NBER WORKING PAPER SERIES

THE EFFECTS OF TAXATION ON THE MERGER DECISION

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Working Paper No. 2192

NATIONAL BUREAU OF ECONOMIC RESEARCH
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March 1987

This paper was prepared for the NBER Conference on Mergers and Acquisitions, Key Largo, Florida, February 1987. We are grateful to the NSF (Grant #SES-8409892), the NBER and the Institute for Law and Economics at the University of Pennsylvania for financial support, and to Kevin Hassett, Eric Gonzales, Ki Ingersol, and Wendy Allyn for research assistance. The research reported here is part of the NBER's research program in Taxation. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

This paper presents estimates of the tax benefits generated by a sample of U.S. mergers and acquisitions involving two public corporations over the period 1968-83 and estimates a "marriage model" based on differences between these mergers and another sample of "pseudomergers" that did not occur to determine the impact of these tax benefits on the probability of two firms combining.

Our findings reject the hypothesis that leverage played a large role in fostering these transactions, and that the tax losses and credits of acquired firms likewise exerted no impact on merger activity. Though the use of such benefits by acquiring firms to shield profits of other firms did increase the level of activity, the impact was quite small.

On the whole, our results suggest that the changes in tax provisions with respect to mergers introduced by the Tax Reform Act of 1986 will have a small impact on U.S. mergers and acquisitions.

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1. Introduction

The recent merger wave in the United States has left observers attempting to uncover explanations for the strong growth in takeover activity. Some have suggested that tax factors have played an important role. Indeed, the Tax Reform Act of 1986 contains several provisions that became effective at the beginning of 1987 that were aimed specifically at reducing the tax benefits available through merger. In two earlier papers (Auerbach and Reishus, 1987a, 1987b), we estimated the tax benefits generated by 318 mergers and takeovers that occurred in the the U.S. during the period 1968-83, and considered whether the level and type of tax benefits available affected the structure of the merger transactions. Our findings suggested that while tax benefits do not appear to be important in the majority of transactions involving large public corporations, there is a significant minority of transactions in which the benefits appeared significant enough to play a role in the decision to merge.

By focusing exclusively on mergers that occurred, we were able to estimate the size of the tax benefits involved, but not the role that these benefits played in the actual merger process. The presence of such benefits is a necessary condition for tax factors to influence merger activity, but not a sufficient one. Given the complex issues involved in changing ownership and management of a company, it is entirely possible that tax benefits, even where significant, come into play only "at the margin," once other conditions have been satisfied. Thus, it remains unclear whether the tax benefits received by merging firms represent more than simple transfers to the parties involved, or

whether the frequency and pattern of takeovers has been significantly influenced by the availability of such tax benefits.

The present paper aims to resolve this question by comparing the sample of mergers which we previously analyzed to "pseudomergers" that did not occur, drawn from random combinations of firms in a broad sample of U.S. corporations. By estimating a "marriage model" based on the differences between mergers that occurred and those that did not, we are able to discern whether the tax benefits observed in mergers were available with the same size and frequency in the population as a whole (conditional on other factors), or whether the tax benefits were larger than would have occurred by chance, as would be the case if tax factors increased the likelihood of a merger.

The paper is organized in the following way. The next section discusses the tax treatment of mergers and acquisitions and what the potential tax benefits of a merger are. Section 3 describes our merger sample and the findings we previously reported on the tax benefits from these mergers and the relation of such benefits to the structure of the transactions. Section 4 describes the underlying model of merger activity that we use to generate the multinomial logit specification of the merger decision, and how we deal with the estimation problem introduced by the large number of alternative mergers in which a firm could engage. Section 5 describes the sampling procedure used to create the pseudomerger sample and the calculation of variables used in the estimation, and Section 6 presents the empirical estimates themselves. The final section offers some brief conclusions concerning the implications of the recent tax law changes for the level of merger activity.

2. Tax Benefits from Merger Activity

There are several different ways that companies may reduce taxes through a merger or acquisition, and tax benefits can accrue at both the corporate and shareholder levels. In some cases, the tax benefits from a corporate combination are also available through other means, and such benefits should not necessarily be attributed to the merger process. The following description, except where noted, applies to the law in force before 1987, when the mergers in our sample occurred.

A. Corporate Taxation

There are three types of potential corporate tax benefit associated with the combination of two public corporations: increased utilization of tax loss and tax credit carryforwards, increased depreciation deductions obtained by stepping up the basis of assets, and increased interest deductions associated with an increase in the debt-equity ratio of the combined enterprise.

i. Tax Losses and Credits

Under the tax law, both present and past, corporations with negative taxable income may claim tax refunds based on these losses only to the extent of the previous three years' taxable income (net of intervening losses). Any additional losses must be carried forward, without interest, until the firm has taxable income sufficient to offset them or until they expire, now after 15 years and before 1981 after 5 years. Estimates in Auerbach and Poterba (1987) and Altshuler and Auerbach (1986) suggest that for the average large corporation experiencing tax losses, the present value of tax refunds so deferred is on the order of half their face value, due to deferral and

expiration. Because each of these papers derives estimates from samples of firms that continued to operate independently, they may overstate the true population average, since one would expect disappearance from the sample to be negatively correlated with the likelihood of becoming taxable in the near future.

Further restrictions exist on the use of investment tax credits. Until 1977 firms could offset at most half of their taxable income, after deduction of losses carried back and forward, with investment tax credits. (This fraction rose to .85 by 1982.) Altshuler and Auerbach estimate that the number of firms paying taxes but carrying credits forward was even larger than the number of firms carrying losses forward and paying no taxes. The size of these tax benefits can be quite substantial. Auerbach and Poterba found several cases of firms carrying forward losses with a face value of tax refunds in excess of the firm's equity value, suggesting not only that these firms had very low values as the result of poor performance, but also that the market did not expect them to obtain close to the full face value of the tax benefits.

Combination with a "fully" taxable firm that has no tax losses and the potential to absorb more credits than it is currently claiming can increase the value of such a firm's tax benefits. Under prior law, a taxable firm could offset the losses and credits of an acquired firm against its own current and future income, subject to the usual expiration provisions and a variety of additional limitations that varied with how the transaction was structured. Few such limitations applied when the benefits were those of the larger, or acquiring firm being used to offset the income of the acquired

company, as was true, for example, in several of the acquisitions by Penn Central that appear in our sample.

The size of such benefits may actually be understated by focusing on current tax carryforwards, since many firms with previous tax losses and unused credits may also have "built-in" losses that will occur in the future. For example, a firm with assets consisting of a depreciable capital good that one year after purchase proved to be valueless will still be entitled to depreciation deductions in subsequent years even without any cash flow from the asset. Such losses have already occurred, in economic terms, but not for tax purposes.

It has often been suggested that the presence of unused tax benefits does not constitute an incentive to merge because firms can dispose of them in other ways, including leasing and reducing debt. The premise of the "safe harbor" leasing provisions introduced briefly in 1981 was to facilitate such transfers, in part to reduce the possible incentives to merge (Warren and Auerbach, 1982). However, the magnitude of unused tax benefits, and the persistence of firms in states where they have such benefits, suggests that the costs to such alternative activities must be large enough to discourage their use in an important number of cases.

ii. Step-Up in Asset Basis

Many companies carry assets on their books with a basis for tax purposes equal to a small fraction of their replacement cost. Such assets, if depreciable, provide a small fraction of the depreciation allowances available on equally productive, newly purchased capital, including used assets that are resold. Hence, resale provides a channel for increasing such allowances.

Opposing this potential tax gain is the tax that must be paid when an asset is sold. Under prior law, the seller in a normal asset sale had to pay some combination of capital gains and ordinary income taxes on the difference between sale price and basis, making such sales by corporations generally unprofitable for tax purposes (Gordon, Hines and Summers, 1987).

However, under the "General Utilities" doctrine, liquidating distributions of assets to shareholders were exempt from the capital gains portion of this tax liability. Such distributions occur, for example, when one corporation acquires another and liquidates it. They could also occur without an acquisition, with the corporation simply distributing its assets to its individual shareholders. This has led some (e.g., Gilson, Scholes and Wolfson, 1987) to argue that the tax advantage to liquidations does not constitute a tax benefit associated with the act of merging. While there is no empirical evidence of which we are aware on this issue, it seems plausible that there are many cases in which the transaction costs of such liquidations would be prohibitive, particularly when the value of the firm as a continuing operation substantially exceeds the sum of the values of its individual assets.

iii. Increased Interest Deductions

The theory of optimal capital structure has some difficulty explaining the choice of debt-equity ratios in the presence of a substantial tax advantage to debt. Except for Miller's (1977) theory that individual tax advantages to equity entirely offset the corporate advantage to debt, most hypotheses about optimal capital structure involve individual firms having interior optimal debt-equity ratios determined by increasing costs to leverage

associated, for example, with increased expected bankruptcy costs, increased agency costs, or the increased probability of tax losses. In these models, the firm's costs of leverage may increase with the variance of its earnings, since such variance may be associated with higher probability of bankruptcy and tax losses. Therefore, the reduction of idiosynchratic risk, which would produce no value in a perfectly competitive model with efficient securities markets, could increase value directly through a reduction in total bankruptcy costs and frequency of tax losses, and indirectly through the reduced marginal costs of borrowing. Hence, it is possible to derive models without independent managerial motives in which it is optimal for firms to merge to reduce own risk, with such models also suggesting that these combinations would involve increased leverage.

Another way in which borrowing could encourage takeovers would be if one of the manifestations of the "bad management" leading to takeovers is overly cautious debt policy. Because of the differing incentives of shareholders and managers, it is plausible that managers would choose to borrow less than a value maximizing amount, since the risks associated with low earnings or bankruptcy might be more costly to managers than shareholders. If current managers are too risk averse, for example, new management could increase value because of its decision to borrow more.

In addition, of course, one would expect increases in borrowing to the extent that takeovers increase value by improving management or the utilization of assets, since such activities essentially increase the scale of the firm, presumably lowering the marginal borrowing cost for a given absolute level of debt. However, unlike the first two cases, this would not

necessarily lead to increased debt-equity ratios, nor would it be associated with a particular type of merger, such as one in which risk is reduced or the target initially has a low debt-equity ratio.

B. Shareholder Taxation

There are two primary ways in which acquired firms' shareholders receive payment: shares in the parent (or combined) company, or cash. The mode of payment may affect the use of corporate tax benefits. In addition, however, the tax treatment of shareholders depends on the form of payment. If cash is received, shareholders are normally taxable on their capital gains. If shares are received, they may be taxable, but the firms may structure the transaction as a reorganization and thereby defer shareholder taxation until the new shares are sold. Each type of transaction has potential tax benefits beyond those corporate level benefits already discussed.

In nontaxable stock transactions, shareholders typically receive shares in a larger, more diversified enterprise in exchange for shares representing a much larger fraction of a smaller company, a process which could facilitate the achievement of a more balanced portfolio without the capital gains taxes usually attendant upon such a move. In taxable cash transactions, the acquiring firm distributes cash out of the corporate form at capital gains tax rates. In models of corporate equity policy which explain the existence of dividends through constraints on such behavior (which also encompasses the repurchase of a company's own shares), such an activity may produce value because firm values are depressed by the anticipation that the acquired firm's value can only reach shareholders via fully taxed dividends (e.g. Auerbach,

1979; Bradford, 1981; King, 1974). A recent paper by King (1986) estimates an aggregate model attempting to explain merger behavior in the U.K. as the result of such a process.

3. Previous Findings

In our two earlier papers, we examined a sample of 318[1] mergers and acquisitions that occurred during the period from 1968 to early 1983. The sample consisted of all mergers and acquisitions in which both firms were on the 1983 Compustat Industrial File or the 1983 Compustat Industrial Research File and for which usable tax data were obtainable from the companies' annual reports and 10-K filings with the Securities and Exchange Commission. Just over three-quarters of these combinations occurred between 1976 and 1982. Parent companies had an average value of equity plus long-term debt of 1.957 billion dollars (before the acquisition), while the average target firm's value was just over one tenth of this, 204 million dollars.

Our estimates (in Auerbach and Reishus, 1987a) suggested that tax benefits through increased use of tax losses and credits were potentially present in about 20 percent of the mergers, with an average value of just over 10 percent of the target's market value in the year prior to the merger. We found smaller evident benefits from stepping up asset basis, but encountered substantial difficulty in estimating such benefits. Perhaps most surprising, though we found noticeable increases in the absolute combined level of debt, we found negligible increases in combined debt-equity ratios (calculated before the merger by combining the debt and equity values for the separate firms) over the period beginning two years before the merger years and ending two years after.

In our second paper, we focused on the relationship between the form of the transaction and the type of tax benefits available. We found that virtually all transactions were either nontaxable stock transactions or taxable cash transactions, the majority being of the first type. This is significant, because in nontaxable transactions the firm has opted for a corporate reorganization, which generally can not include a liquidation and step-up of asset bases. Under a taxable transaction, either a liquidation with step-up or a transer of tax attributes may be chosen. This suggests that taxable transactions might be more common when the potential basis step-up benefits are large, but we could identify no such relationship, perhaps in part because of our inability to measure such benefits precisely. Moreover, since the the transfer of tax losses and credits is also treated somewhat differently under a taxable transaction than under a tax-free reorganization, there could be cases in which firms opting for a transfer of tax benefits would still prefer the taxable (to the shareholders) transaction. Thus, it is possible that firms would be responsive to taxes in their merger planning without there being any discernable relationship between the type of tax benefits available and the form of the transaction. This leaves the merger decision itself to be evaluated in assessing the importance of tax factors.

4. A Model of Mergers and Acquisitions

In this section, we describe a simple model of mergers and acquisitions. Though it is particularly well-suited to the questions we seek to answer, it is applicable more generally. A related model is used by Hall (1987) to study the relationship between mergers and research and development.

The model involves several simplifying assumptions. Although billed as a marriage model, the marriage process is not one currently favored by most cultures, polygamy. We assume that targets can be acquired only once within a year and that parents can acquire as many targets as they wish. This latter assumption leads to a model of the "choice" by prospective targets among alternative acquirers.

In each year, we assume that every potential parent, x, evaluates a function which indicates the joint gains from acquiring a target y, M(x,y). The function M(x,y) may take on negative values, since there may be substantial transaction costs involved in a successful acquisition. If $V_0(y)$ is the value of y if it is not taken over, then firm x will pay up to $V_0(y)$ + M(x,y) to acquire y. Thus, in a competitive market for y, the firm with the highest valuation of y, say x*, will acquire y if M(x*,y) > 0, for a price between $V_0(y)$ + M(x*,y) and $V_0(y) + \max_{x' \neq x^*} M(x',y)$. Note that the observed merger premium may be less than M(x',y), since the possibility of a merger may have led the prior price to exceed $V_0(y)$.

We assume that the function M(x,y) has the specification:

$$(1) \qquad M(x,y) = z_{xy}\beta + \epsilon_{xy}$$

where the vector z includes variables that relate only to the target, only to the parent, or to both, and ϵ is a random disturbance representing benefits to the merger not observed by the investigator. Perhaps the most crucial assumption we make is the one that leads to a tractable empirical model. This is that the error term is uncorrelated with observed variables and takes on the extreme value distribution. Following McFadden (1973), it is then possible to express the probability that x_i will acquire y as:

$$(2) \qquad p_{x_i y} = e^{z x_i y \beta} / (1 + \sum_{j=1}^{N} e^{z x_j y \beta})$$

which is a multinominal logit model of dimension N+1, where N is the number of potential parent firms and the extra dimension is added by the possibility that no merger occurs. As is well known, the multinomial logit model has certain strong properties, such as the independence of irrelevant alternatives, which in this case seems justifiable. This property also simplifies the estimation procedure relative to an alternative approach such as the multinomial probit. However, even for a multinomial logit it is impractical to estimate a model of our dimensions.

This estimation problem has been dealt with in the previous literature in two ways. One approach is to include a small sample of the alternatives. In the current model, this would mean that each observation would involve a potential target and several rather than all potential acquirers. For our model, this estimation approach would pose problems. Many of the parent firm characteristics that appear in the vector z, such as industry dummy variables, occur relatively infrequently in the population. Thus, it might be necessary to include a relatively large number of alternative parents to achieve adequate sampling.

An alternative estimation approach is to treat all combinations with a particular target except one as an aggregate "all other" state. Such aggregation is not straightforward because of the nonlinearity of the logistic specification. Suppose that for the observation for a potential target firm y the "all other" state includes all possible combinations aside

from the one with potential parent x_1. Then, to convert the multinomial logit specification (2) into a trinomial logit, one must define the aggregate state by the function

$$(3) \qquad f(z_{x_2 y}\beta,\ldots,z_{x_N y}\beta) = \ln \sum_{i=2}^{N} e^{z_{x_i y}\beta}$$

Consider a second order Taylor expansion of the function $f(\cdot)$ around some constant value α for each of its N-1 arguments. After a couple of steps of algebra, one obtains:

$$(4) \qquad f(z_{x_2 y}\beta,\ldots,z_{x_N y}\beta) \approx \ln (N-1) + Z_y\beta + \frac{1}{N-1}\sum_i (z_{x_i y}\beta-\alpha)^2 - (\frac{1}{N-1})^2 \sum_i (z_{x_i y}\beta-\alpha)\sum_j (z_{x_j y}\beta-\alpha)$$

where z_y is the mean of $z_{x_i y}$, i=2,...N. By choosing $\alpha = z_y\beta$, one can rewrite (4) (since the last term on the right-hand side vanishes) as:

$$(5) \qquad f(z_{x_2 y}\beta\ldots,z_{x_N y}\beta) \approx \ln(N-1) + z_y\beta + \tfrac{1}{2}\sigma^2(z_{x_i y}\beta)$$

or, letting Ω be the matrix whose ij^{th} element is the sample covariance between independent variables i and j,

$$(6) \qquad f(z_{x_2 y}\beta,\ldots,z_{x_N y}\beta) \approx \ln(N-1) + z_y\beta + \tfrac{1}{2}\beta'\Omega\beta$$

As argued by McFadden (1984), this approximate specification is exact when the elements of the vector z are joint normally distributed, for then higher moments of the Taylor approximation vanish.

This second approach to estimating a high dimension multinomial logit is well-suited for our problem, because the sample means and variances of the

independent variables of our model are easily estimated and have an intuitive economic interpretation.

5. Sampling and Data Preparation

In the literature on mergers and acquisitions, there have been attempts to estimate the factors leading to firms being taken over (e.g. Palepu, 1986) by examining the differences between firms acquired and firms not acquired. By looking at merger pairs, rather than just targets, and including firms that were not acquired in the estimation procedure it should, in principle, be possible to distinguish factors that affect the probability of a firm being acquired from those that determine the actual match that occurs. The acquisition probability should be influenced by target-specific variables that enter both branches of the model just outlined, while the actual match should be influenced by variables that depend on the actual pairing of potential target and parent. This is quite important in the current context, where the tax benefits available from a merger depend not only on the tax status of the potential target but also on the ability of the potential acquirer to use these benefits. If mergers occur for tax reasons, one would not expect the firms acquired by Penn Central to have the same tax characteristics as those acquired by IBM.

To the 316 observations on firms that were acquired, we added a similar number of observations of firms chosen at random from the COMPUSTAT universe of firms according to the following stratified sampling method.[2] For each actual merger, we chose a corresponding "pseudomerger" by choosing a "pseudotarget" firm from all firms in the same size class and year as the

target, and a "pseudoparent" firm from all firms in the same size class and year as the parent. The sample of "pseudomergers" will therefore look almost identical to the actual merger sample in terms of size and year, but may differ with respect to other variables of interest.

For each observation, variables were constructed for the target-parent pair, and the corresponding variables for the aggregate "all other" pairs were then constructed according to expression (6). The variables were either taken directly or constructed from raw data provided by the Compustat files or the annual reports and 10-K filings.

This particular sampling method was chosen for two reasons. Although the optimal sampling scheme is uncertain, it has been suggested (Cosslett, 1981) that an equal number of different alternatives is a good rule of thumb for minimizing variance of estimates when the sample size is limited. The need to obtain from microfiche the tax information for each observation serves to limit our ability to expand the sample. The reason for stratifying the sample on size and year is to match closely the mergers and "pseudomergers" on variables which may be important but not of direct interest. Perhaps more importantly this will serve to limit the unwanted effects of unobserved variables correlated with year and size, as well as direct effects of time and relative size that we would be unable to specify exactly. What we gain in precision on our variables of interest, we lose in determining the effect of time and relative size on merger activity.

A. Nontax Variables

To test the importance of tax factors, it is necessary to control for the other factors likely to affect mergers. Not doing so could clearly lead to incorrect conclusions. For example, in our earlier work, we discovered that there were nine cases in the 316 mergers in which both parent and target were tax constrained. However, most of these were mergers of two firms within a single industry, where a high correlation of profitability would lead one to expect positive correlation of the incidence of tax constraints. Thus, if firms in the same industry are more likely to merge than firms in different industries, not controlling for this factor could lead to a downward bias in the estimated impact of tax factors.

i. Target-Specific Variables

As discussed above, these are factors that affect the probability of a firm being taken over, rather than of a specific merger. We include dummy variables for the target firm's 1-digit SIC industry, to account for the fact that mergers might relate to overall industry conditions. To pick up growth-related merger motives we include the target firm's five year geometric growth rate of sales.

As a measure of management competence, we would like a measure of the market value of the firm to the replacement cost value of its assets. Since firm assets include assets beyond those included in capital stock measures, we suppose that each firm's true capital stock takes the form:

$$(7) \qquad K = K_f + \Sigma_i a_i S_i$$

where K_f is the fixed capital stock, a_i is a parameter to be estimated, and S_i is a proxy for intangible assets, such as research and development

expenditures or advertising. This leads to the inclusion of the variables K_f-V and S_i, where V is the firm's market value, which we approximate by the market value of equity at the close of the previous year plus the book value of financial liabilities. In some specifications, these variables are expressed as ratios with respect to market value.

ii. Pair-Specific Variables

Here, we include dummy variables if the parent and target are in the same industry. Because it is unclear how close two firms must be for them to be in the "same" industry, we specify three dummy variables, equal to one if the two firms are in the same 1-digit, 2--digit, and 4-digit SIC industries, respectively.

Finally, we specify two dummy variables based on the relative size of the two firms. The "same size" dummy variable equals 1 if the prospective parent firm is in the same size class as the target or the next higher size class, where these classes are defined in section 1 of the Appendix. For example, if the target firm had a market value of 200 million dollars, this variable would equal one for a parent with value between 100 and 500 million dollars. The second size dummy, a "larger size" dummy, equals one if the parent is in one of the next two higher size classes; in the example, this would be a firm with value between 500 million and 5 billion dollars in assets. Both dummies will equal zero only if the parent is substantially larger than the target (or much smaller, though this event does not occur in the data set).

B. Tax Variables

There are several variables that we consider to be tax-related. The first is the target firm's debt-equity ratio. As suggested above, this could indicate the presence of a potential for increasing interest deductions. We would have preferred to include other variables potentially related to borrowing, such as the reduction in risk, but data on the covariance of firm earnings were not available or even estimable from what data we had.

The remaining variables are pair-specific. The first is the estimated tax gain available from stepping up the basis of target assets. Because equipment sales and liquidations are subject to recapture at ordinary income tax rates, the main gains coming from avoidance of capital gains taxes should be associated with structures and depletable resources. The appendix describes the algorithm used to estimate such gains. Given the assumptions necessary to make these calculations, the estimates are subject to substantial error and could greatly understate the potential gains in cases where the target firm has assets that have been on its books for many years and/or have appreciated in value at a rate in excess of the inflation rate.

The appendix also describes the method used to estimate the gains from the use of tax credits and tax losses. We assume such gains to be zero unless one of the firms is fully taxable and the other is tax constrained. This is conservative, in that there should be some gains in any case where the taxable income of the two firms is not perfectly correlated. However, such gains are hard to measure and arguably too small to have an impact on merger decisions. Where the tax gain is positive, it is calculated under the assumption that the firm with tax benefits becomes a shell after the merger, generating neither

positive nor negative taxable income, and that the taxable firm uses these benefits to the extent that the law permits. Here, we ignore the additional restrictions that might apply to the full use of benefits in particular cases, because of our inability to identify such cases.

The remaining tax-related variables are related to the shareholder tax incentives for cash acquisitions. Here, we are limited by the absence of a clear theory about the constraints firms face on the avoidance of dividend taxes. If share repurchases are costly, then, as discussed above, a firm wishing to distribute cash in excess of dividends will have the incentive to engage in cash acquisitions in addition to repurchasing its own shares. The same incentive would not be present for a firm already issuing new equity, since cash acquisitions could not be financed by internal funds. Therefore, we would expect constrained firms to be more likely to engage both in share repurchases and cash acquisitions. This suggests that we include dummy variables indicating whether the parent or pseudoparent firm has repurchased its own shares in the past two years and whether it has sold common equity in the past two years (in excess of threshold values of four percent of the firm's shares). In an earlier study (Auerbach and Reishus, 1987b) we did indeed find that, among firms that acquire, the probability of using cash as a means of payment is (insignificantly) higher for firms that have recently repurchased their own shares and (significantly) lower for those that have recently issued new shares.

C. Calculation of Variables for the Aggregate Alternative

For each observation, it is necessary to calculate the values of each of the above variables that correspond to the state respresenting a merger with one of "all other" potential parent firms. However, the only new calculations needed are those for pair-specific variables, since the others have a value that is independent of the characteristics of the potential parent.

For each pair-specific variable, the sample mean must be estimated for inclusion in the vector z_y, and the sample covariance matrix Ω is needed as well. For dummy variables, the mean is simply the fraction of the population in that category (defined to be all firms of equal or greater size). For example, the mean corresponding to the "same industry" dummy is the fraction of potential parent firms in the target's industry. The covariance term between dummy variables equals the difference between the fraction of the sample satisfying both characteristics and the fraction that would be predicted by multiplying the sample means of each dummy variable.

For the continuous tax variables, the aggregate calculations are based on the simplifying assumption that the value is either zero or a constant amount based on the parent firm's tax status not being affected by combining with the target. For example a firm with tax losses acquiring a profitable firm retains excess losses after offsetting the target's taxable income, and a taxable parent firm uses all the tax benefits of the target. This is quite reasonable given the relative sizes of acquired and acquiring firms. Once this value, say T, is calculated for each potential target firm, the aggregate mean is calculated as the product of this variable and the fraction of firms in the state where the tax benefit can be used (taxable if the target is

nontaxable, and tax-constrained if the target is taxable). The covariance term of this variable with the same-industry dummy for example, equals the fraction of all firms in the same industry and the opposite tax state of the potential target, less the product of the same industry fraction and the opposite tax state fraction, all multiplied by the magnitude of the tax benefit.

6. Results

Before turning to the model estimates themselves, it is useful and informative to compare selected statistics for the two samples of firm pairs, those that actually merged and those that did not.

Table 1 presents mean changes in debt-value ratios for the two samples, broken down further by the relative sizes of target and parent. For actual mergers, the change is measured by subtracting the ratio of the two firms' debt to those firms' debt plus equity two years before the merger year from the same ratio for the surviving firm two years after the merger. Because of data problems, only long-term debt (at book value) is used in the calculation. The four-year period is used to distinguish "long run" leverage changes from those that might occur only temporarily around the merger date. For pseudomergers, the combined ratio is used for both dates in computing the change.

The results in Table 1 cast doubt on the association of mergers with increases in indebtedness. For only two of the five groups does the difference in means have the "right" (positive) sign, and for neither of these classes (nor for the total sample) is the difference significant. Only for

the class where targets are roughly equal in size to parents is there any discernible change in leverage, and here there are too few observations to draw any conclusions. This does suggest that data from the post-1983 period, which involved many more acquisitions of large firms, would be useful to examine.

Table 2 presents estimates of the potential tax gains from the transfer of tax losses and credits between parent and target. Again, the calculations are done for both real and pseudomergers. For real mergers, just under one-fifth of the pairs exhibit a tax gain, with a mean weighted gain of 10.5 percent of the target's market value. This mean is larger than the estimate given in our earlier paper, in which a cruder method was used to calculate the gain. There are fewer cases where the gain comes from the parent, but the average gain in these cases is estimated to be much larger. The incidence of tax benefits among the pseudomergers is remarkably similar, a result which suggests that the transfer of tax losses and credits may not be an important factor in the merger decision. However, there is a noticeable difference between the samples in the magnitude of gains coming from cases where the parent firm has unused tax losses and/or credits. These gains are on average much lower for the pseudomerger sample than for the sample of actual mergers. This suggests that distinguishing the source of the tax gain may be important in the estimation procedure.

The estimated gains from the target's basis step-up are given in Table 3.[3] Once again, the differences between the two samples are negligible. Further, based on our very imperfect measurement technique, the estimated potential tax benefits from basis step-up are quite small, averaging only

about 2 percent of the target's value and exceeding 5 percent in only 7.8 percent of both real mergers and pseudomergers.

We turn next to the estimates of the full merger model. Results for a variety of specifications are given in Tables 4 and 5. The estimated equations differ according to whether certain variables are expressed in levels or relative to the market value of the target firm.[4]

Table 4 presents estimates based on the level specification, while those in Table 5 are for the ratio form. The theoretical model introduced in Section 5 does not allow us to determine in advance which of these specifications is to be preferred.

A number of variables are robust and quite significant in all specifications. These include the target debt-value ratio, which has a positive effect on the probability of a firm's being acquired, the target firm's sales growth rate, and the same industry dummies, especially the 4-digit SIC industry dummy. The fact that each of the same industry dummies is always positive suggests that firms are more likely to merge the closer their industrial relationship. The increasing magnitude of the same industry coefficients as one moves from the 1-digit to the 4-digit dummy means that the incremental effect is also increasing: being in the same 4-digit industry relative to the same 2-digit industry has more of an effect on the merger probability than being in the same 2-digit industry as opposed to the same 1-digit industry, for example. The results for industry dummies are interesting but not unexpected, nor is the performance of the sales growth term, given a similar finding by Palepu (1986). The influence of the debt-value ratio, however, is quite surprising, given the argument that firms

with unused debt-capacity are more likely to be taken over. One possible explanation is that firms with high debt are firms in trouble, though other variables included in the regression are intended to control for this characteristic.

The target industry dummies suggest that (relative to the omitted industries, those with SIC codes beginning with 8, which include Health, Education, and Engineering) in only two broad industry groups were firms more likely to be acquired during this period: Transportation, Communication and Utilities and, to a lesser extent, Finance, Insurance and Real Estate.

Certain other variables are also robust to choice of specification and always insignificant. These include the new share and repurchase variables and the parent size variables. The pattern of the size variables suggests that a firm is most likely to acquire other firms that are smaller than itself, but not too much smaller. This is consistant with our observation in Auerbach and Reishus (1987a) that parents are typically larger than the targets they acquire but that relative size is correlated. The repurchase variable has the "wrong" sign in that it suggests firms that have repurchased are less likely to acquire other firms. This result does not necessarily constitute evidence against the "trapped equity" inducement for cash mergers. It may simply mean that firms wishing to get excess cash out of the corporate form tend to specialize in their method, either repurchasing or engaging in cash acquisitions. If this specialization were strong enough, then the observation of a firm repurchasing would reduce the expectation that it would also engage in a cash merger, even though, <u>conditional</u> on its decision to acquire, it would still be more likely to use cash (as suggested by our

previous results cited above). This problem of interpretation underscores the need for a more rigorous model of the constraints that cause equity to be "trapped" and the optimal behavior of firms in response to these constraints.

The performance of the remaining variables, including the tax variables, depends on the model specification. The tax gain variable always has the correct sign, and is significant in the level specification. However, when this variable is broken down into two variables according to the source of the tax gains (target or parent), only tax gains from the potential parent are significant in the level specification. This is entirely consistent with the results given in Table 2, where the only noticeable difference between the sample of real mergers and that of pseudomergers was for the case of parent-related tax gains. Moreover, it is plausible that the target firm tax benefits would present less of an incentive because of the additional restrictions on their use that we have not taken into account.

Despite this statistical significance, however, the parent's tax variable is of little <u>economic</u> importance. Depending on the exact specification setting the value of the parent's tax gain to zero (which simulates the impact of a policy change making the transfer of such benefits impossible) reduces the predicted number of mergers by between just under 1 percent and just over 1.5 percent. In contrast, the predicted number of mergers would be reduced by well over one-half by setting the same-4-digit SIC industry dummy variable equal to zero (which simulates the impact of a policy of prohibiting combinations of firms in the same 4-digit industry occurring with a frequency that cannot be explained by other factors).

The basis step-up variable is disturbingly sensitive to whether the ratio or the level specification is used and to whether industry dummies are

included. In the level specification, it always has the wrong sign. In the ratio specification, it has the wrong sign in the two specifications without industry dummies but is significant and has the predicted sign with the industry dummies present. If this last model were correct, then the predicted decline in mergers associated with a removal of the tax benefits from basis step-up would be over 8 percent, much larger than the predicted impact of removing the ability to transfer losses and credits. However, the instability of this variable's performance and the problems in its construction leads us to discount the importance of this result.

The results for the remaining three variables, which are intended to measure the difference between market value and the value of asset, are also sensitive to whether level or ratio form is used. Under the former, all are quite insignificant. Under the latter, the gap between book and market value has the correct sign and is significant, while the R and D variable has the "wrong" sign and is significant. It should be pointed out, however, that this sign for R and D is wrong in a very limited sense, if R and D affects the merger probability only through its use in correcting our measure of the firm's asset replacement cost. If R and D spending exerts an independent influence on the probability of a firm's acquisition, then it is not clear without further modelling what sign one should expect it to have.

In summary, then, the basic model specification seems good in that variables one associates with acquisitions, such as industry relationship and growth, are consistently significant. The significance of the debt-value ratio is also quite robust, through we are not certain how this is to be rationalized. Given the results in Table 1, however, it is quite hard to

argue that acquisitions by large corporations were driven during this period by the opportunity to tap unused target debt capacity.[5] The performance of the tax gain variable suggests a mild positive effect of tax losses and credits experienced by the potential acquirer, but little effect of those experienced by the potential target. Finally, the basis step-up variable, whose accuracy we have questioned, is of the correct sign (but significant) in only one specification. The values of the likelihood function for ratio and level specifications are virtually identical, making it difficult to decide which model is "best."

7. Conclusion

The object of this paper has been to consider the impact of taxes on the frequency of mergers and acquisitions in the United States over the period 1968-83. To do this, we have compared the tax characteristics of a sample of merging firms to those of a similar sample of nonmerging firms chosen at random and, using both samples, estimated a "marriage" model of merger activity. Our results suggests that the potential increase in interest deductions could not have been an important factor influencing merger activity during this period. The two samples exhibit quite insignificant differences in borrowing patterns, and the logit model estimates suggest that a lower debt-equity ratio is associated with a lower probability that a firm will be acquired.

Likewise, the tax benefits associated with the acquisition of a firm with tax losses or unused tax credits appear to exert an insignificant influence on merger activity. The frequency and size of such benefits is virtually the same

in the real merger sample and the pseudomerger sample, and the size of the potential benefit has no explanatory power in the merger model. One reason for this may be the existence of a variety of restrictions on the use of such tax benefits that, because of their complexity, we have ignored in our analysis.

The two potential tax benefits that do appear to have some impact on merger activity are the use of tax losses and credits by acquiring companies to offset the taxable income of firms they acquire and the option to step up the basis of the assets of acquired firms without paying corporate level capital gains taxes. The first of these is significant in some of the model estimates and is more important in the sample of real mergers than the sample of pseudomergers. However, it is of little economic importance in explaining the frequency of mergers. The second is significant in one of the specifications estimated, but has the wrong sign in all others. Given the difficulty we have encountered in measuring this variable accurately, we are somewhat suspicious of this finding of potential significance.

In terms of the avoidance of individual taxes, we have found that firms that have repurchased their own shares in the past two years are less likely to acquire other firms. This result is hard to relate to the theory that firms seek cash acquisitions to free "trapped equity" without a rigorous model of the constraints on and determinants of repurchase activity.

The Tax Reform Act of 1986 attempted to discourage tax-driven acquisitions by repealing the "General Utilities" doctrine that permitted the tax-free basis step up and by limiting the use of tax losses and credits of acquired firms. Our findings suggest that the latter restriction is of little importance. Ironically, the use of acquiring firms' tax benefits, which

appears to have some impact on merger activity, was not restricted by the recent legislation. A change that, some have argued, could encourage mergers is the strengthening of the corporate alternative minimum tax. Just as with the asymmetry associated with gains and losses, it will be possible for firms subject to the minimum tax to combine with taxable firms not subject to the minimum tax and reduce combined tax payments. However, the potential tax reductions would appear smaller (since the difference between the two firms' marginal tax rates is lower) than for the combination of a taxable and nontaxable firm. Given our findings about mergers between such types of firms, we strongly doubt that the minimum tax provisions will have a significant impact on merger activity.

The results in this paper should be regarded with caution, given the many assumptions that were necessary to estimate the potential tax benefits associated with particular mergers. Without access to the confidential tax returns of the firms involved, such assumptions are unavoidable. Another limitation that deserves mention is the terminal date of our sample: early 1983. Since then, the character of the acquisition process has changed, with many more "megamergers" occurring in which larger firms were acquired. There is some inconclusive evidence in our Table 1 that such mergers may, on average, be associated with increases in leverage for the combined enterprise. Recent observations should facilitate a more precise evaluation of this proposition, along with the one that borrowing to finance acquisitions has, in general, become more important in recent years.

Appendix

In this appendix, we describe the methods used for sampling and calculating the variables.

1. Sampling

The real and "pseudo" samples were matched by year and assets of both parent and target. The method for calculating assets are explained below. The size categories were (in millions) 1 to 10, 10 to 25, 25 to 50, 50 to 100, 100 to 250, 250 to 500, 500 to 1,000, 1,000 to 5,000, 5,000 and up, as well as a category for missing value. The missing values were eliminated for the regressions, which left 310 real mergers, and 291 pseudomergers. The difference is due to the inability to collect meaningful tax or asset information on a portion of the pseudo mergers.

2. Gain From Use of Tax Losses and Credits

This calculation uses the income tax paid, tax loss carry forward, and investment tax credit carryforward information obtained from corporate reports. When a firm without carryforwards and positive tax payments combines with a firm which has carryforwards, we calculate the potential benefit. We assume that the unconstrained firms' level of tax payments grows at 10 percent nominal rate into the future, while the firm with the loss carryforward contributes no new losses, but also no new taxable income in the future -- it is simply a shell for holding tax loss carryforwards. We then calculate the net present value of the tax payments (discounted at 10 percent) combining the two firms' tax attributes through the period when the carryforward is used up

or expires. The net present value of the tax payments of the two firms separately is also calculated using the same assumptions for the same time period. The difference between the combined calculation and the sum of the separate calculations is the tax benefit.

The aggregate calculation is much cruder. If the target is paying positive taxes, then we use three times the tax payment as the tax gain from merging with a parent who has a tax loss carryforward as indicated by Compustat. For targets with tax losses, we use the value of the actual tax loss as the potential benefit for parents who do not have tax loss carryforwards as indicated by Compustat.

3. Basis Step-Up

We begin with the firm's book value of fixed assets at the end of the last year before the merger. Using data on the firm's gross investment and the capital stock at the end of the earliest year for which it is available for the firm, we use the "perpetual inventory" method to estimate the rate of declining balance depreciation that is consistent with the firm's initial and terminal capital stocks. Given this estimate of economic depreciation, we then estimate the current market value of the capital stock by multiplying capital remaining from different vintage by the ratio of the price (represented by the GNP deflator) in the current year to that for the year in which the capital was purchased. We also assume that the initial capital stock was valued correctly on the firm books. That is, we solve for δ from the equation:

$$(A1) \qquad K_T = (1-\delta)^T K_0 + (1-\delta)^{T-1} I_1 + \ldots + I_T$$

where K_t is the book capital stock at the end of year t and I_t is fixed investment in year t. We then calculate the market value of the capital stock as:

$$(A2) \qquad K_T^m = (1-\delta)^T K_0 P_T/P_0 + \ldots + I_T$$

We assume that a fraction θ of this market value is structures, where θ is the fraction that structures represent for all firms in the same industry (taken from Auerbach, 1983). Note that this will understate the market value of assets that have increased in nominal value at a rate in excess of the GNP deflator or were worth more than their book value even at time zero.

Since structures are written off at a different rate from equipment, they will generally represent a different fraction of the book capital stock than of the market value capital stock. Since structures decay more slowly the book fraction will be smaller: inflation has a greater effect on the ratio of the current to book value as the time since purchase increases.

If one assumes that the structures fraction of the firm's capital stock at time zero was also θ, and that structures are written off at the declining balance rate γ, it follows that the book value of structures at date T is:

$$(A3) \qquad K_T^S = \theta(K_0(1-\gamma)^T + [K_T^m - K_0(1+\pi)^T]$$
$$\cdot [1 - (1-g+\pi)(1-\gamma)]/[1 - (1-g+\pi)^T(1-\gamma)^T]$$
$$\cdot \{[1 - (1-g)^T(1-\gamma)^T]/[1 - (1-g)(1-\gamma)]\}$$

where π is the average inflation rate over the period 0 to T and g is the nominal growth rate of investment in structures. These are easily calculated

for each firm. We set γ = .033, the aggregate value derived in Auerbach and Hines (1987).

Given the market value of the firm's structures capital stock, we estimate the after-tax value of depreciation allowances the firm would receive by multiplying the corporate tax rate by the average present value of depreciation allowances on all structures, estimated by Auerbach and Hines (1987). It is somewhat more difficult to estimate the depreciation allowances the firm would receive if continuing along its previous depreciation schedule since its capital stock purchase dates are now known. We simply assume that they would get the same present value as is available on new capital per each dollar of remaining basis. Moreover, we assume that recapture will neutralize the additional depreciation allowances received on increases in basis up to the straight line basis, and that this latter basis equals the actual book value. Thus, the net estimated gain is the present value of depreciation allowances of new structures, multiplied by the corporate tax rate, multiplied by the difference between market and book values estimated for structures.

There are 35 real targets and 46 pseudotargets for which there was insufficient data to perform the basis step-up calculations. For these firms, we use an imputed value equal to the sample average. Use of a separate missing-value dummy variable did not substantively alter the results.

4. Asset Value

Based on Compustat data, the value of a firm is calculated as the market value (year-end) of common stock plus the book value of long-term debt, short-term debt and preferred stock in the year preceding the merger. For an important fraction of targets a closing stock price was unavailable for that

year; if the calculation provided a missing value, we took this value from the previous year.

Footnotes

1. We have subsequently discovered problems with data in two of the mergers, and so have only 316 observations in the current paper.

2. There are actually 291 such observations because of data problems encountered after the second sample was chosen.

3. These are given for all targets and pseudotargets, including the relatively small number matched with a nontaxable parent or pseudoparent who could not use the tax benefits. In the estimation procedure below, the potential gain is set to zero in such cases.

4. In all versions of the model estimates reported in the paper, we weight each observation based on the sampling frequency of the target firm's size class as well as status (acquired or not acquired). In principal, this is the correct approach, though it gives some observations substantial weight. We also tried an alternative weighting scheme that did not distinguish sample weights by size. The coefficients for most variables were nearly identical, though one of the tax variables, the parent's tax gain, had its size reduced somewhat in some specifications.

5. Needless to say, one cannot and should not interpret this finding as applying to the going-private leveraged buyouts that are not included in our sample.

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Table 1: Changes in Debt-Value Ratios

Relative Target Size	Real Mergers #	Real Mergers Average Change	Pseudomergers #	Pseudomergers Average Change	T Statistic
<.1	107	0	71	.013	-0.64
.1 - .25	60	-.032	60	-.011	-0.75
.25 - .50	40	.018	38	-.015	1.01
.50 - .75	14	-.014	21	.028	-0.76
>.75	25	.071	22	-.032	1.59
TOTAL	246	.001	212	-.002	0.21

Notes:

Relative target size is ratio of target value (debt plus equity) to parent value in year before merger. Total number of firms is somewhat lower than overall sample size because of missing data.

T-statistics are for a test of equality of means. Means are unweighted within each cell.

Table 2: Potential Gains from the Transfer of Losses and Credits

Size of Gain	Real Mergers (#=316)			Pseudomergers (#=291)		
	Total	From Target	From Parent	Total	From Target	From Parent
0	255			235		
<.05	26	19	7	23	16	7
.05 - .10	11	7	4	10	7	3
.10 - .25	14	9	5	17	9	8
>.25	10	3	7	6	4	2
Fraction with Gain	.193	.120	.073	.192	.123	.069
Mean Gains:						
Unweighted	.170	.126	.242	.112	.108	.113
Weighted	.105	.049	.163	.078	.058	.100

Notes:

Gains are expressed as a fraction of target firm value (long-term debt plus equity). Mean gains are for those pairs with positive gains, with target firm values used when weighting.

Table 3: Potential Gains from Basis Step-Up

Size of Gain	Real Mergers (#=281)	Pseudomergers (#=245)
< .05	259	226
.05 - .10	12	12
.10 - .25	9	6
> .25	1	1
Mean Gains:		
Unweighted	.019	.020
Weighted	.018	.021

Notes:

Gains are expressed as a fraction of target firm value. Total number of firms is somewhat lower than overall sample size because of missing data.

Table 4
Logit Model Estimation Results
(Dependent Variable = 1 if Merger Occurs)

Independent Variable	Level Specification (1)	(2)	(3)
Constant	11.50 (18.35)	11.50 (18.33)	10.62 (6.29)
Target Debt-Value Ratio	3.64 (5.04)	3.64 (5.03)	2.72 (2.80)
Target Sales Growth Rate	1.99 (2.28)	1.98 (2.27)	2.75 (2.25)
Same 1-digit SIC	1.45 (1.68)	1.45 (1.67)	1.47 (0.79)
Same 2-digit SIC	2.34 (1.98)	2.34 (1.96)	3.38 (2.29)
Same 4-digit SIC	6.60 (7.54)	6.60 (7.51)	6.95 (9.11)
Same Size Parent	-.61 (-.92)	-.61 (-.91)	-.55 (-.66)
Larger Size Parent	.36 (.55)	.36 (.55)	.50 (.58)
New Shares Issued	-.07 (-.12)	-.06 (-.11)	.22 (.35)
Shares Repurchased	-.85 (-1.26)	-.85 (-1.26)	-.86 (-1.01)
Tax Gain*	.20 (3.24)	--	--
Tax Gain* Target	--	-.09 (-.13)	-.60 (-.54)
Tax Gain* Parent	--	.22 (3.40)	.22 (2.04)

Table 4, Continued

Independent Variable	Level Specification (1)	(2)	(3)
Basis Step-up*	-3.10 (-1.97)	-3.07 (-1.85)	-1.13 (-1.34)
Target Book-Market* Value	-.05 (-.57)	-.05 (-.56)	-.07 (-.72)
Target Advertising*	.03 (.03)	.05 (.03)	.33 (.16)
Target R&D*	-.92 (-.56)	-.97 (-.56)	-1.11 (-.36)
Target Industry Dummies (1-digit SIC)			
1 (Mining and Resource Extraction)	--	--	-1.80 (.99)
2 (Nondurable Goods Manufacturing)	--	--	1.49 (.87)
3 (Durable Goods Manufacturing)	--	--	1.15 (.67)
4 (Transporation, Communication and Utilities)	--	--	4.31 (2.24)
5 (Retail Sales)	--	--	1.00 (.58)
6 (Finance, Insurance and Real Estate)	--	--	2.82 (1.52)
7 (Services)	--	--	.53 (.27)

Notes

t-statistics are in parentheses.

In "ratio" specifications, starred variables are divided by target firm's market value.

Table 5
Logit Model Estimation Results
(Dependent Variable = 1 if Merger Occurs)

Independent Variable	Ratio Specification (1)	(2)	(3)
Constant	11.59 (19.14)	11.62 (18.57)	10.87 (6.60)
Target Debt-Value Ratio	3.55 (4.83)	3.44 (4.56)	2.33 (2.25)
Target Sales Growth Rate	2.33 (2.57)	2.43 (2.56)	3.29 (2.79)
Same 1-digit SIC	1.41 (1.59)	1.40 (1.56)	1.47 (0.81)
Same 2-digit SIC	2.25 (1.82)	2.23 (1.80)	3.26 (2.21)
Same 4-digit SIC	6.76 (7.35)	6.78 (7.31)	6.96 (8.76)
Same Size Parent	-.69 (-1.11)	-.69 (-1.13)	-.61 (-.79)
Larger Size Parent	.35 (.56)	.34 (.55)	.49 (.61)
New Shares Issued	-.11 (-.20)	-.10 (-.18)	.19 (.31)
Shares Repurchased	-.87 (-1.26)	-.85 (-1.23)	-.90 (-1.07)
Tax Gain*	.27 (.69)	--	--
Tax Gain* Target	--	-.02 (-.05)	-.90 (-.69)
Tax Gain* Parent	--	1.75 (.34)	1.93 (.38)

Table 5, Continued

Independent Variable	Ratio Specification (1)	(2)	(3)
Basis Step-up*	-6.90 (-.89)	-6.40 (-.82)	10.82 (2.55)
Target Book-Market* Value	.26 (.81)	.32 (.94)	.44 (.95)
Target Advertising*	-1.88 (-1.18)	-1.94 (-1.22)	-1.59 (-.69)
Target R&D*	-7.46 (-2.67)	-7.49 (-2.68)	-4.03 (-1.31)
Target Industry Dummies (1-digit SIC)			
1 (Mining and Resource Extraction)	--	--	1.76 (1.01)
2 (Nondurable Goods Manufacturing)	--	--	1.47 (.89)
3 (Durable Goods Manufacturing)	--	--	1.11 (.68)
4 (Transporation, Communication and Utilities)	--	--	4.87 (2.60)
5 (Retail Sales)	--	--	.90 (.54)
6 (Finance, Insurance and Real Estate)	--	--	2.60 (1.43)
7 (Services)	--	--	.45 (.24)

Notes

t-statistics are in parentheses.

In "ratio" specifications, starred variables are divided by target firm's market value.