TAKEOVERS, INSTITUTIONAL INVESTMENT AND THE PERSISTENCE OF PROFITS

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Abstract

This paper studies the impact of takeovers on the profitability of the participating companies and the influence of institutional investors on this process. It involves an original approach to assessing the profitability impact by modelling the dynamics of corporate profitability. It is shown that the standard counterfactual assumptions made in most merger effect studies are biased against finding profit - enhancing merger effects where acquiring firms display above average profitability prior to the merger. On the other hand, acquisition is shown to reinforce the tendency amongst companies for their profitability to move towards industry norms over time.

Keywords: Company Takeover, Institutional Investors, Company Profitability

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1. Introduction

This paper is concerned with the inter-relationship between the shareownership characteristics of companies, their takeover activity and the impact upon them of competitive forces affecting the persistence of their profits. It reflects three strands of work carried out in the DAE since its foundation 50 years ago. The first is the pioneering work on estimating the wealth of the nation by Jack Revell which *inter alia* led to the first systematic analysis of UK shareownership patterns (Revell and Moyle (1966) and Moyle (1971)). The second is the work on company growth, profitability and takeovers making use of the major company panel data set constructed at the DAE during Brian Reddaway's period as Director (Singh and Whittington (1968), Singh (1971), Meeks (1977), Kumar (1984) and Cosh, Hughes and Singh (1980)). The third is work using the same database on the prediction of profitability by Whittington (1971).

The paper revisits the question of the impact of merger on corporate profitability using UK data for the 1980s. This is familiar territory and is also one of the few areas of economics where there is more or less unanimity of empirical findings. Mergers research from many different countries over diverse time periods has established that mergers normally have a negative or neutral impact on corporate profitability.[1] The present paper brings three new dimensions in re-examining this question. First, it is concerned not just with the average impact of mergers, but also with the dispersion of post-merger outcomes. Although the average outcome may be neutral or negative, some mergers do nevertheless succeed. Can such successful mergers be predicted on the basis of the pre-merger characteristics of merging firms? Secondly, we focus in this paper on the role of institutions as share owners and how their presence may influence the outcome of the merger and takeover process. Thirdly and importantly, we provide a more rigorous *counterfactual* for analysing the impact of mergers than

that used in most previous studies. For the latter purpose, we locate our analysis within a general discussion of the forces impacting upon company profitability over time. This is important because the counterfactual used in merger studies is central to testing the usual maintained hypothesis that a shareholder-welfare motivated merger should raise share returns and/or profitability. Mueller (1986) and others have argued that there operate general forces of a competitive kind which generate a tendency (which may be weak and which may leave some companies with persistent above profit performance) for profits to converge toward competitive norms. If this is so then high profitability firms will tend to experience some erosion of their relative superiority over time, and vice versa for low profitability firms. Moreover if the most profitable firms acquire the least profitable, as advocates of the market for corporate control would expect, then arithmetically speaking the combined profitability of the merged entity will be lower than the profitability of the acquirer alone.

The implications for studies assessing the impact of merger on profitability are clear. First there will be an averaging effect from combining sets of differently performing assets. This can be handled in empirical work by making an appropriate before and after comparison of the post-merger acquiring firm's performance with the weighted average pre-merger performance of the two firms (for a discussion of averaging effects in the US context see Mueller (1988) esp. pp.173 ff. UK studies dealing explicitly with this issue include Singh (1971), Meeks (1977), Cosh, Hughes and Singh (1980), Kumar (1984) and Cosh, Hughes, Lee and Singh (1989)). The second implication is that competitive forces themselves may have led to profit changes *without merger* and the relative strength and direction of these for the acquiring and acquired firm should be taken into account in setting up a counterfactual test of merger effects. This is a much less straightforward issue since we need to specify a dynamic profit generation model to compare pre- and post-merger profitability. Moreover we would like to purge pre-merger profits of the effects of previous mergers. Merger is so widespread in the UK that finding samples of firms free from mergers over extended periods is virtually

impossible. This has led the authors of a recent overview of work on profits' persistence to argue that the proper modelling of merger/profitability inter-relationships was a long way off (Geroski and Mueller (1990) p.201). Our approach here is to focus on periods of time which, whilst too short to explicitly model time series movements of profitability of individual firms, are long enough to pick up post merger effects. In doing so we consider carefully the econometric implications of evaluating the forces determining post-merger outcomes on such short period cross sectional data, in the context of a dynamic competitive process which acts to erode profitability extremes and imparts a dynamic path to profits over time.

We do this by making use of samples of acquired firms and matched sample of acquiring, and non-acquiring companies. We also allow for possible samples selection biases in assessing merger impacts from samples of surviving companies.

The remainder of this paper is organised in six sections. Section 2 briefly reviews existing literature and outlines the hypotheses to be tested in this paper. Section 3 considers the econometric issues involved in modelling merger outcomes in the context of a tendency for profits to regress to equilibrium values and proposes a way forward involving matched samples which is used on the data described in Section 4. Section 5 outlines the characteristics of the acquired and acquiring companies and of average merger outcomes and the role of institutions in our sample period. Section 6 then provides our analysis of the determinants of post merger outcomes allowing for sample selection and regression to the norm issues. A final section outlines our main conclusions.

2. Post-merger Performance, Pre-merger Characteristics of Institutional Investors and Regression to the Norm: Conceptual Issues and Previous Results

Studies of the impact of merger within the profit maximisation paradigm assume that to be "successful" mergers must raise the

profitability of participating companies, and that for this improvement to represent a welfare gain it must not be due to the exploitation of customers or suppliers through enhanced monopoly or monopsony powers. A number of arguments have been advanced as to how these gains might arise involving enhanced efficiency through economies of scope or scale, either at the individual plant or overall corporate level. Whatever the pre-merger profit performance of the merging companies relative to their industry norms, the implication here is that merger should enhance it by shifting the production possibility frontiers which they face. Where mergers are for scale reasons we might expect mergers with relatively small pre-merger sizes to have the most scope for post-merger scale related profit gains, so pre-merger size should help predict post-merger success.

Another view of the impact of mergers on profitability emphasises selection through the capital market. This links pre-merger profit and growth performance to post-merger success. Causation here works through shifts in performance arising from movement towards the production possibility frontier. This argument is based on the view that merger leads to efficiency improvements not through any scale or complementarity factors, but simply through the replacement of inferior by superior management of existing assets in the market for corporate control. The more dynamic and profitable the acquirers, and the more sluggish and unprofitable their targets, the bigger the potential improvements in the profitability of asset use should be by shifting the performance of the latter towards existing best practice. The most dynamic and profitable acquirers pre-merger should have greatest potential for raising post-merger performance in the companies they acquire.

Given that the motivation behind merger in these approaches is essentially profit maximising it may nonetheless be the case that the intention to improve performance is thwarted by the problems of implementation alluded to in the organisational literature on mergers. This suggests, that 'successful' outcomes are more likely the more horizontal the acquisition, and the less likely are 'culture' clashes.

Diversifying mergers and the acquisition of smaller companies by large holding companies appear from this and other literature to be most likely to lead to problems of control loss and inferior post-merger performance. (Kitching (1967), (1973), Hunt et al. (1987), Ravenscraft and Scherer (1987) and Hughes (1993)). On the other hand, there are some arguments to suggest that where diversification occurs by merger it may be more easily integrated than in horizontal acquisitions, given the predominance of divisionalised management structures in the typical large diversified firm and the purchase of human as well as physical capital in the merger process (Williamson (1975) and for a survey Hughes (1993)). These approaches suggest that the direction of merger and the absolute size of acquiring companies will influence post-merger success.

The analysis so far has assumed profit maximisation as the motivating force behind merger, with the spread of post-merger profit performance put down to variations in managerial competence to manage the merger process, or to variations in the potential for improvement represented by the pre-merger performance of merging parties. It has been argued of course that the objective of merger is not in all cases the pursuit of profit and that those mergers inspired by the pursuit of managerial self-interest are not intended to improve profitability. These then may lead to the appearance of 'unsuccessful' mergers in profit terms and account for the poor average performance so often noted in the literature. Indeed if mergers are more frequently used as a means of growth by 'managerial' than owner-controlled firms then the problem is compounded.

There are a number of reasons for arguing that this might be the case. First, following Penrose (1959), it may be argued that merger eases the managerial staff constraint on growth by the acquisition of skilled experienced management along with productive assets. In effect a merger growth strategy pushes the demand growth curve (in a Marris type model) out to the right enhancing the growth possibilities for management for any rate of profit. Second, to the extent that merger is particularly appropriate as a method of diversification to stabilise

profits, then risk averse management may adopt a merger intensive growth strategy (Amihud and Lev (1981)). The link between merger and management control has also been emphasised by Reid (1968) and by Mueller (1969). The latter has argued, in a manner echoed later by Jensen (1986), that large mature managerial companies with access to substantial internal cash flows will have in effect a lower discount rate than the market in general and thus regard all other companies as undervalued takeover targets. Thus corporate age and the freedom from shareholder interference should weaken the drive to pursue profit-motivated takeover. The burden of these arguments has been to imply that if owners of equity were more active in monitoring the managers of more mature companies, they would be more likely to perform in a manner consistent with shareholder value maximisation. In this context institutional shareholders may have a critical role to play as a countervailing force either to propertyless, inside management, or entrenched managers with substantial ownership rights (Cosh and Hughes (1987), Cosh, Hughes, Lee and Singh (1989) and Charkham (1995)).[2] We should therefore include the presence prior to merger of a significant shareholding by financial institutions as a pre-merger characteristic likely to favourably influence post-merger profitability outcomes. The importance of doing so is emphasised by the increased significance attached to the potential disciplinary role of institutions as their shareownership has grown. Whereas in 1969 insurance companies, pension funds, unit trusts and investment trusts held 34.2% of all UK listed market securities by value this had risen to 58.9% by 1985, and to 61.2% by 1993 (Cosh, Hughes, Lee and Singh (1989) and CSO (1994)).

So far we have focused on the individual pre-merger company characteristics which might predispose merger outcomes to be more or less unsuccessful in terms of enhanced profitability. In measuring the success or failure of a particular merger however a counterfactual estimate of profits in the post-merger period is required with which to compare the actual post-merger outcomes. One common method is to compare the post merger profitability with the weighted average pre-merger profitability of the parties to a merger with both sets of data

normalised by mean industry or economy wide profitability to adjust for common average trends in performance. This also deals with the averaging effect discussed earlier. It does not however pick up any effects on profitability which would have been expected to occur on the basis of the pre-merger characteristics of individual companies, and in particular of their pre-merger relative profitability. The most important argument here is based on the notion of Galtonian regression to the norm in which inter-company rivalry leads to a competitive process in which profitability extremes are competed away over time (Downie (1959), Mueller (1986) (1990)). This suggests that in the absence of merger profit changes might be expected to occur in a predictable fashion based on past profits. It is important therefore to allow for these possible effects in assessing merger related outcomes.

There have been some attempts to do so in the recent merger literature. Ravenscraft and Scherer consider 67 lines of business acquisitions in the period 1965-74 and analyse the relationship between their post-acquisition profitability averaged over the period 1974-77 (POSTPI) and their pre-merger profitability in the year before acquisition (PREPI), and asset growth in the period 1974-77 (GROW). To allow for variations in overall profit rates movements when aggregating across the various pre-merger event years they adjust each line of business profit rate by a variable MACRO which reflects the ratio of overall manufacturing profit rates in the particular merger year to overall average manufacturing profit rates in the period 1974-77. They report the following result ('t' ratios in parentheses):

$R^2 = 0.034$	POSTPI	=	-2.84	+ 0.10 PREPI	+ 0.15 GROW	
n = 67			(1.31)	(0.81)	(0.81)	

The coefficient on PREPI is not significantly different from zero, but is significantly different from 1 (t=7.18) so that there is regression towards the 'normal' rate of profit. They test for the impact of merger on this 'regression' effect by estimating the same equation on a pooled sample of their 67 lines of business and 261 corporations which survived as independent companies on the Compustat data tapes from

1965 to 1980 and which had assets of less than $50 million and profit rates on assets of 15% or higher in 1965. The median size and profit characteristics of this group were close to that of the 67 acquired lines of business in 1965. In the regression the 261 corporations are represented by their 1965 'MACRO' adjusted profit rates for PREPI and their average profit rate and growth in the period 1974-77. The 67 acquired lines of business are identified within the sample by a dummy variable taking the value of 1 for an acquired business and zero for the non-merging corporations. They estimate two equations, first for the full 261 plus 67 sample and second for 67 plus a restricted surviving group of 179 corporations with 1966 and 1967 profit rates at least 70% of their level in 1965. The results are as follows:

$R^2 = 0.157$ POSTPI	= -4.55	+ 0.32 PREPI	- 0.19 DUM.PREPI	+ 0.24 GROW
N = 328	(4.68)	(5.76)	(2.78)	(3.48)

$R^2 = 0.160$ POSTPI	= -3.5	+ 0.40 PREPI	- 0.29 DUM.PREPI	+ 0.19 GROW
N = 246	(3.13)	(5.06)	(3.54)	(2.36)

Both equations report coefficients on PREPI consistent with regression to the norm with a faster 'regression' to the norm for acquired firms (mostly falls). The second equation (which removes those survivors with substantial profit falls after 1965) exhibits less regression to the norm overall and a commensurately bigger relative effect for merged firms. The consistently positive significant coefficient on growth suggests that acquired lines of business were not used as 'cash cows' and starved of investment funds. They conclude that acquisition activity lowers profitability and that part of this is due to Galtonian regression to the norm from unsustainably high pre-merger performance.

Ravenscraft and Scherer's treatment of merger and regression to the norm is based on the approach of Mueller (1986) who examined the cross-section impact of mergers on the persistence of profitability using rates of return on assets for US corporations for seven sub-periods in the years 1947-74. His basic estimating equation involves regressing

rates of return (π) on assets in time period t+1 on rates of return in time period t-1 (i.e. lagged two periods); assets acquired as a percentage of asset size (ACQ) in period t; and the interaction of ACQ and π_{t-1}. The detailed estimates vary by time period but the coefficients on π_{t-1} indicate regression to the norm whilst the coefficient on ACQ. π_{t-1} is negative, often significantly so, implying that merger enhances regression to the norm. The coefficient on ACQ itself is usually significantly positive when rates of return are measured gross of interest payments. This is not the case for net of interest profit rates. This reflects the use of heavy debt financing in the US conglomerate merger waves of the 1960s. In the period 1962-67 Mueller interprets his results as showing that for firms earning roughly double the average rate of return (gross of interest) mergers tended to reduce profitability, for all other companies they tended to raise it. When profit rates are measured net of interest mergers tended to reduce profitability for the majority of companies (i.e. all companies with profitability greater than one third of the sample mean).

Geroski and Cubbin (1990) follow a different route in attempting to measure merger impacts within an analysis of profit persistence. They estimate separate time series profit equations on annual data for each of 239 UK quoted companies in the period 1951-77 of the form:

$$\pi_{it} = \alpha \times \lambda\pi_{it-1}$$

and attempt to explain the estimated parameters for each company in terms of industry and company specific variables, including the number of acquisitions a company makes in the period 1951-73. This latter variable is negatively related to α, λ and $\alpha/1-\lambda$ (where the latter is interpreted as an estimate of the long period equilibrium rate of profit of the firm). Acquisition activity *ceteris paribus* reduces profitability and speeds up regression to the norm. They recognise that their sample has potential selection biases because it focuses on surviving firms and also because it may reflect the 'averaging' effect of merger. They therefore construct a separate panel of 217 'pseudo' companies adding back to each surviving 'real' company over the period 1951-77 the

assets and profits of each firm it acquired over each year prior to acquisition. Estimates of their basic profit equation for this adjusted sample suggest that purging merger effects raises the proportion of firms which appear able to sustain long run profits above the norm. In particular they note that 'The higher incidence of significant α's in the current sample may also be due in some way to the reduced scope for a profit rate dilution effect of mergers in our (purged) sample' (p.164). They also find that attempts to explain cross firm estimates of α, λ and $\alpha/1-\lambda$ suggest a negative merger impact when acquisition intensity is measured by the number of acquisitions.

Thus each of these studies have followed somewhat different paths in assessing the strength of the regression towards the mean effect in their analysis of the impact of mergers on profitability. We outline below a somewhat different route to the modelling of the dynamics of corporate profitability. However, we must emphasise that our main objective in this exercise is not the dynamics per se, but the assessment of the impact of mergers on profitability given the dynamics. We therefore pay particular attention to the econometric problems involved in carrying out such an analysis on the basis of cross section data for a limited period - a data choice itself dictated by the exigencies of the merger phenomena. Had our primary interest been in simply the dynamics, the appropriate data set would necessarily have involved long time-series of profitability for each firm. It is the focus on mergers which requires a relatively short period cross-section analysis. The latter in turn obliges us to use suitably matched samples of merging and non-merging firms to draw inferences about the effects of mergers.

3. Modelling the Effects of Merger on Company Profitability

In this section, we consider some of the difficulties encountered in the empirical investigation of the effects of merger activity on company profitability in the existing literature discussed above, we then suggest an approach which attempts to mitigate some of the associated econometric problems which we identify. These difficulties arise from the fact that the population of companies is constantly changing; some

companies disappear from the population through failure or through take-over; and those that remain undergo considerable changes in their nature as they evolve over time, possibly involving a sequence of takeovers or restructures. This means as we have already argued that it is unlikely that an investigator can readily construct samples which can be analysed to isolate the effect of a merger using a long run of data for a merging company prior to and following the merger event. There are in any case obvious difficulties of self-selection, since the companies which appear in the sample as 'acquirers' clearly exist (separating them from those which have been acquired or died), and have chosen to engage in merger (separating them from other survivor firms who have not engaged in merger activity).

There have been, as we have seen, some ingenious attempts to establish suitable counterfactuals and to cope with the problems of data limitations in the context of studying the impact of merger on profit persistence. The most straightforward approach remains however to apply cross-section methods to analyse the effects of mergers in a sample of companies over a shorter time frame which captures genuinely merger free years (i.e. the sample is chosen to ensure that the effect of the included mergers are not distorted by further merger activity or death). However, where an important purpose of the analysis is to consider the effect of merger on the dynamic time path of profitability (e.g. whether mergers help to speed up, or delay the workings of the 'competitive process') there are, as we elaborate below, econometric problems which arise in estimating these dynamics from a cross-section regression. These problems arise whether we consider a sample of merging firms only, or whether we consider a sample of merging and non-merging firms. However, in this latter case, we can obtain an indication of the *differences* that exist between the two groups, so that inferences about the effects of mergers can be drawn more readily. For this reason, in the analysis of merger activity, we favour here the use of cross-sectional methods on a sample of acquiring companies and a carefully selected matching sample of firms not involved in mergers, and focus attention on the differences between these. Of course, the self-selection problems still remain, but there are

standard estimation procedures which can be employed to deal with these. Moreover, as we explain below, the choice of the variable on which the match is based can also be used to mitigate some of the effects of self-selection.

In the remainder of this section, we briefly describe the modelling framework that underlies our analysis of company profitability, before turning to the choice of the appropriate econometric methods for use in the analysis. We then elaborate on the arguments outlined above, and describe in more detail the estimation methods that are employed in the empirical work described in Section 6 of the paper.

3.1 The modelling framework

In general, and ignoring the possible effects of merger for the time being, we might assume that profits in firm i at time t, expressed relative to industry profits, are given by the following linear model:

$$y_{it} = \alpha_i + \beta X_{it} + \lambda y_{it-1} + \varepsilon_{it} \qquad (1)$$

The terms '$\alpha_i + \beta X_{it}$' capture the factors which systematically influence (relative) profits while the intercept α_i captures the factors which influence firm i's profits and which are not time-varying. We assume β, λ common to all firms. The ε_{it} represent random shocks which impact on firm i's profits (e.g. a strike in time t, or an unexpected increase in demand). The presence of λy_{it-1} indicates that there is a degree of inertia in profitability. If there is an increase in warranted/equilibrium profits, because X_{it} rises, then profits only gradually rise (assuming $1>\lambda>0$); the speed of adjustment depends on λ (large λ corresponds to slow adjustment). Equally if there is a positive shock (an unexpected increase in demand, say), then the effect dies away only gradually. Equation (1) can be considered to be a 'structural relationship', in which case X_{it} is likely to include variables, measured at time t, which are determined simultaneously with profitability (e.g. firm growth). Alternatively, equation (2) can be considered as the 'reduced form' equation for profitability (based on a

system of equations explaining profitability, growth, and other variables), in which case X_{it} will include all those variables, measured at time t-1, which influence the endogenous variables in the system. The λ coefficient can be interpreted as capturing the workings of the "competitive process" (e.g. Downie (1959), Clifton (1977)) exerted directly on profitability in the 'structural' interpretation of (1), or exerted indirectly on all the endogenous variables of the system in the 'reduced form' interpretation of (1). A small λ (close to zero) means firms take advantage of changes in 'warranted' profits quickly, and the effects of random shocks are quickly eliminated.[3]

One main aim for this paper is to find the effect of merger activity on profitability. In terms of the above formulation much of the discussion in Section 2 can be regarded as being concerned with the possible effect merger has on the speed of adjustment. To consider the effects of merger activity, we can use the following generalised version of (1):

$$y_{it} = \alpha_i + \beta X_{it} + \gamma merg_{it} + \lambda y_{it-1} + \phi(merg_{it} \times y_{it-1}) + \psi(merg_{it} \times X_{it}) + \varepsilon_{it} \qquad (2)$$

where $merg_{it} = 1$ if a merger has occurred in firm i at time t or 0 if no merger has occurred in firm i at time t. The inclusion of the variable $(merg_{it} \times y_{it-1})$ allows the speed of adjustment to differ in the two cases. An estimate of $\phi = 0$ means there is no difference in adjustment speeds with or without merger; $\phi < 0$ means adjustment is quicker with mergers; $\phi > 0$ means adjustment is slower with mergers. The inclusion of $(merg_{it} \times X_{it})$ is also important. In the *absence* of this variable, a different speed of adjustment will *force* X_{it} to have different long run effects on y_{it}, since where $merg_{it} = 1$, $\frac{\partial y_{it}}{\partial X_{it}} = \frac{\beta}{1-(\lambda+\phi)}$, while when $merg_{it} = 0$, $\frac{\partial y_{it}}{\partial X_{it}} = \frac{\beta}{1-\lambda}$. Including the variable $(merg_{it} \times X_{it})$ allows $\frac{\partial y_{it}}{\partial X_{it\ LR,merg_{it}=1}} = \frac{\partial y_{it}}{\partial X_{it\ LR,merg_{it}=0}}$ if $\psi = \frac{-\beta\phi}{1-\lambda}$.

3.2 Some econometric considerations

The most straightforward way of looking at these models, *assuming no data constraints*, would be to use a fixed-effect pooled regression. This uses data for many firms over many years, pools all the data, and estimates a single regression with separate 'intercepts' for each firm obtained using firm-specific dummies. In this case, where we have assumed that the parameters in the regression are common to all firms, pooling is acceptable.[4] In general, however, there are considerable data constraints in work of this type, the result of which is that we are typically faced with just two observations for each company: one prior to the merger, and one following the merger.[5] In these circumstances, only cross-sectional regression methods are available. If the model was static (i.e. $\phi = 0$ and $\lambda = 0$), a standard cross-section would give consistent estimates of β, γ and ψ. If the model is dynamic (i.e. $\lambda \neq 0$ and $\phi \neq 0$), and we know $\psi = \frac{-\beta\phi}{1-\lambda}$, so that the *long-run* elasticities $\left(\frac{\partial y_{it}}{\partial X_{it}}\right)$ are the same for $merg_{it} = 0$ and $merg_{it} = 1$, then this same cross-section will give consistent estimates of the long-run elasticities (see Pesaran & Smith (1995)). But if $\psi \neq \frac{-\beta\phi}{1-\lambda}$, then these cross-section estimates are not consistent. Moreover, and this is particularly relevant here, standard cross-section analysis can say nothing about the dynamics themselves (i.e. the value of λ).

In this paper, we consider a *"Barro cross-sectional"* regression in which we include a lagged y_{it} on the RHS of a cross-section regression i.e. across firms we regress y_{it} on y_{it-1}, X_{it}, $(merg_{it} \times y_{it-1})$... and so on.[6] The aim is to obtain an estimate of λ and hence examine the dynamics directly. However, Barro cross-sections suffer from econometric problems of their own[5]. Specifically, in a cross-section regression of y_{it} on an intercept and y_{it-1}, the estimator of λ is given by $\hat{\lambda}$ where:

$$E(\hat{\lambda}) = \lambda + (1-\lambda)\frac{\sigma_\mu^2}{\left[\sigma_\mu^2 + \frac{(1-\lambda)}{(1+\lambda)}\sigma_\varepsilon^2\right]}$$

where, recall: $y_{it} = \alpha_i + \lambda y_{it-1} + \varepsilon_{it} = \alpha + \lambda y_{it-1} + (\alpha_i - \alpha) + \varepsilon_{it}$, and σ_μ^2 is the inter-firm variance in intercepts, i.e. $v(\alpha_i)$, and σ_ε^2 is $v(\varepsilon_{it})$, which is assumed the same for all, and gives the time-series variability. If the cross-section variability (σ_μ^2) is large relative to the time series variability (σ_ε^2) so that relative profits across firms varies by a lot compared to the variation in a single firm's profitability over time, then:

$$\frac{\sigma_\mu^s}{\sigma_\mu^2 + \left(\frac{1-\lambda}{1+\lambda}\right)\sigma_\varepsilon^2} \approx 1 \text{ and } E(\hat{\lambda}) \approx \lambda + (1-\lambda) = 1$$

irrespective of the true value of λ.[8] Hence, the estimated coefficient on y_{it-1} says little about the dynamics and simply reflects the relative size of these variances.[9]

However some information can be gained by use of *matched samples*. If we have two samples in which σ_μ^2, σ_ε^2 are the same in both, then we can run two Barro cross-sections (one on each sample). If we find $\hat{\lambda}$(sample 1) > $\hat{\lambda}$(sample 2), then the true λ(sample 1) >λ(sample 2). Moreover, in the (pooled) cross-section regression (i.e. using both samples together) where we regress y_{it} on an intercept, y_{it-1} and ($merg_{it} \times y_{it-1}$), then the estimated coefficient on ($merg_{it} \times y_{it-1}$) is given by $\hat{\phi}$ where:

$$E(\hat{\phi}) = \phi - \phi\sigma_\mu^2\left\{\frac{(1+\lambda)(1+\lambda+\phi)\sigma_\mu^2 + (1-\lambda)(1-\lambda-\beta)\sigma_\varepsilon^2}{\left[(1+\lambda)\sigma_\mu^2 + (1-\lambda)\sigma_\mu^2\right]\left[(1+\lambda+\beta)\sigma_\mu^2 + (1-\lambda-\beta)\sigma_\varepsilon^2\right]}\right\}$$

$$= \phi\frac{2\left[1 - \lambda(1+\beta)\sigma_\mu^2\sigma_\varepsilon^2\right]}{2\left[1 - \lambda(1+\beta)\right]\sigma_\mu^2\sigma_\varepsilon^2 + (1+\lambda)(1+\lambda+\beta)(\sigma_\mu^2)^2 + (1-\lambda)(1-\lambda-\beta)(\sigma_\varepsilon^2)^2}$$

Hence, it appears that, although we are unable to obtain reliable point estimates of the speed of adjustment of company profitability, we are able to obtain some information on the effect of mergers on this dynamic process by comparison of a sample of companies who have engaged in merger with a sample of companies who have not. Biases also render the estimated effect of mergers unreliable, but they do so by under-estimating their effect; evidence of significant effects based on these cross-sections would therefore provide strong evidence to support the view that mergers are important.

3.3 Self-selection issues

Even if we abstract from the difficulties experienced in estimating the dynamic effects of merger on the dynamic processes involved in modelling company profitability, there remain problems in the empirical work because of the problem of self-selection. In the empirical exercise to be carried out here, the self-selection problem arises in two forms.

First, the sample of companies to be analysed, whether engaged in merger activity or not, are 'survivors' in the sense that they exist during the two periods for which data is collected (i.e. at least seven years during the late 1970s/early 1980s in our analysis). It is important that both the merging and non-merging samples of companies survived for the same reasons, since otherwise comparison of the determination of profitability in the two samples could be dominated by the (unequal) influences of the factors affecting survival, and may not provide an adequate reflection of the influence of merger on profitability.

And second, even assuming that the merging and non-merging samples differ only in those characteristics which affect profitability (when it is known that both groups are 'survivors'), it is important to recognise that the decision to enter into a merger is unlikely to be independent of the process determining the company's profitability. For example, imagine that we observe that merging companies have higher profits than non-merging companies. But the merging companies might have

achieved high profits even if the merger had not taken place, and the observed link between merger and profitability might be obtained because the factors which result in high profits are correlated with those which encourage a company to decide to take-over another.

In fact, treatment of these self-selection issues is relatively straightforward. The first problem, relating to the fact that only survivors are considered in the analysis, can be remedied if we choose our sample of non-merging companies so that they match the merging companies according to the variable (or variables) which distinguish 'survivors' from 'non-survivors'. In our own previous work (Cosh et al. (1989)), we observed that victims were routinely smaller than average so that the primary factor distinguishing the victims of take-overs, from their acquirers and from the companies in the industry as a whole, was their size. If the sample of non-merging companies is chosen so as to match the acquiring sample by size, therefore, then the analysis can proceed on the assumption that both sets of companies provide an equally representative reflection of the properties of 'survivors', and differences between them can be attributed to the effects of mergers alone (see the section below for further discussion of the distinguishing features of acquired companies).

The effect of self-selection in the analysis of 'treatment effects' has been widely discussed (see, for example, Greene (p.713, 1993)), and is also relatively straightforward to take into account using Heckman's (1979) two-stage treatment of sample selection as a specification error. Specifically, we can complement the profitability equation given in (2) with the following model of the decision to engage in merger activity:

$$\text{merg}_i = \begin{cases} 1 \text{ if } \text{merg}_i^* = \pi Z_i + \nu_i > 0 \\ 0 \text{ if } \text{merg}_i^* = \pi Z_i + \nu_i < 0 \end{cases} \qquad (3)$$

where merg_i^* is an unobserved underlying latent variable, influenced by Z_i. The self selection issue arises if ε_i and ν_i are correlated, since the effects picked up by the merger dummy in (2) will, in these

circumstances, confuse the effect on profitability due to the merger and the characteristics of the merging firms as they relate to post-merger profitability (i.e. the typical firm engaging in merger might have achieved high profits anyway, so that it would be wrong to ascribe all the effects of high profitability to the merger itself). Now, abstracting from the dynamic issues, and under the assumption that ε_i and ν_i are from a bivariate normal distribution, with $\varepsilon \sim N(0, \sigma_\varepsilon^2)$, $\nu_i \sim N(0,1)$ and correlation of ρ, then:

$$E[y_{it}|merg_i = 1] = \alpha + (\beta + \psi) X_i + \gamma + E[\varepsilon_i|merg_i = 1]$$

and

$$E[y_{it}|merg_i = 0] = \alpha + \beta X_i + E[\varepsilon_{it}|merg_i = 0]$$

and hence

$$E[y_{it}|merg_i = 1] = \alpha + (\beta + \psi) X_i + \gamma + \rho\sigma_\varepsilon^2 \, mills_i$$

$$E[y_{it}|merg_i = 0] = \alpha + \beta X_i + \rho\sigma_\varepsilon^2 \, mills_i$$

where $mills_i = \dfrac{\phi(\pi Z_i)}{\Phi(\pi Z_i)}$ if $merg_i=1$, and $mills_i = \dfrac{-\phi(\pi Z_i)}{1-\Phi(\pi Z_i)}$ if $merg_i=0$.

Hence, the effect of the merger decision on the profitability equation can be identified by construction of the "$mills_i$" variable, and by its inclusion in the profitability equation. As usual in the implementation of the Heckman two-stage procedure, the inclusion of this term requires use of an estimate of the variance/covariance matrix for the parameters which is adjusted to take into account the heteroskedasticity induced by the self-selection process when testing hypotheses. Given the biases that arise due to the use of "Barro cross-sectional" regression methods, it seems inappropriate to rely too heavily on such hypothesis tests. On the other hand, this adjustment might be important, and a pragmatic approach would be to consider hypothesis tests based on both

unadjusted and adjusted variance/covariance matrices to give an indication of the robustness of the results obtained and inferences drawn.

4. Merger Sample and Variable Definitions

Our sample consists of 59 companies involved in a merger in the years 1981-83 (i.e. t = 1981, 1982 or 1983) for which data were available on the Exstat UK Company Accounts databank for the relevant pre-merger and post-merger periods (i.e. (t-4) to (t+3) for acquirers), and for which we were able to gather shareholding information for the acquirer in the year prior to merger. The Exstat database is intended to be comprehensive in its coverage of the UK quoted company sector. Around 2,400 non-financial records existed on the database for the early 1980s. All companies identified in the database coding system as having lost their independence through merger were listed for analysis. There were 143 in the three years 1981-83. We were able to obtain the necessary seven years of accounting data and information on pre-merger shareholdings for 59 of these. The major reason for exclusion from the sample was an insufficient run of years of data, either because the acquirer was relatively new to the population or was acquired or lost quotation soon after merger, or because the acquired was also a newcomer. An inspection of other lists of major mergers in these years in the financial press and elsewhere suggested that the Exstat records were reasonably comprehensive at the top end of the size distribution of acquisitions. We estimated that the total consideration paid for our sample of 59 mergers was around £1.7 billion, with 16 costing less than £5m to effect and 11 costing over £25m. The largest of the latter amounted to £250m. This may be roughly compared with the official estimate of £4.2 billion paid to effect a total of 931 acquisitions of UK independent industrial and commercial companies (quoted and unquoted) in the period 1981-83. Of these, 27 cost over £25m, and 821 less than £5m (Business Monitor M7 *Acquisitions and Mergers of Industrial and Commercial Companies* (HMSO, London) various issues). Our sample therefore emphasises the larger end of the size spectrum of acquisitions in the UK in this period, which is to be

expected since it is where the majority of quoted companies are located. Even so a substantial proportion of our sample cost less than £5m to effect.[10] In addition to our 59 merging companies a matched sample of 59 non-merging companies was drawn from the Exstat database which most closely matched our acquirers by size and industry group. It was also possible to obtain institutional investment holdings data for 47 of these.

The following variables have been used in the analysis:[11]

(a) LSIZE — log(size), pre-merger, measured by the logarithm of net assets in year (t-1), where t is the year of the merger.

(b) PREPROF — pre-merger profitability, measured by the % pre-tax return on net assets averaged over the three pre-merger years (t-3) to (t-1).

(c) PERFIMP — short run improvements in performance, measured by the change in pre-tax return within the three pre-merger years (i.e. (t-1) less (t-3)).

(d) PREGRO — pre-merger growth, % change p.a. in net assets in the three pre-merger years (i.e. (t-4) to (t-1)).

(e) $POSTPROF_i$ — post-merger profitability, measured by the % pre-tax return on net assets averaged over the three post-merger years (t+1) to (t+3).

(f) $HORZ_i$ — dummy variable taking the value 1 when acquirer and acquired are drawn from the same industry group, and 0 otherwise.

(g) $INST_i$ dummy variable taking the value 1 when acquirer has a significant institutional shareholding of 5% or more in the year prior to merger, and 0 otherwise.

(h) $MERG_i$ dummy variable taking value 1, when company engages in merger, and 0 otherwise.

(i) AGE_i number of years since company registration.

To control for industry differences and changes in the economic environment the variables (a) to (e) were all measured as differences from the mean values for other companies in their industry groups.[12]

5. Takeovers in the Sample: An Overview[13]

Before turning to an analysis of the links between pre-merger characteristics and post-merger profitability, it is helpful to summarise the principal characteristics of the takeover process as a whole in our sample since this reveals the likely nature of potential selection biases in our later analysis. We also pay particular attention here to the role of institutional investment in the merger process. The evidence presented below also bears inter alia on two main hypotheses[14]: (a) the strong hypothesis, that the increasing domination of the stock market by institutional investors has led to a change in the behaviour of all companies in the market whether or not they have an institutional presence; (b) a weaker hypothesis that only the behaviour of companies in which the institutions have a sizeable shareholding will be affected. Table 1 shows the pre-merger characteristics of the acquired and acquiring companies compared with their industry averages. It shows that the acquired companies were significantly smaller and performing worse than their industry averages. However this under-performance in terms of profitability, growth and share return was significant only for companies acquired by acquirers with a significant institutional holding (F acquirers). Indeed the companies which were acquired by companies without a significant financial holding (N acquirers) showed better pre-

merger performance in both share return and short-run change in profitability than their industry averages. On the other hand it can be seen that acquiring companies were performing better than their industry averages in the period immediately prior to merger announcement in terms of profitability and share return. This above average performance was more marked for N acquirers which were also larger than their industry averages. But the average size of F acquirers was less than their industry averages and their pre-merger performance was not so superior - short-term profitability and change in profitability were significantly better, but pre-merger growth was lower than industry averages and the other variables were not significant. These findings suggest that we should find significant differences between acquirers and acquired in both the F group and the N group, but for slightly different reasons. In the case of the F group the acquired were significant under-performers and the acquirers were marginal over-performers; whilst in the N group it was the acquirers which were the significant over-performers with the acquired as marginal under-performers. These expectations were confirmed by Table 2 which provides a univariate pre-merger performance comparison of acquirers with that of those they acquired. In both F and N groups the pre-merger performance of the acquired companies was noticeably worse and they were found to be significantly smaller than their acquirers.

Multivariate discriminant analysis was used to assess the collective discrimination between acquiring and acquired companies achieved by our variables and to discover which variables are most important in a multivariate context.[15] The impact of financial institutions' shareholdings on the merger process is examined in two ways.[16] First, in Table 3 we present the results of an analysis of the characteristics of acquirers as a whole versus the acquired as a whole. Then, the discrimination between acquirers and acquired on the basis of their pre-merger characteristics is contrasted for the sample of acquirers with financial holdings to those acquirers which have none. Second, in Table 4, these variables are used to discriminate F acquirers from N acquirers and F acquired from N acquired. In general the results are

supportive of the univariate findings. The significant differences found between acquirers and acquired are reflected in the strong statistical significance and the success of the discriminant function in correctly classifying companies as acquirers or acquired. The importance of size and the unimportance of profitability as a characteristic distinguishing acquirers as a whole from the acquired as a whole, is shown in the discriminant function.

As might have been expected from the univariate results, the good pre-merger share return of acquirers means that this variable too, along with growth is a significant discriminator. It could of course be argued that the importance of the share return variable suggests that the stock market disciplinary mechanism is working in the interests of stockholders. However this interpretation is not straightforward since, as we have seen, the acquired companies were not significantly underperforming relative to the market prior to acquisition. Moreover, a key question from the acquiring company's shareholders point of view is not so much how their company is performing pre-merger, but what impact the merger has on subsequent returns.

Comparing the results of our analysis here with those of previous merger studies suggests that the characteristics of the selection process as a whole have not been significantly modified by the increased importance of financial institutions. The influence of the latter might nonetheless be manifested in the acquisition behaviour of companies in whose shares they held significant stakes. We tested this in a multivariate context by recomputing discriminant functions for F acquirers and their acquired and N acquirers and their acquired.

This analysis, also presented in Table 3, shows that in both F and N groups size remains a significant discriminator. It is however less important in discriminating between F acquirers and their acquired. Moreover in the F group the profitability and share return variables are the most important discriminators. In the N group on the other hand, size and growth remain the most important. Although the share return enters as a significant discriminatory variable for both groups it is less

important in the N group. The change in profitability in the pre-merger period appears in both the discriminant functions, but the interpretation of its appearance is made difficult by its strong positive correlation with 1 year profitability. These results are entirely consistent with our univariate findings, and reinforce our tentative conclusion that any beneficial impact of financial institutions is to be felt at the level of the firms in which they hold significant equity stakes, rather than in terms of the takeover process as a whole.

So far, we have concentrated on discriminating between acquirers and their acquired. Now we can turn in Table 4 to the related but separate question of the extent to which it is possible to discriminate between companies acquired by F and N acquirers respectively, and between F and N acquirers themselves. The analysis of acquired companies suggests, as did the univariate tests for that period, that acquiring companies with a strong institutional presence were more likely to seek out small and unprofitable companies than other acquirers. No doubt this in part reflects their own relatively small size, which along with their relatively low growth, improving profits and high share return, distinguishes them from other acquirers. Whether this acquisition strategy led to further profit or improved share return is taken up next.

The impact of merger was assessed by comparing the post-merger performance of the acquirer relative to its industry with its pre-merger performance relative to its industry. The pre-merger performance of the acquirer is measured simply for the acquirer itself, and as a weighted average of the pre-merger performance of the acquirer together with the company it acquired. The latter measure corrects for the averaging effect discussed earlier

The implications of the findings presented in Tables 5 and 6 are clear despite there being few statistically significant results. For the sample as a whole there is significant deterioration in the short-term profitability of acquirers relative to industry averages. This is *ceteris paribus* to be expected given the lower profit performance of the acquired relative to their acquirers in this period. It is therefore not

surprising to find that this change switches from weakly significant to statistically insignificant when the pre-merger weighted performance of the acquirer and acquired are compared with the acquirer's post-merger data. This confirms the usefulness of allowing for averaging effects in this context. The picture is however worse for N acquirers than for F acquirers on either basis so that averaging is less important here. Thus we find that merger appears to have worsened the profitability, growth, profit change and share performance of the N killers. On the other hand the acquirers with financial holdings appear to have fared better than the N acquirers. Growth and share returns appear higher for the F acquirers although insignificantly so, and profitability is unchanged relative to the industry average. Further analysis reveals that the decline in profitability of the N acquirers represents a move from being significantly above their industry averages to being insignificantly above and the same is true for share return. On the other hand in the case of growth and change in profitability they have moved from above to below average. Our univariate analysis revealed that F acquirers were less successful pre-merger in terms of growth and 3 year profitability than N acquirers. It could therefore be argued that there was more scope for them to improve relative to the N acquirers in these areas.

The differences in the impact of merger on performance between acquirers with, and those without, institutional holdings can be tested more directly using the Mann-Whitney test. This test confirms that the merger effect is better for the F acquirers and their superior relative performance is statistically significant at the 5% level or better in terms of the effect of merger on both 1 and 3 year profitability and the post-merger change in profitability, and at the 12% level for share returns. These significant differences arise only when comparing the post-merger performance of the acquirer with the weighted average pre-merger performance of the acquirer and its acquired combined (i.e. relating to the results presented in Table 6 and not Table 5).

The Mann-Whitney test revealed no significant differences between the changes in performance of F and N acquirers relative to their industries.

On the other hand the post-merger performance of the acquirers and the acquired was found to be significantly better in the F group relative to the N group. These findings are reflected in the multivariate analysis, presented in Table 7, since the discrimination between F and N acquirers in terms of their change in performance is much higher when the change in performance is measured relative to the weighted average of the acquirer and its acquired. In this case a reasonable degree of discrimination is achieved, with the change in 3 year profitability from before to after the merger emerging as the dominant variable. Indeed it can be seen that, owing to the strong positive correlation between this variable and all the others, the inclusion of other variables adds little to the discrimination achieved. This reinforces the conclusion of our univariate analysis.

In summary, for the sample of acquirers as a whole we find a generally insignificant worsening of relative performance. This appeared to be due to the relatively inferior post-merger performance of acquiring firms in which there was no significant institutional presence. These acquirers suffered a relative deterioration in performance much as the majority of previous studies of UK mergers have led us to expect. On the other hand the F acquirers show a positive (albeit insignificant) post-merger performance. This finding raises the question of whether the superior merger effect for F acquirers is due to the presence of institutional investors themselves (through motivational or expertise effects), or to the other pre-merger characteristics of these acquirers in particular their tendency to be somewhat below the average pre-merger profitability of N acquirers. This is explored further in the analysis which follows.

6. Regression Results

The central purpose of this section of the paper is to consider whether the long-run level of company profitability (relative to its industry average) can be explained by company characteristics; whether the determination of this long-run level differs in companies engaging in merger compared to those who do not; whether the "competitive

process" (associated with the speed of adjustment to the long-run equilibrium) is enhanced by merger activity; and how the influence of institutional investors identified in the preceding section can be interpreted in this framework. In particular we question whether the acquirer's decline in profitability relative to its industry average is simply a reflection of its superior relative profitability pre-merger. If this were found to be the case it would both provide an alternative explanation for the superior merger effect of F acquirers discussed above and would call into question the typical counter factual assumption used in many merger studies.

To do this we draw upon the modelling framework presented in Section 3. This required the creation of a matched sample of 59 companies for the same time period as our merger sample. Each company in this sample matched one of our acquirers by size and industry group; and none had engaged in merger activity in this period. Our matching was designed to control for differences in profitability due to different competitive circumstances which might arise between a randomly selected sample of firms and a sample in which firms which might become victims have been omitted (as is the case here). As discussed in the previous section of the paper, company size is the primary determinant of the likelihood of the company being taken over, and matching by size therefore ensures that the merging and non-merging firms can be considered to have the same "survivor" characteristics, and differences between them can therefore be ascribed to the merger effect.

However, it is also important that the two samples have similar characteristics in terms of the time-series and cross-section variability of the firms' profitability series. As discussed in the earlier sections, biases in the estimators of the coefficients on the dynamic terms in the profitability regression are influenced by the relative size of these variance terms, and it is important that the biases in the two samples are comparable if inferences are to be drawn through comparison of the two samples. As it turns out, matching by size and industry provides samples which have very similar cross-section variation in firm

profitability.[17] Since there is no a priori reason to believe that the time series variation would differ significantly between the samples, we proceed on the assumption that the biases affecting the two samples are also comparable across firms and industries. The comparison of the findings for these two groups allows us to draw inferences about the effect of merger itself.

Our first approach estimates the profitability equation using OLS and the results are presented in Table 8. In this table column (1) examines directly the difference in adjustment speeds between the acquirers and the matched sample and provides a point of reference with the previous literature in this area. It shows that the adjustment coefficient on PREPROF (λ in our earlier discussion) is between zero and unity and that merger appears to accelerate this adjustment. Both of these results are statistically significant. The full set of explanatory variables is introduced in the equation reported in column (2). The inclusion of further variables supports the conclusions derived from column (1). Company size has a weak, positive effect on profitability within the matched sample, but this effect is not found amongst the acquirers. The results suggest that rapid growth in the earlier period reduces subsequent profitability, but this effect is not present for the acquirers. The result for the sample as a whole echoes the findings of Whittington (1971) for the UK quoted sector in the period 1948-60. The result for the acquiring sample is consistent with a Penrose effect in which merger allows the pursuit of fast growth without diseconomies of growth adversely affecting profitability. For the matched sample there is a significant, positive relationship between current profitability and the previous period's performance improvement. However, it appears that merger largely eliminates this effect on profits. Company age is unrelated to profitability in these samples, but there is some evidence for a negative impact in the case of horizontal mergers (which is in accordance with previous studies for the UK). Overall, the impact of merger appears to eliminate, or reduce the impact of a company's history on its current profitability. This accounts for the higher intercept term for the sample of acquirers.

In order to examine the impact of institutional investor presence on this process we introduced the institutional dummy variable. Lack of information for some of our matched companies restricted the sample to 47 acquirers and their matched companies. Column (3) presents the findings for this sample and a comparison with the full sample shown in column (2) shows that our previous findings apply equally to this restricted sample. Columns (4) and (5) then present the results when the institutional dummy is introduced. its inclusion reinforces our earlier conclusions about the impact of the other variables and about the adjustment process. Furthermore, a significant institutional presence appears to be associated with higher profitability and this effect is greater amongst the acquirers. On the other hand the statistical significance of these findings is poor.

Finally, column (6) provides comparable results in which the acquirer's prior period profitability is replaced with the average profitability of the acquirer and acquired together (weighted by their assets in that period). It can be seen that this has very little impact on the estimated coefficients for the sample of acquirers and requires no qualification of our earlier conclusions.

The OLS results potentially suffer from sample selection bias. We therefore also employ Heckman's two-stage procedure to check for this. The first stage involves the estimation of a probit model of the decision to merge and these results are presented in Table 9. The first two columns relate to the full sample of acquirers and matched and the last two columns are for the restricted sample with institutional investor data. A reasonable degree of discrimination is achieved in each case, with profitability in the pre-merger period having the greatest degree of explanatory power, although pre-merger growth also shows in these equations. This corroborates our finding in the previous section of this paper that acquirers were significantly more profitable than their industry averages. The insignificant coefficient on size reflects the success of our matching procedure.

The second stage of the Heckman approach involves calculation of the inverse Mills ratio from equations (2) and (4) of Table 9. This variable is then included as an additional explanatory variable in an attempt to distinguish between the merger sample selection effect and the effect of merger itself. There was found to be a high correlation between the calculated inverse Mills ratio and the merger dummy and so the latter was excluded from the second stage OLS runs. The Heckman regression results are presented in Table 10 along with the unadjusted and adjusted t ratios.

The main conclusion is that the estimated coefficients are very similar to those obtained by OLS analysis. The t ratios are generally higher and give us greater confidence in our earlier conclusions. The importance of the effect of merger on the path of profitability is confirmed and is shown by the statistical significance of the coefficients for the interaction terms including the merger dummy variable in the Heckman equations.

7. Conclusion

Our overall conclusions may be briefly summarised. We did not find that size in our acquiring sample was significantly related to profitability in our profit equations, and conclude that in our sample scale effects were not a significant factor in determining post-merger profit outcomes. We did however find that rapid growth by acquisition avoided a future falling off in profitability performance than was experienced by rapidly growing non-acquirers. We conjecture that this is consistent with acquisition growth avoiding management and related diseconomies of expansion in the manner hypothesised by Penrose. We also found that expansion by horizontal merger was likely to reduce future profitability. This is also inconsistent with most scale based arguments for horizontal acquisitions. It is more consistent with control loss arguments in which horizontal expansion is less likely to benefit from divisionalised management structures than diversified expansion by merger. We found no evidence of life cycle effects in our sample.

Our overall findings on the pre- and post-merger characteristics of firms involved in takeover were much the same as the studies covering previous periods when institutional investors were a less significant component of stockownership patterns in the UK. In that sense their increased presence appears not to have greatly affected the selection process as a whole. We did find however that acquiring companies with significant institutional investment holdings (F acquirers) were associated with mergers which had relatively positive post-merger outcomes compared with mergers where the acquirers did not have such holdings present (N acquirers). We also found that the F acquirers were somewhat less profitable pre-merger than the N acquirers and sought out significantly less profitable targets.

These results on merger outcomes were derived using the standard counterfactual basis for estimating merger effects. This assumes that the best estimate of post-merger profitability in the absence of merger is the pre-merger level of the merging companies profitability relative to their industry mean. This counterfactual neglects the insight into the dynamic path of profits provided by the literature of regression to the norm. When we carried out an analysis of the persistence of profits using appropriately constructed matching samples of acquiring and non-acquiring firms, and allowed for potential sample selection biases we found that regression to the norm exists in the absence of mergers, and is reinforced by their presence. The existence of regression to the norm implies that the standard counterfactual is biased against finding positive normalised post-merger impacts where acquirers exhibit better than the norm pre-merger profitability. This is of course typically the case. This has important implications for existing merger results which do not correct for this effect. In the context of testing for differences in merger outcomes between F and N acquirers in our sample ignoring regression to the norm will lead us to bias our results towards finding more favourable outcomes for F acquirers. This is because they were typically less profitable pre-merger than were the N acquirers. The fact that F acquisitions produced a positive difference between post- and pre-merger normalised profitability suggests, however, that as a group they were able to offset to a greater degree the regression effect experienced by N acquirers. In that sense the presence of institutional investors has a beneficial impact on merger outcomes.

Notes

1. For recent surveys of the international evidence on the effects of mergers on profitability, see Hughes (1993), Singh (1992, 1993). It is important to note that these studies, which have generally been carried out by industrial organisation economists, are based on accounting data. There is however another set of studies which use a different method - the so called "event" studies methodology - and arive at a very positive assessment of the impact of mergers. This research, which is normally the province of finance specialists is based on stock market data. The dependent variables in these investigations are the share prices of the merging companies. Such studies have also been reviewed in the survey articles mentioned above. The latter point out that the differences in the results of the two types of studies are more apparent than real and go on to show how these can be reconciled.

2. See however Demsetz who has argued that ownership structure is endogenous and has no independent effect on performance (Demsetz (1988)).

3. In all discussions, we ignore the possibility that $\lambda = 1$. If $\lambda = 1$, then:

   (i) the model explains profit *growth* in terms of X_{it}, and says nothing about levels

   (ii) random shocks have an effect on profit levels which persist indefinitely, and in principle π is unbounded

4. Heterogeneity in parameters in a *dynamic* model of this sort (i.e. with $\lambda = 0$) would mean that pooling gives inconsistent estimates. See Pesaran and Smith (1995) for further discussion.

5. Hopefully these observations relate to time periods which are sufficiently long for the effects of short term volatility to be eliminated. In our own work, the pre and post-merger periods are the three year time intervals before and after the year in which the merger takes place.

6. This is termed a Barro cross-section as it has been popularised by Rober Barro in work on cross-country growth and convergence (regressing the change in output over a lenght of time on output in the initial period across countries, i=1,....n). See Barro and Sala-I-Martin (1995).

7. These are elaborated in detail in Lee et al (1995).

8. Note that $E(\hat{\lambda}) = 1\frac{\sigma_\mu^2}{\left[\sigma_\mu^2 + \frac{(1-\lambda)}{(1+\lambda)}\sigma_2^2\right]} + \lambda\left(1 - \frac{\sigma_\mu^2}{\left[\sigma_\mu^2 + \frac{(1-\lambda)}{(1+\lambda)}\sigma_\varepsilon^2\right]}\right)$,

i.e. $\hat{\lambda}$ is a weighted average of the true λ and unity, with weights dependant on $\sigma_\mu^2, \sigma_\varepsilon^2$, and λ itself.

9. The intuition behind the bias is as follows: when running the cross-section, one assumes a common intercept (α), placing the deviations (α_i - α) into the error. Usually this is reasonable, as this term is not correlated with the other regressions in the x-sectional regression. But when one of the regressors is the lagged value of y_{it}, it is clear that (α_i - α) is correlated with the regressor. This results in bias, and the bias is larger the greater this correlation (based on σ_μ^2) relative to time series movement (based on σ_ε^2).

10. For an analysis of smaller non-quoted acquisitions in this period see Cosh and Hughes (1995).

11. Apart from the institutional holding variable all the data is drawn from the Exstat UK Company Accounts database.

12. The definition of industry group used throughout is that which appears in the UK Stock Exchange official list and includes about 100 industry groups.

13. This section draws upon some of the results of Cosh, Hughes, Lee and Singh (1989)

14. For a fuller discussion, see Cosh et al. (1989)

15. In contrast to the preceding non-parametric univariate analysis, the multivariate discriminant analysis makes the strong assumption of multivariate normality in the exogenously determined RHS variables. The extent to which results are robust to the violation of this assumption depends on the extent of the presence of multivariate skewness and kurtosis, and on the precise nature of the interdependencies between the RHS variables; this latter point is particularly relevant when the RHS variables include discrete variables. There are no uncontroversial procedures for dealing with, or indeed testing for, the presence of multivariate non-normality, although it has been suggested that, if possible, data should be transformed to achieve approximate univariate normality. In fact all of the variables involving profits and the share returns variable pass Kolmgorov-Smirnov tests of univariate normality and can therefore be used with some degree of confidence. The variable which least approximates normality is, as usual, the size variable and it is for this reason that the log transformation is used in the discriminant analysis. Obviously univariate normality is a necessary but not sufficient condition for multivariate normality, and in the absence of further evidence on the validity of the multivariate normality assumption, the results obtained are to be treated with appropriate reservations. (See, for example, Singh (1971), Altman et al. (1981)).

16. It may be argued that 5% holdings are more likely to occur outside the ranks of the largest companies, so this result is unsurprising. This may be so, but it may also accurately identify the size range within which institutions may exercise influence. In this way the institutions reinforce the tendency for the selection mechanism to be most effective in the middle size ranges, leaving the very largest companies and the smallest (where personal ownership influences are more dominant) relatively unscathed. For a fuller discussion of this argument see Hughes (1988).

17. A test of the equality of cross-firm variance in profitability in the two samples provided a test statistic valued at 1.53 which compared to the F(58,58) distribution is insignificant.

TABLES

Table 1: Pre-merger characteristics - The sign test - Comparison of acquirers and acquired with their industry averages

		Whole Sample			Sample of acquirers with financial holding (F)			Sample of acquirers without financial holding (N)		
Variable	Sample	Sample size	Comparison with Industry average	Significance level (two-tail)	Sample size	Comparison with industry average	Significance level (two-tail)	Sample size	Comparison with industry average	Significance level (two-tail)
Size	Acquired	59	Smaller	0.1%	25	Smaller	0.1%	34	Smaller	0.1%
Size	Acquirer	59	Smaller	-	25	Smaller	5%	34	Larger	-
1 yr Profitability	Acquired	59	Lower	5%	25	Lower	5%	34	Lower	-
1 yr Profitability	Acquirer	59	Higher	0.1%	25	Higher	5%	34	Higher	0.1%
3 yr Profitability	Acquired	59	Lower	5%	25	Lower	5%	34	Lower	-
3 yr Profitability	Acquirer	59	Higher	0.1%	25	Higher	-	34	Higher	0.1%
Growth	Acquired	59	Slower	1%	25	Slower	0.1%	34	Slower	-
Growth	Acquirer	59	Slower	-	25	Slower	5%	34	Faster	-
Change in profitability	Acquired	59	Better	-	25	Worse	-	34	Better	-
Change in profitability	Acquirer	59	Better	1%	25	Better	5%	34	Better	-
Share return	Acquired	47	Lower	-	19	Lower	5%	28	Higher	-
Share return	Acquirer	47	Higher	-	19	Higher	-	28	Higher	10%

Table 2: Pre-merger characteristics - The sign test - Comparison of the acquired with their acquirers

	Whole Sample			Sample of acquirers with financial holding (F)			Sample of acquirers without financial holding (N)		
Variable	Sample Size	Comparison of acquired with acquirer	Significance level (two-tail)	Sample size	Comparison of acquired with acquirer	Significance level (two-tail)	Sample size	Comparison of acquired with acquirer	Significance level (two-tail)
Size	59	Smaller	0.1%	25	Smaller	0.1%	34	Smaller	0.1%
1 yr Profitability	59	Lower	0.1%	25	Lower	0.1%	34	Lower	-
3 yr Profitability	59	Lower	0.1%	25	Lower	0.1%	34	Lower	1%
Growth	59	Slower	1%	25	Slower	-	34	Slower	5%
Change in profitability	59	Worse	1%	25	Worse	1%	34	Worse	-
Share return	47	Lower	0.1%	19	Lower	0.1%	28	Lower	5%

Table 3: Multivariate analysis - Pre-merger characteristics - Discrimination between acquirers and acquired[a]

Variables	Whole Sample	Killers with financial holding	Killers without financial holding
Standardised discriminant function coefficients			
Size	0.69	0.76	0.86
1 yr Profitability	-	1.82	-
3 yr Profitability	-	-1.00	-
Growth	0.28	-	0.41
Change in profitability	-	-1.22	-0.39
Share return	0.63	0.88	0.49
Tests of significance			
Significance level	0.1%	0.1%	1%
Canonical correlation	0.54	0.76	0.59
% Correctly classified	77.7%	84.2%	78.6%
Number of companies	118	50	68

[a] The variables used in each sample are differences from their industry averages

Table 4: Multivariate analysis - Pre-merger characteristics
- Discrimination between those with and those without a significant financial holding[a]

Variables	Acquired Companies	Acquirers
Standardised discriminant function coefficients		
Size	0.63	0.99
1 yr Profitability	0.64	-
3 yr Profitability	-	-
Growth	-	0.49
Change in profitability	-	-0.57
Share return	-	0.67
Tests of significance		
Significance level	1%	0.1%
Canonical correlation	0.49	0.63
% Correctly classified	61.0%	80.9%
Number of companies	59	59

[a] The variables used in each sample are differences from their industry averages.

Tabel 5: Merger effect - The sign test - The change in performance of the acquirer relative to its industry

	Whole Sample			Sample of acquirers with financial holding (F)			Sample of acquirers without financial holding (N)		
Variable	Sample Size	Comparison of after with before	Significance level (two-tail)	Sample size	Comparison of after with before	Significance level (two-tail)	Sample size	Comparison of after with before	Significance level (two-tail)
Size	59	Smaller	-	25	Same	-	34	Smaller	-
1 yr Profitability	59	Lower	10%	25	Lower	-	34	Lower	-
3 yr Profitability	59	Lower	-	25	Same	-	34	Lower	-
Growth	59	Faster	-	25	Faster	-	34	Slower	-
Change in profitability	59	Worsens	-	25	Improves	-	34	Worsens	5%
Share return	47	Lower	-	19	Higher	-	28	Lower	5%

Table 6: Merger effect - The sign test - The post-merger performance of the acquirer relative to its industry compared with the weighted average pre-merger performance of the acquirer and the acquired relative to its industry

	Whole Sample			Sample of acquirers with financial holding (F)			Sample of acquirers without financial holding (N)		
Variable	Sample Size	Comparison of after with before	Significance level (two-tail)	Sample size	Comparison of after with before	Significance level (two-tail)	Sample size	Comparison of after with before	Significance level (two-tail)
Size	59	Larger	5%	25	Larger	1%	34	Same	-
1 yr Profitability	59	Lower	-	25	Same	-	34	Lower	10%
3 yr Profitability	59	Lower	-	25	Same	-	34	Lower	-
Growth	59	Faster	-	25	Faster	-	34	Slower	-
Change in profitability	59	Worsens	10%	25	Same	-	34	Worsens	5%
Share return	47	Lower	-	19	Higher	-	28	Lower	10%

Table 7: Multivariate Analysis - Merger effect - The change in performance of the acquirer relative to its industry. - Discrimination between those acquirers with and those without a significant financial holding[a]

	Acquirer after compared with acquirer before		Acquirer after compared with weighted average of acquirer and acquired before	
Change variables	Stepwise	Direct	Stepwise	Direct
Standardised discriminant function coefficients				
Size (not included)	-	-	-	-
1 yr Profitability	-	0.88	-	0.25
3 yr Profitability	1.00	0.24	1.00	0.79
Growth	-	0.08	-	-0.20
Change in profitability	-	-1.02	-	-0.63
Share return	-	0.52	-	0.52
Tests of significance				
Significance level	17%	75%	2%	19%
Canonical correlation	0.21	0.25	0.35	0.40
% Correctly classified	66.1%	61.7%	67.8%	66.0%
Number of companies	59	59	59	

[a] The variables used are post-merger differences from industry averages compared with pre-merger differences.

Table 8: OLS Regression Analysis of Company Profitability

Dependent variable: $POSTPROF_i$ = company i's profitability relative to industry average

	(1)	(2)	(3)	(4)	(5)	(6)
CONST	-2.1864	-4.7763	-2.4599	-3.4588	-4.3585	-4.3315
	(1.67)	(1.98)	(0.75)	(0.99)	(2.64)	(1.65)
$MERG_i$	3.4232	8.9504	7.1171	5.8616	5.9756	6.3712
	(1.79)	(2.33)	(1.58)	(1.20)	(2.54)	(2.82)
$PREPROF_i$	0.7390	0.6429	0.7153	0.7477	0.7578	0.7570
	(3.81)	(3.49)	(3.29)	(3.40)	(3.56)	(3.56)
$LSIZE_i$	-	1.4071	1.4101	1.6656	1.7337	1.7274
		(1.82)	(1.62)	(1.82)	(2.12)	(2.11)
$PERFIMP_i$	-	0.4560	0.5724	0.5702	0.5722	0.5722
		(4.23)	(4.74)	(4.75)	(4.90)	(4.91)
$PREGRO_i$	-	-0.2947	-0.4546	-0.4902	-0.4995	-0.4986
		(1.75)	(2.14)	(2.27)	(2.43)	(2.43)
$INST_i$	-	-	-	2.5103	3.6688	3.6061
				(0.84)	(1.65)	(1.62)
AGE_i	-	0.0332	-0.0073	-0.0080	-	-
		(0.70)	(0.13)	(0.14)		
$MERG_i.PREPROF_i$	-0.4838	-0.4142	-0.4789	-0.4548	-0.4935	-0.4975
	(1.94)	(1.67)	(1.59)	(1.49)	(1.68)	(1.67)
$MERG_i.LSIZE_i$	-	-1.5109	-1.8982	-1.5307	-1.7773	-1.9132
		(1.40)	(1.56)	(1.17)	(1.55)	(1.64)
$MERG_i.PERFIMP_i$	-	-0.3347	-0.4660	-0.4934	-0.4848	-0.5055
		(2.04)	(2.59)	(2.74)	(2.76)	(2.91)
$MERG_i.PREGRO_i$	-	0.1761	0.3390	0.4077	0.4141	0.4047
		(1.00)	(1.54)	(1.82)	(1.93)	(1.89)
$MERG_i.INST_i$	-	-	-	2.6132	-	-
				(0.57)		
$MERG_i.AGE_i$	-	-0.0670	-0.0296	-0.0249		-
		(0.96)	(0.37)	(0.31)		
$HORZ_i$	-	-3.1600	-5.0485	-4.7081	-5.4746	-5.3311
		(1.18)	(1.53)	(1.43)	(1.79)	(1.74)
N	118	118	94	94	94	94
R-Bar-Squared	0.1372	0.2844	0.3387	0.3462	0.3643	0.3632
σ_e	10.0603	9.1616	9.3771	9.3244	9.1939	9.2019
LLF	-437.8142	-421.920	-336.7823	-335.0766	-335.5044	-335.5860
$\chi^2_{FE}(1)$	0.3668	1.4301	1.9434	2.1565	2.4923	2.4354
$\chi^2_R(r)$	27.8650 (9)	-	3.3502 (2)		0.8516 (3)	0.9114 (3)

Notes (see overleaf)

Notes

Results refer to regressions of the form

$$\begin{aligned} POSTPROF_i = \quad & \alpha \\ & + \alpha_0 MERG_i + \alpha_1 PREPROF_i \\ & + \alpha_2 LSIZE_i + \alpha_3 PERFIMP_i + \alpha_4 PREGRO_i \\ & + \alpha_5 INST_i + \alpha_6 AGE_i \\ & + \beta_1 (MERG_i \times PREPROF_i) + \beta_2 (MERG_i \times LSIZE_i) \\ & + \beta_3 (MERG_i \times PERFIMP_i) + \beta_4 (MERG_i \times PREGRO_i) \\ & + \beta_5 (MERG_i \times INST_i) + \beta_6 (MERG_i \times AGE_i) \\ & + \beta\, HORZ_i + \varepsilon_i \end{aligned}$$

estimated using OLS on a sample of 118 or 94 companies (N=118 or N=94). Due to missing observations, $INST_i$ and $MERG_i.INST_i$ are omitted when N=118.

Figures in parentheses are (absolute) t-values.

R-Bar-Squared is the square of the adjusted correlation coefficient. σ_ε is the standard error of the equation. LLF is the log-likelihood of the regression, $\chi_{FF}^2(1)$ is Ramsey's RESET test of functional form, and $\chi_R^2(r)$ is the LM test of r linear restrictions, [col. (4) is unrestricted where N=118, and col. (5) is unrestricted when N=94].

AGE_i = number of years since registration for company i

$PREPROF_i$: Columns (1) - (5) = the pre-tax return is measured for the acquirer alone
Column (6) = the acquirer's pre-tax returnis measured as the weighted average of the acquirer and the acquired.

Table 9: Probit Analysis of Companies' Merger Decision

Dependent variable: $MERG_i$ =0 if company does not engage in merger
1 if company does engage in merger

	(1)	(2)	(3)	(4)
CONST	-0.18312	-0.07587	-0.00133	-0.09510
	(0.693)	(0.626)	(0.004)	(0.691)
$PREPROF_i$	0.03378	0.03116	0.04062	0.03960
	(2.105)	(2.004)	(2.091)	(2.117)
$LSIZE_i$	-0.05294	-	-0.03059	-
	(0.738)		(0.375)	
$PERFIMP_i$	0.01189	-	0.01651	-
	(1.066)		(1.361)	
$PREGRO_i$	0.01466	0.01441	0.01293	0.01476
	(1.650)	(1.806)	(1.447)	(1.830)
$INST_i$	-	-	-0.01467	-
			(0.048)	
AGE_i	0.00088	-	-0.00288	-
	(0.193)		(0.563)	
N	118	118	94	94
LLF	-77.0945	-77.9520	-60.0869	-61.3416
L_0	-81.7914	-81.7914	-65.1558	-65.1558
P	70/118	75/118	57/94	61/94

Notes

Results refer to probit regressions of the form

$$MERGi = \begin{cases} 1 \text{ if } \gamma_0 + \gamma_1 PREPROF_i + \gamma_2 LSIZE_i \\ \quad + \gamma_3 PERFIMP_i + \gamma_4 PREGRO_i \\ \quad + \gamma 5\ INST_i + \gamma_6 AGE_i + vi > 0 \\ 0 \text{ otherwise} \end{cases}$$

where the idiosyncratic component of the underlying latent variable is assumed to be normally distributed. Due to missing observations, $INST_i$ is omitted when N=118

Figures in parentheses are the (absolute) values of the ratio of the estimated coefficient and the asymptotic standard error.

LLF refers to the value of the log-likelihood of the estimated model. LLF_0 is the value of the model under the assumption that the slope coefficients in the probit model are all zero. P is the proportion of companies correctly assigned to the merger/non-merger groups.

Table 10: Heckman Two-Stage Regression Analysis of Company Profitability

Dependent variable: y_i = company i's profitability relative to industry average

	(1)	(2)	(3)	(4)	(5)	(6)
CONST	-0.5215	-0.5656	0.8773	-0.7087	-1.5896	-1.3022
	(0.55,0.61)	(0.29,0.43)	(0.39,0.51)	(0.29,0.35)	(1.08,1.33)	(0.91,1.15)
$MILLS_i$	2.6403	5.4705	4.3665	3.5884	3.6845	3.9719
	(2.19,2.48)	(2.31,3.39)	1.58,2.08)	(1.20,1.47)	(2.54,3.15)	(2.78,3.54)
$PREPROF_i$	0.7998	0.7522	0.8270	0.8394	0.8515	0.8571
	(4.09,4.55)	(3.99,5.97)	(3.70,4.95)	(3.63,4.51)	(3.91,4.89)	(3.93,5.07)
$LSIZE_i$	-	1.4139	1.4186	1.6725	1.7348	1.7255
		(1.83,2.67)	(1.63,2.15)	(1.82,2.24)	(2.12,2.63)	(2.11,2.68)
$PERFIMP_i$	-	0.4542	0.5709	0.5689	0.5712	0.5709
		(4.21,6.00)	4.73,6.09)	(4.74,5.74)	(4.89,5.94)	(4.88,6.08)
$PREGRO_i$	-	-0.2474	-0.4172	-0.4594	-0.4669	-0.4621
		(1.44,2.10)	(1.93,2.54)	(2.10,2.58)	(2.28,2.83)	(2.26,2.88)
$INST_i$	-	-	-	2.5048	3.6662	3.5699
				(0.84,1.02)	(1.65,2.03)	(1.61,2.04)
AGE_i	-	0.0321	-0.0085	-0.0090	-	-
		(0.68,0.99)	(0.15,0.20)	(0.16,0.20)		
$MERG_i.PREPRO_i$	-0.5221	-0.4124	-0.4838	-0.4587	-0.4968	-0.5034
	(2.10,2.32)	(1.67,2.48)	(1.60,2.12)	(1.50,1.85)	(1.69,2.09)	(1.68,2.14)
$MERG_i.LSIZE_i$	-	-1.5042	-1.8983	-1.5306	-1.7719	-1.9547
		(1.39,2.04)	(1.56,2.07)	(1.17,1.44)	(1.55,1.92)	(1.67,2.14)
$MERG_i.PERFIMP_i$	-	-0.3344	-0.4664	-0.4937	-0.4853	-0.51269
		(2.04,2.91)	(2.59,3.34)	(2.74,3.32)	(2.77,3.36)	(2.94,3.66)
$MERG_i.PREGRO_i$	-	0.1718	0.3372	0.4082	0.4117	0.3977
		(0.98,1.41)	(1.53,2.01)	(1.81,2.22)	(1.92,2.37)	(1.86,2.36)
$MERG_i.INST_i$	-	-	-	2.6205	-	-
				(0.58,0.71)		
$MERG_i.AGE_i$	-	-0.0653	-0.0288	-0.0241	-	-
		(0.94,1.36)	(0.36,0.47)	(0.30,0.37)		
$HORZ_i$	-	-3.1217	-5.0175	-4.6827	-5.4508	-5.218
		(1.17,1.69)	(1.52,1.97)	(1.42,1.73)	(1.78,2.18)	(1.70,2.15)
N	118	118	94	94	94	94
R-Bar-Squared	0.1487	0.2838	0.3387	0.3461	0.3641	0.3616
σ_ε	9.9928	9.1658	9.3777	9.3251	9.1954	9.2136
σ_u	4.8556	5.8851	5.2649	4.8456	4.927	5.0634
ρ	0.5438	0.9295	0.8293	0.7405	0.7479	0.7844
LLF	-437.0200	-421.9741	-336.7880	-335.0840	-335.5192	-335.7054
$\chi_{FF}^2(1)$	0.6658	1.4429	2.0220	2.2279	2.5626	2.4076
$\chi_R^2(r)$	26.7689(10)	0.2880(1)	3.3629(8)	0.0166(1)	0.8829(4)	1.2800 (4)

Notes (see overleaf)

Notes

Results refer to restricted versions of the following regression

$$\begin{aligned} POSTPROF_i = \quad & \alpha \\ & + \alpha_0 MILLS_i + \alpha_1 PREPROF_i \\ & + \alpha_2 LSIZE_i + \alpha_3 PERFIMP_i + \alpha_4 PREGRO_i \\ & + \alpha_5 INST_i + \alpha_6 AGE_i \\ & + \beta_1 (MILLS_i \times PREPROF_i) + \beta_2 (MILLS_i \times LSIZE_i) \\ & + \beta_3 (MILLS_i \times PERFIMP_i) + \beta_4 (MILLS_i \times PREGRO_i) \\ & + \beta_5 (MILLS_i \times INST_i) + \beta_6 (MILLS_i \times AGE_i) \\ & + \beta\, HORZ_i + \gamma\, MERG_i + \varepsilon_i \end{aligned}$$

estimated using OLS on a sample of 118 or 94 companies (N=118 or N=94). Due to missing observations $INST_i$ and $merg_i INST_i$ are omitted when N=118. Here $MILLS_i$ is the inverse of the Mill's ratio, calculated using the Probit regression results of Table 9, column (2) for columns (1)-(2), and using the probit regression results of Table 9 column (4) for columns (3)-(6).

Figures in parentheses are the (absolute) values of the ratio of the estimated coefficient and the unadjusted (OLS) and adjusted standard errors respectively (see text for discussion).

R-Bar-Squared is the square of the adjusted correlation coefficient. σ_ε and σ_u are, respectively, the unadjusted and adjusted standard errors of the equation, ρ is the estimated correlation coefficient between the error term of the profitability regression equation and the idiosyncratic element of the latent variable underlying the decision to enter into merger. LLF is the log-likelihood of the regression, and $\chi_{FF}^2(1)$ is Ramsey's RESET test of functional form. χ_r^2 is the LM test of r linear restrictions [based on the unadjusted var/cov. matrix]

$PREPROF_i$: Columns (1) - (5) = the pre-tax return is measured for the acquirer alone
Column (6) = the acquirer's pre-tax returnis measured as the weighted average of the acquirer and the acquired.

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