \varepsilon] = F(Z_i(t))$$

where $Z_i(t)$ is the ratio of (maximal) bid offer to stand alone market value and ε is a firm specific stochastic factor such that F(1+ε) remains invariant across firms and time.

Cabral (2002) provides a model in which firms imitate merger behaviour which may generate a bandwagon phenomenon. Toxvaerd (2008) also argues that, because there is uncertainty and mergers are largely irreversible, there may be an options value to the bidder from delaying mergers. One might expect that such uncertainty will tend to fall over time as potential bidders learn about their targets. To cater for either possibility we report results for a loglogistic model in which the baseline hazard is allowed to be time dependent.

Other factors that are considered in the literature as potential determinants of merger activity are incorporated by considering $Z_i(t)$ to be a function of a vector of relevant variables as follows.

1. Exogenous macroeconomic factors represented by a series of calendar year dummies.

2. Perry and Porter (1985) argue that when the number of merged firms in an industry is small the potential profit gain from merger is low compared to when the number is large, implying that $Z_i(t)$ will be a positive function of completed mergers to date (a stock effect). On the other hand there may be early mover advantages in merger activity suggesting that $Z_i(t)$ may decline with the number of completed mergers (an order effect). Introducing in to the hazard function the cumulative number of acquisitions up to and including time t in the sector j to which the firm belongs, $S_i(t)$, covers both the stock and order effect and the size and sign of the estimated coefficient will indicate the relative dominance of the two forces.

3. Toxvaerd (2008) argues generally for pre-emption effects. With early mover advantages it could also be rational for a firm to pre-empt a merger bid by another firm with its own acquisition attempt (Fridolfsson and Stennek, 2005) to avoid the loss of profits it would have suffered had its rival been successful. Such expectational order effects may cause $Z_i(t)$ to increase as the expectation of merger bids by other firms increases. Expectations of further mergers may also, for a given $S_i(t)$, cause $Z_i(t)$ to increase via an expectational stock effect. These effects are represented by the inclusion of the expected change in $S_i(t)$ as measured by $O_i(t) = S_i(t+1) - S_i(t)$ as an explanatory variable.

4. Some target firms may be more attractive than others and thus attract higher bids (rank effects). Characteristics (see Dickerson et al., 2002) considered here are:

(i) Efficiency as represented by profitability (measured by net income divided by total shareholders' equity, $ROE_i(t)$), with low profit firms attracting more interest.

(ii) The value of Tobin's q of the target (market value divided by the book value of total assets), with low values encouraging acquisition (Jovanovic and Rousseau, 2002).

(iii) Dividend policy. Free cash flow theory (Jensen, 1986) argues that a larger share of profits distributed in the form of dividend payments acts as a signal to the market that the firm's managers are acting prudently and would be associated with a low acquisition probability. Additionally high dividends induce shareholders' loyalty. The measure used is cash dividends divided by earnings available to common shareholders.

(iv) Other arguments suggest that: less leveraged or more liquid firms are more attractive - the former being measured by total liabilities divided by total assets and the latter by current assets divided by current liabilities; small firms may be easier targets although larger firms are more likely to be the target of a disciplinary takeover (Offenberg, 2009) – size is measured by total assets; firms exhibiting low price/earnings (p/e) ratio may be considered cheap and more attractive buys – p/e is measured by the per share market price divided by earnings.

5. Agency or hubris theories suggest that sometimes managers, via mergers, may extract private benefits at the expense of shareholders (Cai and Vijh, 2007). In the absence of good empirical proxies for managerial motivations we introduce an unobservable firm specific effect (frailties) in to the hazard equation (which also covers firm characteristics that we have been unable to measure).

6. A vector of 11 sector dummies is included in the hazard equation to pick up synergies between bidders and targets as well as different sector-specific economic, technological or regulatory environments.

7. To allow for interactions e.g. between stock and order effects and firm characteristics and/or time, a number of cross product terms have also been included in the hazard equation.

2. Sampling, Data and Estimation

The empirical analysis encompasses a full cycle of merger activity in the UK, 1990-2004, with the proportion of acquired firms in the sample the same as the UK population proportion of acquired firms over this period (30%). Sample mergers involved a 50% or higher change of ownership with the acquirer and acquired companies operating mainly in the UK and listed on the UK stock exchange. Using the *Thompson ONE Banker* database , 720 acquisitions initially identified were reduced to 234 by a requirement for three years pre merger market and accounting data. DataStream was used to randomly select 2183 similar firms that were not engaged in any mergers during the sample period and every tenth firm selected from each of 12 alphabetically ordered sectoral lists to generate a random group of 546 non merging firms.

Model time (Time) is measured by the number of years since 1990. The period until acquisition for any firm is measured from each firm's own date of entry into the study, with some firms entering the study later than 1990. Also, some firms exit the study before 2004 for reasons other than being acquired. The sample thus has examples of both right censoring and left truncation.

To counter endogeneity bias, predicted values for $S_i(t)$ are substituted for the actual values in the estimates of the hazard function and the expectation term $O_i(t)$

replaced by the first difference of these values. The predictions are generated from regressing $S_i(t)$ on its first period lagged value using GMM.

Maximum likelihood estimates with time to acquisition as the dependent variable are presented in Table 1. To save space we do not report coefficient estimates for the time and sector dummies (each jointly significant) and only report for those cross product terms significant at 5% or better.

[Table 1 about here]

Jointly, the modelled effects generate an estimated hazard function which exhibits wave-like behaviour. We calculate that the average generated hazard in the model rises from a little above zero in year 1 to peak in year 8 at 16.5%, before falling back to 14% in year 14.

The estimated value of the shape parameter, gamma, is 0.39 which indicates that the baseline hazard rate increases (up to year 9) and then decreases (slowly) with time. Although supporting the view that bandwagon phenomenon and option considerations are correlated with merger waves, because the baseline hazard is only about a quarter the size of the overall hazard (peaking at 4%), they may not be quantitatively important.

The time dummies are jointly statistically significant indicating that the macroeconomic environment may exert a significant external influence on merger timing. However, we found no significant firm specific effects suggesting that self seeking managerial motivations are not the primary motivating factor behind mergers.

The several terms involving $S_i(t)$ are significant suggesting that merger timing is correlated with stock and order effects. Taking account of level and quadratic terms and the cross product with time we find that $S_i(t)$ initially has a negative impact (shortens time to merger), approaches zero at time 10, and then becomes positive. A one unit increase in $S_i(t)$ at time 2 will, for the average firm, (ceteris paribus) reduce time to merger by 27 days while at time 12 it will increase the time to merger by 29 days. This suggests that the stock effect is initially dominant but, over time, the order effect grows to outweigh the stock effect.

As the various terms involving $O_i(t)$ are significant the expectational effects also play a role. The impact of $O_i(t)$ is negative to time 11 after which it becomes positive. Quantitatively, a one unit increase in $O_i(t)$ will shorten the time to merger by 39 days in time 2 but increase it by 26 days at time 12. This suggests that, as in theoretical models of pre-emptive mergers, in the early stages, expectations of being left behind encourage mergers.

Firm size is significant with medium sized firms more likely to be acquired than small firms. The elasticity of time to acquisition with respect to firm size, calculated at the sample mean is 0.27. In addition highly liquid firms are acquired later, the elasticity at the sample mean is however small at 0.01. The cross product terms show that the price earnings ratio, liquidity and leverage also influence the impacts of $S_i(t)$ and $O_i(t)$, although with small elasticities at the sample mean respectively of -0.03, 0.002, and 0.004.

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Table 1: Estimates of the loglogistic hazard model

Variable	Coefficient	(t statistic)
Constant	2.235	(4.5***)
Gamma	0.3946	
$S_i(t)$	-0.0423	(-1.68***)
$S_i(t)^2$	-0.0006	(-1.52*)
$S_i(t)$ x Time	0.0061	(2.70***)
$O_i(t)$	-0.0454	(-1.66**)
$O_i(t)^2$	-0.0028	(-2.30**)
$O_i(t)$xTime	0.0067	(1.70**)
$ROE_i(t)$	-0.5674	(-0.89)
$Dividends_i(t)$	-0.0001	(-0.15)
$TA_i(t)$	0.0238	(1.27*)
$TA_i(t)^2$	- 0.00002	(-0.80)
$q_i(t)$	0.5992	(0.82)
$PE_i(t)$	0.0232	(0.43)
$Liquidity_i(t)$	0.6304	(2.03**)
$Leverage_i(t)$	-0.6404	(-0.82)
$S_i(t)$ x $PE_i(t)$	-0.0103	(-1.85**)
$O_i(t)$ x $Liquidity_i(t)$	0.0816	(1.96**)
$O_i(t)$ x $Leverage_i(t)$	0.2430	(2.77***)
Pseudo R sq	0.35	
Log Likelihood	-283	
No. Obs	4842	

Note: significance at *** 1%, ** 5%, and *10%.