On the Patterns and Wealth Effects of Vertical Mergers

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June 2002

We gratefully acknowledge comments from Sudipto Dasgupta, Boyan Jovanovic, Ken Lehn, Vojislav Maksimovic, John Matsusaka, Harold Mulherin and the seminar participants at the Annual Meeting of the American Finance Association (AFA) in Atlanta, Australian Graduate School of Management, National University of Singapore, Nanyang Technological University, University of Melbourne, and the Hong Kong University of Science & Technology. Joseph P.H. Fan is grateful for research support from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. HKUST6183/98H).

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Abstract

We use industry commodity flows information to measure vertical relations for completed mergers from 1962 to 1996. Almost one-third of the mergers display relations that provide opportunities for vertical integration between merging firms. Vertical mergers generate positive wealth effects that are significantly larger compared with those for diversifying mergers; the wealth effects in vertical mergers are comparable to those in pure horizontal mergers. We find a significant, positive co-movement in vertical merger activity and wealth effects, consistent with economy-wide shocks that affect both the incentives for firms to integrate vertically and the resulting efficiency gains from such mergers. In addition, consistent with the "specific assets" rationale for vertical mergers, the drop in asset beta around vertical mergers is significantly larger relative to asset beta changes in other types of mergers.

JEL Classification: G00, G30, G34, L22
Keywords: Mergers and Acquisitions, Vertical mergers

1. Introduction

Theoretical research on possible motivations for why firms vertically integrate is abundant.[1] Empirical work, however, has not kept pace. We know little about the intensity of vertical merger activity in a particular economy, and whether or not vertical mergers have increased or decreased over time.[2] We also know little about whether vertical mergers create wealth for shareholders, how significant these wealth effects are compared with the wealth effects in horizontal or diversifying mergers, and how the wealth effects of vertical mergers have changed over time.[3]

In addition, we do not fully understand the relatedness of the firms in mergers over time. For example, while the literature shows that mergers during the 1980s and the 1990s were mostly between related firms, we do not know whether these were purely horizontal mergers or if they provided firms with opportunities for vertical integration. The literature also shows that mergers during the 1960s and 1970s formed conglomerates (diversification). But we do not know whether or not such mergers between bidders and targets in different industries were vertically related. Significant vertical integration

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[1] These include reduction in transactions costs when the costs of using markets exceed the costs of internal organization (Coase, 1937); mitigation of the hold-up problems associated with asset specificity and uncertainty in market transactions (Williamson (1971, 1975, 1979); Klein, Crawford, and Alchian, 1978); price control (Stigler, 1951); risk aversion (Blair and Kaserman, 1978); price inflexibility (Carlton, 1979); and market power (see Perry, 1989, for a survey).

[2]Several non-merger studies report the trends of vertical integration for industries or firms. These include those by Adelman (1955), Laffer (1969), Tucker and Wilder (1977), Maddigan (1981), Levy (1985), and Fan and Lang (2000).

[3]Chandler (1977) points out that vertical integration was a critical success strategy for firms that grew large by mergers during the first merger wave at the turn of the twentieth century

opportunities exist even when bidders and targets belong to different industries. A key objective of this paper is to determine the patterns and wealth effects of vertical mergers.

The current literature, with few exceptions, classifies a merger as unrelated if the bidder and target have different Standard Industry Classification (SIC) codes.[4] For example, a merger between a petroleum refining (SIC 29) company and a petroleum exploration (SIC 13) company would be classified as a diversifying merger because the refining and the exploration businesses are in different 2-digit SIC industries. But these two industries obviously have significant vertical linkages. Another issue with the SIC-code-based classification scheme is that mergers between firms in the same industries can create significant opportunities for vertical integration. However, without a more sophisticated measure of input-output (IO) linkages, we cannot distinguish between vertical and horizontal mergers.

In this study, we utilize the industry commodity flows information in input-output (IO) tables to impute vertical relations in mergers.[5] With the IO data, we can capture the vertical relation between a pair of merging firms by the dollar amount of input transfer

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[4]The exceptions are Spiller (1985) and Ravenscraft and Scherer (1987). Spiller (1985) identifies vertical links in a list of mergers complied by Federal Trade Commission (FTC). Together with other sample selection criteria, his final sample consists of 29 vertical mergers. Ravenscraft and Scherer (1987) classify vertical relations for mergers in the FTC list, using FTC's survey on line of business for over 400 large manufacturing companies in 1974-1977. Using the line-of-business information, they classify a merger as vertically related if the acquired unit made at least 5% of its sales to, or purchases from, another unit operated by the parent for at least five years before the merger.

[5]There are other non-IO based measures of vertical integration of firms or industries (Adelman (1955) and Gort (1962)). Examples of subjective schemes to classify vertical relations are by Rumelt (1974) and Johnson and Houston (2000).

between industries in which the merging firms operate. The idea is that two industries are vertically related if one can use the other's products or services as input for its own production, or can supply output as the other's input. The IO-based measure does not necessarily capture actual vertical integration. Instead, it serves as a proxy for potential integration and can be easily applied to measure vertical relations in large sample studies.[6]

Using the IO-based method, we find significant vertical merger activity in a large sample of over 2,100 mergers completed between 1962 and 1996. More than one-third of the sample mergers show vertical relations. More importantly, almost 18 % of the mergers create significant opportunities for vertical integration, even though they are between firms that belong to different industries and would surely be classified as unrelated by a classification scheme that relies only on industry codes. We also find that vertical merger activity has increased over time. A significantly higher number of mergers in the post-1980 period exhibit vertical relatedness compared with those during the pre-1980s.

Vertical mergers generate significantly positive wealth effects. The average combined wealth effect in vertical mergers is about 2.5% during a three-day event window surrounding the announcement of the merger transactions. The wealth effect is

[6]Several other papers also develop IO-based methodologies to measure vertical relation of industries or firms (Maddigan (1981), Lemelin (1982), Caves and Bradburd (1988), and Fan and Lang (2000)). Merger studies that employ IO-based methodologies to classify vertical relation include those by McGuckin, Nguyen, and Andrews (1991) and Matsusaka (1996).

significantly larger when compared with that for diversifying mergers. Overall, the wealth effect in vertical mergers is comparable to that for horizontal mergers.

Merger wealth effects are generally greater in the 1980s and 1990s relative to those in the 1960s and 1970s. More importantly, we find that the increasing wealth effects of merger activity in the 1980s and 1990s are mainly attributable to vertical mergers. There is no clear time-series pattern for wealth effects in horizontal or diversifying mergers.

Finally, we perform two tests to examine if vertical mergers are a response to holdup problems caused by specialized investment that has lower value outside the transaction. First, economic shocks typically exacerbate contracting problems. This suggests that when there is high uncertainty in an economy, both the incentives for firms to integrate vertically and the resulting efficiency gains from such mergers are likely to be larger. Consistent with this view, our time-series analysis shows a positive co-movement in aggregate vertical merger activity and wealth effects over time. In contrast, such co-movements in horizontal or diversifying mergers are not evident in the data.

Second, the possibility of holdup in the presence of specialized investment suggests that the alternative use value of assets is correlated with the market portfolio. Following a vertical merger, the holdup problem is suppressed under the common ownership and the covariance between the value of specialized assets of merged firm and the market portfolio declines. Therefore, the systematic risk of a portfolio of two vertically related firms will be greater than the post-merger systematic risk under vertical integration

(Spiller (1985)). Consistent with this view, we find that the decline in asset beta following vertical mergers is significantly larger than that for other types of mergers.

The paper is organized as follows. In Section 2, we describe the sample and the methodology. In Section 3, we report the time patterns of vertical mergers and compare the patterns with those of horizontal and diversifying mergers. Section 4 reports evidence on the relation between vertical mergers and wealth effects. Section 5 concludes.

2. Sample and methodology

2.1. The sample

We construct a merger database by searching the CRSP (Center for Research in Security Prices) tapes for all NYSE, Amex, and Nasdaq firms delisted during 1962-1996. CRSP uses delisting codes between 200 and 203 to identify firms that are delisted because of an acquisition. The delisting date is the effective date of the acquisition. For these delisted firms, we first check the Wall Street Journal Index (WSJI) to identify the bidder for each delisted target, the date of the first announcement of the merger transaction, and the method of payment. If this information is unavailable in the WSJI, we check the Lexis/Nexis database.

We include those mergers in the sample in which both the bidder and target are listed on CRSP's daily NYSE/Amex/Nasdaq tapes. We exclude mergers for which we cannot

identify the primary industry affiliation and mergers in which either the bidder or the target is a financial services firm.[7] The final sample consists of 2,162 completed mergers.

Figure 1 presents the aggregate merger activity over time. The dotted line expresses the number of firms acquired during a year as a fraction of the beginning-of-year firms on CRSP. The solid line is the ratio of the aggregate dollar value of acquisitions to the total beginning-of-year market capitalization of the firms listed on CRSP. The figure illustrates the well-known merger cycle as documented by Andrade, Mitchell, and Stafford (2001) and Jovanovic and Rousseau (2001). We note intensive merger activity in the mid-1960s, the 1980s, and the mid-1990s. Other periods exhibit relatively less intensive merger activity.

2.2. Measuring vertical relations of merging firms

To measure vertical relatedness, we use a procedure similar to that used by Fan and Lang (2000). We begin by constructing the inter-industry vertical relatedness coefficients. The building block of these coefficients is the Use Table of Benchmark Input-Output Accounts for the U.S. Economy. The Use Table is a matrix containing the value of commodity flows between each pair of roughly 500 private-sector intermediate IO industries. The table reports for each pair of industries, i and j, the dollar value of i's output required to produce industry j's total output, denoted as a_{ij}.

[7] Mergers where either the bidder or the target is in the financial services industry are excluded because the IO-based methodology cannot adequately classify vertical relations in these mergers.

We divide a_{ij} by the dollar value of industry j's total output to get v_{ij}, which represents the dollar value of industry i's output required to produce one dollar's worth of industry j's output. Conversely, we divide a_{ji} by the dollar value of industry i's total output to get v_{ji}, which represents the dollar value of industry j's output required to produce one dollar's worth of industry i's output. We then use the maximum of the two input requirement coefficients to obtain the vertical relatedness coefficient of industries i and j, We can intuitively interpret V_{ij}=max (v_{ij}, v_{ji}). V_{ij} as a proxy for the opportunity for vertical integration between industries i and j.

We use the plastics, i, and non-textile bags, j, industries as an example. In 1992, the total plastics output was $31,502 million. The total output of non-textile bags was $8,389 million. The bags industry consumed $1,259 million in plastics (a_{ij}), and the plastics industry utilized $10 million in bags ($a_{ji}$) as input. On a per-dollar basis, the bag industry consumed $0.15 (1,259/8,389) of plastics for each dollar of bags produced (v_{ij}), and the plastics industry consumed $0.0003 (10/31,502) of bags for each dollar's worth of plastics produced (v_{ji}). The vertical relatedness coefficient between the two industries is 0.15, which indicates the potential input transfers between the two industries on a per dollar basis.

In the second step, we assign a vertical relatedness coefficient to a given pair of merging firms according to their primary industry affiliations. This step requires us to first identify the industry affiliations of firms constituting our sample.

The primary source of industrial classifications for bidders and targets is the historical SIC code information on the announcement dates in the CRSP database. If CRSP reports a missing SIC code on the announcement date, we replace it with the SIC code as of the delisting date if it is available. If CRSP does not report any SIC code, we read the business description of the bidder (or the target) in WSJI and Lexis/Nexis and assign it an SIC code based on the 1987 SIC manual. Finally, we check the validity of all SIC codes in our sample against the codes listed in the 1987 SIC manual. We were surprised to see that many CRSP listed SIC codes did not match with the codes in the SIC manual. Some of these CRSP SIC codes follow the earlier 1977 SIC manual, and we use a concordance table to convert the 1977 CRSP SIC codes to the 1987 SIC codes. We correct the remaining errors in CRSP SIC codes by reading through the business descriptions of the bidders and targets at the time of merger and then replacing these SIC codes. Since the Use Table classifies the input-output data by IO codes, we convert each of the SIC codes of bidders and targets into an appropriate IO.[8]

Once we identify the pair of primary industries for a pair of merging firms, we determine the vertical relation between them by using the vertical relatedness coefficient associated with that industry pair. The first year for which the IO data are available to us is 1982. The IO data are updated every five years. We use the 1982 IO data for mergers

[8] The conversion table takes into account changes in industry definitions in the *Use Table* over time. It is based on the information in the 1982, 1987, and 1992 conversion tables prepared by the Bureau of Economic Analysis.

announced prior to 1985. To account for changing input-output relations over time, we switch to the 1987 IO data for mergers between 1985 and 1989. For mergers between 1990 and 1996, we use the 1992 IO data. We also replicate the analysis using IO data from the 1982 table for the entire sample and find similar results.

Although we expect these industry vertical relatedness coefficients to be reasonable proxies for firm-specific vertical relations, there could still be potential measurement biases. Therefore, following McGuckin, Nguyen, and Andrews (1991) and Matsusaka (1996), we adopt two alternative cut-offs to categorize mergers as vertically related – a 1 percent cut-off and a 5 percent cut-off. Based on the looser criteria, we classify a merger as vertically related if its associated vertical relatedness coefficient is greater than 1 percent. Based on the stricter definition, we classify a merger as vertically related if its associated vertical relatedness coefficient is greater than 5 percent.

3. Vertical merger activity

3.1. Pattern of vertical merger activity over time

Table 1 reports the summary statistics on the vertical relatedness coefficients for mergers during 1962-1996. Overall, the mean vertical relatedness coefficient for the sample mergers is 0.034, which suggests that the potential input transfers between firms that engage in mergers average about three cents for every dollar of output produced. However, the median value is 0.003, indicating that a majority of the mergers is vertically unrelated. The third quartile is 0.027, suggesting significant vertical relations in at least a quarter of the sample.

We next examine separately the vertical relatedness coefficients in 1,544 cross-industry (across different IO industries) and 618 within-industry (within the same IO industry) mergers. We find some relatively large differences in the vertical relatedness between the two groups. The average vertical relatedness coefficient for within-industry mergers is significantly higher at about 0.065, compared with that for cross-industry mergers at 0.022. Mergers within the same IO industries generally have more opportunities for vertical integration than do mergers across different IO industries.

Panel B of Table 1 reports the average vertical relatedness coefficients and the fraction of mergers classified as vertically related for both the full sample and the subsamples over time. Over the entire sample period, vertical mergers account for approximately 36 percent of all mergers based on the 1 percent cut-off.

We also estimate the vertical merger activity by value by estimating the combined market equity value of bidders and targets in vertical mergers as a fraction of combined values of bidders and targets in all mergers. Using the combined bidder-target equity value, we find that vertical mergers account for 43 percent of the combined value of all mergers in the sample. When we use a stricter definition of vertical relatedness and classify a merger as vertically related if the vertical relatedness coefficient exceeds 5 percent, we find that 19 percent of the mergers by number and 22 percent by value are vertically related.

The table also shows a notable increase in vertical merger activity over time. The period-by-period mean values of vertical relatedness coefficients show that the mergers

during the 1980s and 1990s are more vertically related compared to those during the 1960s and 1970s. The mean value of the vertical relatedness coefficient is about 0.03 in the 1960s and 1970s. The mean value increases to roughly 0.04 in the 1980s and 1990s. When we classify mergers as vertically related based on either the 1 percent cut-off or the 5 percent cut-off, we also find a similar increasing trend in the number and value fractions of vertical mergers relative to all mergers. Based on the 1-percent cut-off, the fraction of vertical mergers increases from about 30 percent in the 1960s and 1970s to about 45 percent in the 1990s. In terms of value, the corresponding figure for vertical mergers is 35 percent during the 1960s and 70s, and about 50 percent during the 1990s. Figure 2, which plots the fraction of vertical mergers, also shows an increasing proportion of vertical mergers during the 1980s and 1990s.

In sum, our results show that a substantial amount of merger activity exhibits vertical relatedness and that the intensity of vertical mergers increases over time. Both the fraction of vertically related mergers and the market capitalization of assets involved in vertical mergers have increased. The pattern is also robust to the vertical relatedness coefficient cut-off.

3.2. Patterns of vertical, horizontal, and diversifying mergers over time

The results in Table 1 show that vertical relatedness is generally higher in within-industry mergers than in cross-industry mergers, which leads us to ask if cross-industry mergers exhibit any vertical relatedness at all.

To examine this issue, we classify the sample mergers more finely by using a classification scheme similar to that used by McGuckin, Nguyen, and Andrews (1991). We identify "pure vertical mergers" as those mergers between firms belonging to different IO industries, but exhibiting vertical relatedness based on the 1 percent cut-off. We identify "pure horizontal mergers" as those mergers that take place between firms in the same IO industry but exhibiting no vertical relatedness based on the 1 percent cut-off. We classify mergers between firms in the same IO industry that also have vertical relations as "mixed vertical-and-horizontal mergers." Finally, when firms in different IO industries merge and the merging firms show no vertical relatedness, we classify them as "diversifying mergers."

Table 2 reports the pattern of merger activity for mergers classified as cross-industry, diversifying, pure vertical, mixed vertical-horizontal, and pure horizontal mergers. Column (1) of Table 2 reports the fraction of cross-industry mergers over time. Of the 2,162 mergers in the sample, 71 percent are between firms in different IO code industries. Cross-industry mergers occurred frequently in the 1960s and to some extent also in the 1970s. Since the late 1970s, cross-industry mergers appear to be on the wane. For example, in the 1990s, only about 58 percent of the mergers were between firms in different IO codes.

To see if the time pattern is sensitive to the different industry classification systems we use, we alternatively classify cross-industry mergers using SIC codes. That is, we classify a merger as cross-industry when the merging firms are in different industries, as

defined by two-digit SIC codes. This broader industry definition yields similar patterns in cross-industry merger activity. Although not reported in a table, we obtain similar trends in cross-industry merger activity over time when we estimate the fraction of cross-industry mergers by value.

Overall, the declining frequency of cross-industry mergers over time supports the conventional view, which suggests that conglomerate mergers peaked in the 1960s as firms diversified into new industries. According to this view, mergers since the 1970s are more likely to be between firms in similar industries, which indicates a trend towards increasing focus.

But, as we argued earlier, not all cross-industry mergers are conglomerate mergers. A significant fraction of cross-industry mergers are vertically related. The third and the fourth columns of Table 2 report the pattern for diversifying mergers. Similar to the patterns for cross-industry mergers, diversifying mergers show a marked decline over time. Overall, 53 percent of the mergers during the entire period were diversifying. In the 1960s, more than 60 percent of the mergers were diversifying. By contrast, in the 1990s, the proportion of diversifying mergers had declined to 40 percent. Again, these results suggest that conglomerate mergers common in the 1960s declined in importance, and in the past two decades, firms more often choose related mergers.

Comparing the fraction of mergers classified as cross-industry and those classified as diversifying suggests that crude measures of relatedness based on SIC codes can substantially overstate the number of unrelated mergers in the sample. Almost 18 percent

of the mergers in the sample are cross-industry and vertically related and would have been classified as unrelated based on the simple SIC-code method of classifying mergers. In these pure vertical mergers, there are significant vertical linkages, even though the bidders and the targets belong to different industry codes. In contrast to results on vertically related mergers, the time-trend in pure vertical mergers is unclear.

If vertical mergers have increased over time but pure vertical mergers remain relatively stable, then the number of mixed vertical-horizontal mergers must account for the increasing intensity of vertical relatedness over time. The results in Table 2 show that almost 17 percent of all mergers are mixed vertical-horizontal, i.e., the merging firms belong the same IO industry and have significant vertical relatedness. Mirroring the pattern for vertical mergers reported in Table 1, the proportion of mixed vertical-horizontal mergers in the sample shows a significant increasing trend. Although only about 13 percent of the mergers had both vertical and horizontal linkages between bidders and targets in the 1960s, the proportion had substantially increased by the 1990s, when almost 25 percent of the mergers exhibited such linkages.

Finally, pure horizontal mergers account for approximately 11 percent of the sample. Reflecting the refocusing trend, pure horizontal merger activity significantly increased from 6 percent in the 1960s to almost 17 percent in the 1990s. We replicate all of the tests using the stricter definition of vertical relatedness, i.e., the 5 percent cut-off. Panel B reports the results using the stricter definition of vertical relatedness. The results are qualitatively identical to those based on the 1 percent cut-off.

Our results show that since the 1980s, mergers are often vertically related. This increase is largely attributable to firms merging with firms in their own industries that present good opportunities for vertical integration. We also find an increasing trend of pure horizontal mergers. The results also contribute to the literature on corporate diversification. We find that diversifying mergers, i.e., mergers that are neither vertically nor horizontally related, have decreased in importance since the late 1970s.[9]

4. Vertical mergers and wealth effects

This section addresses several important issues concerning the wealth effects of mergers of different types. Do vertical mergers create value? How do the wealth effects of vertical mergers compare with those of horizontal and/or diversifying mergers? Earlier studies show that wealth effects are smaller for cross-industry mergers.[10] However, as we reported earlier, not all cross-industry mergers are unrelated. Are the wealth effects in cross-industry, but vertically related, firms different from those in cross-industry, but vertically unrelated firms? To answer these questions, we examine the cross-sectional variation in the wealth effects of mergers by merger type. We also examine if there is a time-series relation between vertical merger activity and wealth effects.

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[9] These findings are consistent with the trend of de-conglomeration and refocusing documented in the literature (Ravenscraft and Scherer (1987) and Markides (1995)).

[10] See, for example, Kaplan and Weisbach (1992), Chevalier (2000), Andrade, Mitchell, and Stafford (2001), and Graham, Lemmon, and Wolf (2002). These studies also report that acquirers' abnormal returns are insignificant or slightly negative. Morck, Shleifer, and Vishny, (1990) and Maquieira, Megginson, and Nail (1998) document that conglomerate mergers, mergers between firms of different industry codes, negatively affect acquirers' abnormal returns. On the other hand, Matsusaka (1993) and Hubbard and Palia (1999) report that conglomerate mergers in the 1960s and the early 1970s are associated with positive abnormal returns for acquirers.

4.1. Measuring the wealth effects of mergers

We use standard event study methodology to estimate the wealth effects of mergers. We estimate market model parameters for bidders and targets, using daily returns over a 255-day estimation period that ends 46 days before the initial merger announcement. We use the CRSP value-weighted index as the market proxy. We estimate cumulative abnormal returns (CARs) for two different event-windows, a shorter window, one day before the event date through one day after the event date, (-1,+1); and a longer window, ten days before the event date through ten days after the event date, (-10,+10), where day zero is the initial merger announcement as determined by the Wall Street Journal Index (WSJI) or the Lexis/Nexis database. Following Bradley, Desai, and Kim (1988) and Mulherin and Boone (2000), we estimate the combined wealth effect of mergers as the weighted average CARs of bidders and targets. We use the respective market values of the equity of bidders and targets ten days before the initial announcement as weights.

4.2. Wealth effects by merger type and by period

Table 3 reports descriptive statistics on the wealth effects of mergers. The combined average wealth effect for the entire sample of 2,162 mergers during the 1962-1996 is 1.9 percent for the (-1,+1) window and 2.4 percent for the (-10,+10) window.[11] Overall, the

[11] Not reported in the table, the median combined return is in excess of 1 percent. Only a little over one-quarter of the mergers destroy value, i.e., have negative wealth effects.

magnitude of the wealth effects for this sample of mergers supports the findings in previous studies on the value gains in mergers.[12]

The combined wealth effects in vertical mergers are larger compared with the effect for the overall sample. The combined wealth effect in the (-1,+1) window is 2.5 percent in vertical mergers compared with 1.9 percent for the entire sample. The difference between wealth effects for vertical mergers and that for all mergers is statistically significant at the 1 percent level (p-value=0.008). When we disaggregate the vertical mergers into pure vertical mergers and mixed vertical-horizontal mergers, we find wealth effects for these subsamples that are similar to those for the overall vertical merger sample. The wealth effects in pure vertical mergers are 2.3 percent and 2.7 percent in mixed vertical-horizontal mergers.

Confirming previous evidence, our results also reveal that diversifying mergers generate significantly lower wealth effects. The average returns for diversifying mergers are about 1.4 percent over the entire period. Although diversifying mergers are associated with smaller wealth effects, they are nonetheless positive.[13]

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[12] For example, Andrade, Mitchell, and Stafford (2001) report a very similar positive 1.8 percent combined wealth effect for the (-1, +1) window for CRSP mergers during 1973 through 1998. Jensen and Ruback (1983) and Jarrell, Brickley, and Netter (1988) survey the earlier evidence on the wealth effects in mergers and acquisitions. Mulherin and Boone (2000) provide more recent evidence from the 1990s.

[13] The results that diversifying mergers do not destroy value are consistent with prior findings in merger studies (see Kaplan and Weisbach (1992), Chevalier (2000), Andrade, Mitchell, and Stafford (2001), and Graham, Lemmon, and Wolf (2002)) and with the plant-level evidence in Maksimovic and Philips (2002)).

In contrast, pure horizontal mergers create the most value; the average wealth effect in pure horizontal mergers is approximately 2.9 percent. However, the wealth effect in pure horizontal mergers is statistically indistinguishable from that in vertical mergers (p-value=0.43).

To examine robustness, Panel B of Table 3 presents results on combined wealth effects for the longer window (-10,+10). Panels C and D present results for related mergers for the two windows for vertical relatedness based on a 5 percent cut-off. The results in these panels indicate that our conclusions are robust to the choice of event window and the vertical relatedness cut-off that defines merger types.

The period-by-period wealth effects for the overall sample suggest that the average merger wealth effects are greater during the 1980s and 1990s compared with those during the 1960s and 1970s.

The results in Table 3 also show that vertical mergers generated significantly greater wealth effects during the 1980s and 1990s than in the previous two decades. Vertical mergers, defined at the 1 percent cut-off, indicate a positive 3.3 and 1.9 percent wealth effects for the (-1, +1) window during the 1981-1990 and the 1991-1996 subperiods. In contrast, the wealth effects in the earlier 1962-1970 and 1971-80 periods are only positive at 1.4 and 1.2 percent, respectively. Measuring wealth effects using the (-10, +10) window yields a similar result. When we disaggregate vertical mergers into pure vertical and mixed vertical-and-horizontal mergers, we find that both types of vertical mergers

generated higher wealth effects in the 1980s and 1990s. We do not find a similar trend in wealth effects for the pure horizontal mergers or for the diversifying mergers.

4.3. Regression analysis

To examine if wealth effects and the degree of vertical relatedness are cross-sectionally related, we regress the combined wealth effect of a merger on several sets of variables that indicate relatedness. As control variables, all regressions include the relative size of the target and dummies for stock-financed mergers, industry and time on the right-hand side.

All of the estimated regressions include three broad industry dummies for basic, manufacturing and utility industries. The broad industry dummy variables equal one if the acquirer is primarily affiliated with basic (SIC<3000), manufacturing (3000<=SIC<4000), or utilities (4000<=SIC<5000) industries, respectively. We also include three time-period dummies that are equal to one if the initial announcement of the merger occurred during 1971-1980, 1981-1990, or 1991-1996. The coefficients on the industry and time dummies are not reported in the tables.

In Table 3, the dummy for stock-financed mergers takes a value of one if the merger is partially or wholly financed by stock. We include a dummy for stock-financed mergers because several studies show that announcement returns to bidding firms are higher in cash offers compared with stock offers (see Travlos (1987)). We expect stock-financed mergers to generate lower wealth effects because of the adverse selection associated with

the payment of stock. We estimate relative size as the ratio of the target's equity value divided by the bidder's equity value two days before the initial merger announcement.

Table 4 presents the regression results. The dependent variable in Columns (1)-(5) is the wealth effect for the (-1,+1) window. The dependent variable in Columns (6)-(10) is the wealth effect for the (-10,+10) window. In addition to the control variables, the independent variables in the first equation include the vertical relatedness coefficient. In the second equation, the independent variables include a vertical relatedness dummy that takes a value of one if the merger is between firms with a vertical relatedness coefficient that exceeds 1 percent. The third equation includes a set of dummy variables for related mergers. We include a dummy for pure vertical mergers, a dummy for mixed vertical-horizontal mergers, and a dummy for pure horizontal mergers.

We report a positive and statistically significant coefficient on the vertical relatedness coefficient and dummies in the first and second column, respectively. These results show that wealth effects are significantly higher for vertically related mergers relative to other types of mergers. As with our previous findings, results in the third column suggest that vertically and horizontally related mergers create significantly greater wealth effects than do diversifying mergers. The estimated coefficients on pure vertical mergers and on mixed vertical-horizontal mergers are both positive and significant.

The intercept term is positive and significant in the third column, suggesting that diversifying mergers also create value, albeit less value than other related mergers. This

evidence is consistent with the basic statistics in Table 3 and echoes evidence from prior studies.

As predicted, the estimated coefficient on the stock-financed dummy is consistently negative and the estimated coefficient on relative size is consistently positive. Although we do not report the estimated coefficients on the broad industry dummies and time period dummies, we generally find that mergers that involve bidders in the manufacturing industry are indicative of higher value gains. However, the differences are not statistically significant across industry groups.

To examine the robustness of the results, we define vertical relatedness at the alternative 5-percent cut-off and repeat the regression tests. We obtain results that are similar to those reported in the second and third columns of Table 4. We also replicate the regression tests using the wealth effect defined at the longer (-10, +10) window. The results in Columns (6)-(10) remain similar.

To examine whether these regression results are period specific, we divide our sample in four subperiods. We re-estimate the three equations described above separately for each of the subperiods, but without the time-period dummies. Table 5 reports the results from these subperiod regressions.

The notable finding that emerges from these estimated regression results is that, in the 1960s, the wealth effects in mergers in the (-1,+1) window are unrelated to the relatedness measures and the method of payment. During the 1970s, the wealth effects

are systematically related to the stock finance dummy and relative size, but are still unrelated to various relatedness measures. However, the sensitivity of wealth effects to vertical and horizontal relatedness dramatically increases in the 1980s and 1990s. These period results are robust to the choice of event window and the vertical relatedness cut-off.

It is unclear why the wealth effects of relatedness in the 1960s and 1970s are insignificant. Perhaps the lack of relationship indicates that the merging firms were unable to realize the potential synergy, or that they faced additional costs in vertical or horizontal combinations. For example, the stiffer antitrust regulation and enforcement in the 1960s and 1970s may have imposed costs and thus reduced both the frequency and the benefits from vertical and horizontal mergers.

4.4 Specific assets, vertical mergers and risk changes

The transactions cost theory of Williamson (1971, 1975, 1979) and Klein, Crawford, and Alchian (1978) maintains that vertical relations often require contracting parties to invest in relationship-specific assets that are subject to the hazards of opportunistic behaviour. A major motivation for vertical mergers is to protect the investments in specific assets from opportunistic expropriation. The following subsections test two implications resulting from the transactions cost rationale for vertical mergers.

4.4.1 Co-movement in vertical merger activity and wealth effects

The transactions cost theory emphasizes that uncertainty is a necessary condition for asset specificity to affect organizational structure. Economic shocks, which result in high price uncertainty, exacerbate contracting problems and alter the relative efficiency of alternative organizational structures. Economic shocks therefore affect both the incentives for firms to integrate vertically and the resulting efficiency gains from such mergers.[14]

We therefore examine time-series co-movement between vertical merger activity and average wealth effects in vertical mergers. For comparison, we also analyze the aggregate activities of the other types of mergers. We transform the data to generate annual observations of average wealth effects by merger type and merger intensity by merger type, which we define as the ratio of the number of mergers of a given type to the total number of mergers in a particular year. This results in 35 annual observations, one for each year during 1962-1996. We then estimate regressions of the wealth effects on merger intensity by merger type.

Table 6 reports the estimated coefficients of the merger intensity variables from the set of regressions, the associated t-statistics and the adjusted R^2s. Confirming our conjecture, the average wealth effect in vertical mergers is significantly and positively

[14] Consistent with the transactions cost rationale for vertical integration, Fan (2000) finds that input price uncertainty in the 1970s positively affected the extent of vertical integration by petrochemical firms into input stages.

related to the intensity of vertical merger activity relative to overall merger activity. The results also show that this relation is largely attributable to the mixed vertical-horizontal mergers. Pure vertical mergers, pure horizontal mergers, and diversifying merger activities are not significantly correlated with average wealth effects over time.

4.4.2 Vertical merger and risk changes

The presence of specialized assets suggests that the systematic risk of assets of a portfolio of vertically related firm depends on the covariance between the value of assets in their alternative use and the market portfolio. The systematic risk declines when two vertically related firms merge and the possibility of hold-up is suppressed under the common ownership (see Spiller (1985) for a formal derivation). Thus, the covariance between the alternative-use value of assets of vertically related firms and the market portfolio is larger than what would be obtained if the two vertically related firms were merged. We therefore predict that the asset beta of the merged firm in vertical mergers will be lower than the pre-merger asset beta of a portfolio consisting of the bidder and the target.

We estimate the pre- and post-merger asset betas for the sample mergers classified by relatedness. The asset beta equals

$$\beta^{E} \times \frac{E}{D+E} + \beta^{D} \times \frac{D}{D+E} \qquad (1)$$

where D is book value of debt in the year prior to the merger for pre-merger asset betas, and the year after the completion of the merger for the post-merger asset betas. E is

market value of equity at the fiscal year-end before the merger announcement for pre-merger asset betas, and at the fiscal year-end after the merger completion for post merger asset betas, β^E is the equity beta and β^D is the debt beta, which we assume equals 0.15.

We calculate pre-merger equity betas for the bidder and the target by using the market model and the value-weighted index from 270 trading days to 16 trading days before the merger announcement. We estimate post-merger equity betas for the merged firm using the market model and the value-weighted index from 16 trading days to 270 trading days after the merger completion. We estimate the combined pre-merger asset beta by value-weighting the bidder and target asset betas, using weights based on market values of the bidder and target ten days before the merger announcement.

Table 7 reports the average asset betas for the value-weighted portfolio of bidders and targets in the pre-merger period and for the combined firms in the post-merger period. The results in Panel A show that although the asset betas decline for all mergers, the drop in asset beta is greatest for vertical mergers. The mean change in asset beta around vertical mergers is -0.09, compared to -0.02 for diversifying mergers.

To examine whether the decline in asset beta is significantly greater for vertical merger relative to other mergers, Panel B presents results from regressions on the change in asset betas around mergers on vertical relatedness dummies. As we predicted, we find that the coefficient on the vertical merger dummy is negative and significant at the 10 percent level, which suggests that asset betas in vertical mergers decline by an amount

that is statistically larger than the decline in asset betas in other mergers. These results support the systematic risk reduction rationale for vertical mergers.

5. Conclusion

By using industry commodity flows information in input-output tables, we create a unique opportunity to measure vertical relatedness in a large sample of mergers during the period 1962-1996.

We present four key findings in this paper.

First, a significant fraction of mergers during the 1962-1996 had significant vertical relatedness. When we classify a merger as vertically related if the vertical relatedness coefficient exceeded 1 percent, almost one-third of mergers in the sample exhibit vertical relatedness. When we use a stricter definition of vertical relatedness that requires the vertical relatedness coefficient to exceed 5 percent, almost 19 percent of mergers are vertically related.

Second, we find that the vertical merger activity has been increasing over time. Mergers in the 1980s and 1990s provide significantly greater opportunities for vertical integration.

Third, vertical mergers result in significant positive wealth effects that are comparable to those in horizontal mergers. Even in a subsample of mergers between bidders and targets in different industries, vertically related mergers generate significantly greater positive wealth effects compared to vertically unrelated mergers.

The wealth effects of vertical mergers are greater in the post-1980 period compared with those in the 1960s and 1970s. Moreover, we can attribute the higher merger wealth effects in the 1980s and 1990s relative to the 1960s and 1970s to vertical mergers, those mergers that create opportunity for vertical integration.

Fourth, consistent with the view that economic shocks induce vertical merger activity and the associated wealth gains from vertical mergers, we find a significant co-movement in the wealth effects in vertical mergers and vertical merger activity. Thus, periods of intense vertical merger activity are also periods in which vertical mergers create larger positive wealth effects. We also find a significant decline in asset beta around vertical mergers. This result is consistent with the view that vertical mergers protect investments in specific assets that are subject to hazards of opportunistic behavior.

This paper takes a first step in understanding the patterns and wealth effects of vertical mergers. Future research could examine how macroeconomic or industry shocks alter the cost tradeoffs between contracting and internal organization, and how the changes in these tradeoffs affect merger activity. Future research could also explore alternative theories that explain the pattern of vertical mergers and their value gains that we report in this paper.

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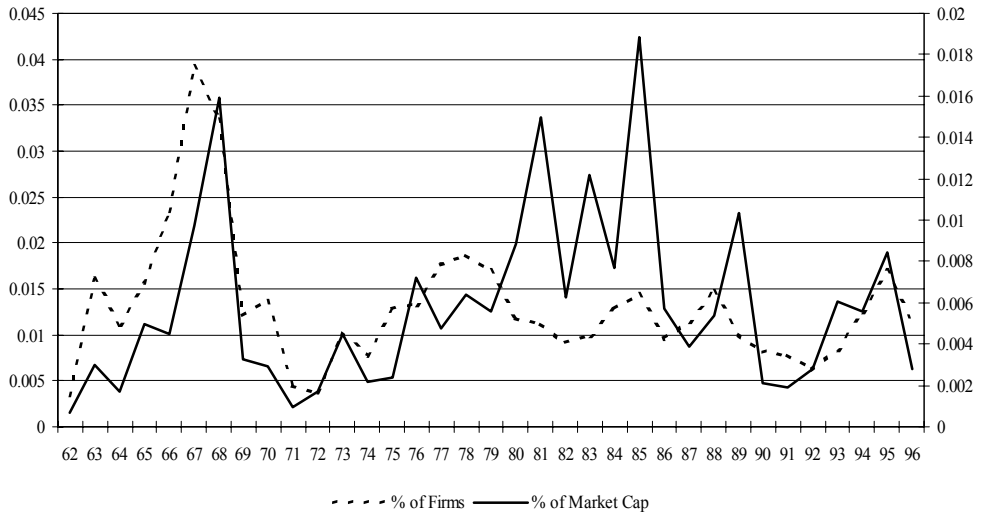

Figure 1: Merger activity, 1962-1996. The dotted line indicates the number of firms during the year expressed as the fraction of the beginning-of-year firms on CRSP. The solid line indicates the ratio of aggregate dollar value of merger over the year divided by the total beginning-of-year market capitalization of the firms listed on CRSP.

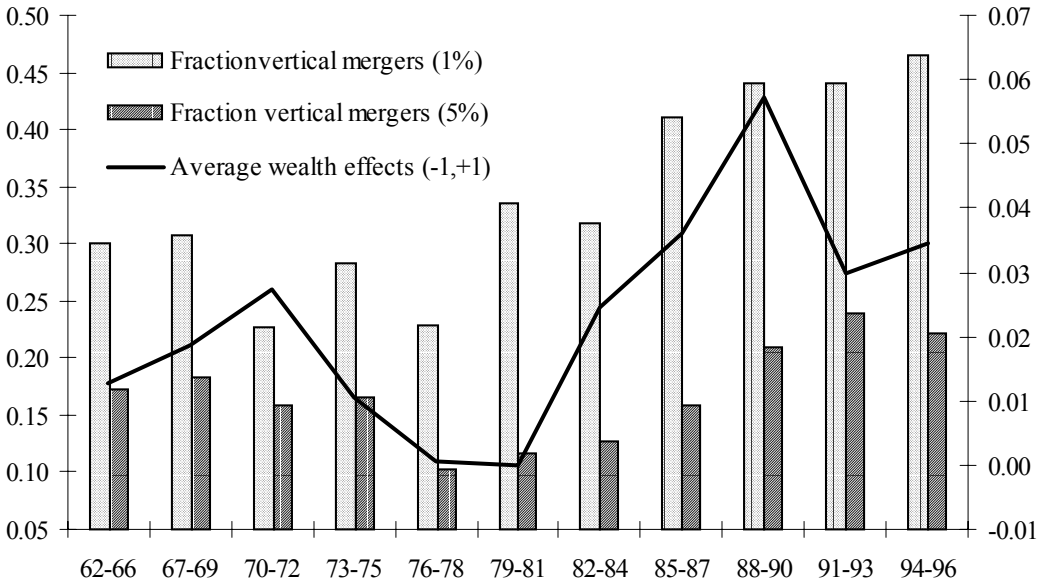

Figure 2: Fraction of vertically related mergers (at the 1% and 5% cut-offs) and average combined wealth effects in vertical mergers during 1962-1996.

Table 1

Vertical merger activity

The sample includes 2,162 mergers completed during 1962-1996. Panel A provides descriptive statistics on the vertical relatedness coefficients in mergers grouped by whether they are cross- or within-industry. We follow the Bureau of Economic Analysis in defining cross-industry mergers as combinations between firms in different input-output (IO) industries. Within-industry mergers are combinations between firms in the same IO industry. We define the vertical relatedness coefficient as the maximum of the input requirement coefficients between the industries in which the merging firms operate. The input requirement coefficients of a pair of industries represent the dollar value of one industry's output required to produce one dollar's worth of the other industry's output. Panel B provides the mean vertical relatedness coefficient and the fraction of vertical mergers by number and by value (using both the 1% and 5% cutoffs) for various sub-periods.

Panel A: Descriptive statistics for vertical relatedness coefficients

	N	First quartile	Mean	Median	Third quartile
All mergers	2162	<0.001	0.034	0.003	0.027
Cross-industry	1544	0.000	0.022	0.001	0.011
Within-industry	618	0.004	0.065	0.030	0.104

Panel B: Average vertical relatedness coefficient and vertical merger activity over time

		Mean vertical relatedness	Fraction of vertical mergers (1 percent cutoff)		Fraction of vertical mergers (5 percent cutoff)	
Period	N	coefficient	by number	by value	by number	by value
1962-70	377	0.031	0.30	0.35	0.17	0.20
1971-80	569	0.028	0.27	0.36	0.13	0.14
1981-90	702	0.035	0.39	0.44	0.18	0.25
1991-96	514	0.041	0.45	0.51	0.28	0.25
1962-96	2162	0.034	0.36	0.43	0.19	0.22

Table 2

Merger activity among cross-industry, diversifying, pure vertical, mixed vertical-and-horizontal, and pure horizontal mergers during 1962-1996

The sample consists of 2,162 mergers. Panel A reports the fraction of cross-industry, diversifying, pure vertical, vertical-horizontal and pure horizontal mergers based on a 1% vertical relatedness cutoff. Panel B reports similar fractions except that vertical relatedness is based on a 5% cutoff. Cross-industry mergers are between firms belonging to different input-output (IO) codes. Diversifying mergers are cross-industry and vertically unrelated. Pure vertical mergers are between firms that are vertically related but belong to different industries based on IO codes. We classify vertically related mergers within industry as mixed vertical-horizontal. A merger is purely horizontal if it is within-industry but vertically unrelated.

	Cross-industry mergers		Diversifying mergers		Pure vertical mergers		Vertical-horizontal mergers		Pure horizontal mergers	
Period	number	value	number	value	number	value	number	value	number	value
Panel A: Based on a 1 percent cut-off										
1962-70	0.81	0.86	0.64	0.64	0.17	0.25	0.13	0.13	0.06	0.04
1971-80	0.82	0.86	0.65	0.67	0.18	0.22	0.10	0.16	0.08	0.03
1981-90	0.67	0.71	0.49	0.49	0.18	0.23	0.20	0.23	0.12	0.08
1991-96	0.58	0.72	0.37	0.40	0.20	0.33	0.25	0.19	0.17	0.11
1962-96	0.71	0.79	0.53	0.57	0.18	0.26	0.17	0.19	0.11	0.08
Panel B: Based on a 5 percent cut-off										
1962-70	0.81	0.86	0.73	0.77	0.07	0.12	0.10	0.12	0.10	0.05
1971-80	0.82	0.86	0.75	0.78	0.07	0.10	0.06	0.05	0.12	0.13
1981-90	0.67	0.71	0.62	0.64	0.05	0.10	0.13	0.18	0.20	0.15
1991-96	0.58	0.72	0.50	0.66	0.07	0.07	0.20	0.18	0.22	0.13
1962-96	0.71	0.79	0.65	0.71	0.07	0.09	0.12	0.15	0.16	0.13

Table 3

Wealth effects for the sample mergers by time-period and relatedness, 1962-1996

This table reports the combined wealth effects for a sample of 2,162 mergers during 1962-1996. The combined wealth effect is the value-weighted average of the bidder and target cumulative abnormal returns (CAR), where we estimate the weights based on bidder and target equity values ten days before the initial merger announcement. We estimate the CARs for the bidder and the target around the day of the merger announcement for two different event windows, (-1,+1) and (-10,+10), using a market model with an estimation period of 250 days ending 46 days before the announcement. The table also reports CARs for mergers stratified by various relatedness types. In Panels A and B, we classify mergers as vertically related if the vertical relatedness coefficient exceeds 1%. In Panels C and D, we classify mergers as vertically related if the vertical relatedness coefficient exceeds 5%. Pure vertical mergers are between firms that belong to different input-output (IO) codes but are still vertically related. Mixed vertical-horizontal mergers are between firms that belong to the same IO code and are also vertically related. Pure horizontal mergers are between firms that are not vertically related but belong to the same IO code. Diversifying mergers are between firms in different IO codes that are also vertically unrelated. ***Significant at the 1% level. **Significant at the 5% level. *Significant at the 1% level.

Period	All mergers (1)	Vertically related (2)	Pure vertical (3)	Pure horizontal (4)	Mixed vertical-and-horizontal (5)	Diversifying mergers (6)
Panel A: Mean wealth effects (-1,+1) by period and by type of mergers (1% cutoff)						
1962-70	0.015***	0.014***	0.011**	0.033***	0.018***	0.014***
1971-80	0.015***	0.012***	0.017***	0.039***	0.003	0.014***
1981-90	0.021***	0.033***	0.031***	0.020**	0.035***	0.012***
1991-96	0.024***	0.029***	0.026***	0.031***	0.031***	0.016***
1962-96	0.019***	0.025***	0.023***	0.029***	0.027***	0.014***
Panel B: Mean wealth effects (-10,+10) by period and by type of mergers (1% cutoff)						
1962-70	0.022***	0.030***	0.028***	0.022	0.032**	0.018***
1971-80	0.019***	0.024***	0.022**	0.049***	0.027**	0.013***

Period	All mergers (1)	Vertically related (2)	Pure vertical (3)	Pure horizontal (4)	Mixed vertical-and-horizontal (5)	Diversifying mergers (6)
1981-90	0.027***	0.046***	0.045***	0.037**	0.047**	0.009
1991-96	0.027***	0.037***	0.038***	0.024*	0.036***	0.015**
1962-96	0.024***	0.037***	0.035***	0.033***	0.038***	0.013***
Panel C: Mean wealth effects (-1,+1) by period and by type of mergers (5% cutoff)						
1962-70	0.015***	0.016***	0.016**	0.031***	0.016**	0.013***
1971-80	0.015***	0.009*	0.018**	0.031***	-0.002	0.014***
1981-90	0.021***	0.033***	0.036***	0.028***	0.031***	0.016***
1991-96	0.024***	0.031***	0.032***	0.031***	0.031***	0.017***
1962-96	0.019***	0.025***	0.026***	0.030***	0.025***	0.015***
Panel D: Mean wealth effects (-10,+10) by period and by type of mergers (5% cutoff)						
1962-70	0.022***	0.031***	0.029*	0.025*	0.033**	0.019***
1971-80	0.019***	0.012	0.016	0.051***	0.008	0.015***
1981-90	0.027***	0.048***	0.040***	0.038***	0.051***	0.017***
1991-96	0.027***	0.042***	0.049***	0.024**	0.039***	0.019***
1962-96	0.024***	0.037***	0.034***	0.035***	0.038***	0.017***

Table 4

Wealth effects and vertical mergers

The table presents regressions of combined wealth effects on variables that describe the vertical and/or horizontal relations of the merged firms, a dummy for stock-financed mergers, and relative size of the target (*t*-statistics are reported in parentheses). All of the regressions control for industry and time period effects (coefficients are not reported in the table). We define the vertical relatedness coefficient as the maximum of the input requirement coefficients between the industries in which the merging firms operate. The vertical merger dummy takes a value of one if the merged firms are vertically related at the 1% (5%) cut-off and zero otherwise. The pure vertical dummy takes a value of 1 if the merged firms are vertically related but belong to different input-output (IO) industries. The mixed vertical-horizontal dummy takes a value of one if the merged firms are vertically related and belong to the same IO industry. The pure horizontal dummy takes a value of one if the merged firms are vertically unrelated and are assigned the same IO industry. We measure relative size as the ratio of the pre-bid equity value of the target to the pre-bid equity value of the bidder. ***Significant at the 1% level. **Significant at the 5% level. *Significant at the 1% level.

	(-1,+1) window					(-10,+10) window				
		Vertically related at the level of					Vertically related at the level of			
		1 percent	1 percent	5 percent	5 percent		1 percent	1 percent	5 percent	5 percent
Intercept	0.023 (4.7)***	0.022 (4.3)***	0.014 (2.6)***	0.23 (4.6)***	0.016 (3.0)***	0.021 (2.6)***	0.018 (2.1)**	0.005 (0.5)	0.021 (2.5)**	0.010 (1.1)
Vertical relatedness coefficient	0.029 (1.8)*					0.078 (2.9)***				
Vertical merger dummy		0.009 (3.0)***		0.006 (1.8)*			0.20 (4.2)***		0.014 (2.4)**	
Pure vertical merger dummy			0.009 (2.9)***		0.010 (2.1)**			0.023 (4.2)***		0.016 (2.0)**
Vertical-horizontal merger dummy			0.013 (3.6)***		0.009 (2.1)**			0.028 (4.1)***		0.022 (2.8)***
Pure horizontal merger dummy			0.017 (3.0)***		0.016 (3.6)***			0.030 (3.3)***		0.024 (3.3)***
Dummy if stock financed	-0.018 (-7.3)***	-0.18 (-7.3)***	-0.018 (-7.4)***	-0.018 (-7.3)***	-0.018 (-7.4)***	-0.021 (-4.6)***	-0.021 (-4.6)***	-0.021 (-4.6)***	-0.021 (-4.6)***	-0.021 (-4.6)***

	(-1,+1) window					(-10,+10) window				
		Vertically related at the level of					Vertically related at the level of			
		1 percent	1 percent	5 percent	5 percent		1 percent	1 percent	5 percent	5 percent
Relative size	0.009	0.009	0.009	0.009	0.009	0.014	0.014	0.014	0.014	0.014
	(2.4)**	(2.4)**	(2.3)**	(2.4)**	(2.3)**	(3.1)***	(3.1)***	(3.1)***	(3.1)***	(3.1)***
N	2137	2137	2137	2137	2137	2141	2141	2141	2141	2141
R^2	0.06	0.06	0.07	0.06	0.06	0.04	0.04	0.05	0.04	0.04

Table 5

Period analysis of the relation between wealth effect and vertical relatedness

The table presents regressions of combined wealth effects (-1,+1) on variables that describe the vertical and/or horizontal relations of the merged firms, a dummy for stock-financed mergers, and the relative size of the target (t-statistics are reported in parentheses). We estimate the regressions separately for the 1962-1970, 1971-1980, 1981-1990, and 1991-1996 periods, and include broad industry dummies. The vertical relatedness dummy takes a value of one if the merged firms are vertically related at the 1% cut-off and zero otherwise. The pure vertical dummy takes a value of one if the merged firms are vertically related but belong to different input-output (IO) industries. The mixed vertical-horizontal dummy takes a value of one if the merged firms are vertically related and belong to the same IO industry. The pure horizontal dummy takes a value of one if the merged firms are vertically unrelated and are assigned the same IO industry. We measure relative size as the ratio of the pre-bid equity value of the target to the pre-bid equity value of the bidder. ***Significant at the 1% level. **Significant at the 5% level. *Significant at the 1% level.

	1962-1970			1971-1980			1981-1990			1991-1996		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept	0.025	0.026	0.019	0.023	0.024	0.016	0.015	0.010	0.003	0.028	0.026	0.014
	(2.1)**	(2.1)**	(1.3)	(4.2)***	(4.1)***	(2.4)**	(2.3)**	(1.5)	(0.4)	(4.2)***	(3.7)***	(1.7)*
Vertical relatedness	-0.004			-0.026			0.085			0.051		
coefficient	(-0.1)			(-1.1)			(2.6)***			(1.1)		
Vertical merger dummy		-0.003			-0.004			0.021			0.010	
		(-0.7)			(-1.0)			(4.1)***			(1.6)	
Pure vertical merger			-0.005			0.003			0.021			0.013
dummy			(-0.9)			(0.7)			(3.1)***			(1.6)
Vertical-horizontal dummy			0.002			-0.011			0.027			0.020
			(0.2)			(-1.9)*			(4.1)***			(2.5)**
Pure horizontal dummy			0.015			0.018			0.015			0.022
			(1.1)			(1.8)*			(1.5)***			(2.0)**
Dummy if stock financed	-0.008	-0.008	-0.009	-0.018	-0.018	-0.017	-0.025	-0.025	-0.025	-0.014	-0.014	-0.014
	(-1.6)	(-1.6)	(-1.8)*	(-5.0)***	(-5.0)***	(-5.0)***	(-5.0)***	(-5.1)***	(-5.1)***	(-2.4)**	(-2.4)**	(-2.4)**

	1962-1970			1971-1980			1981-1990			1991-1996		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Relative size	0.014	0.014	0.014	0.025	0.025	0.024	0.013	0.013	0.013	0.002	0.002	0.002
	(2.3)**	(2.3)**	(2.2)**	(4.7)***	(4.7)***	(4.6)***	(2.9)***	(3.0)***	(3.0)***	(0.7)	(0.7)	(0.7)
N	370	370	370	564	564	564	693	693	693	510	510	510
R^2	0.05	0.05	0.06	0.14	0.14	0.15	0.10	0.11	0.12	0.02	0.02	0.03

Table 6

Time series regression estimates of wealth effects and merger activity, 1962-1996

The table reports the estimated regression coefficients from regressions of annual average wealth effects (-1,+1) on the merger intensity of different merger types each year. *t*-statistics are in parentheses and R^2 are in brackets. The sample includes 35 annual observations. Vertically related mergers have a relatedness coefficient exceeding 1%. Pure vertical mergers are between firms vertically related but belonging to different input-output (IO) industries. Mixed vertical-horizontal mergers are between vertically related firms belonging to the same IO industry. Pure horizontal mergers are between vertically unrelated firms belonging to the same IO industry. Diversifying mergers are between vertically unrelated firms belonging to different IO industries. ***Significant at the 1% level. **Significant at the 5% level.

	Dependent variable: Annual average wealth effects
Vertical merger activity	0.053
	(2.7)***
	[0.19]
Pure vertical merger activity	-0.034
	(-0.6)
	[0.01]
Pure horizontal merger activity	-0.125
	(-0.8)
	[0.03]
Mixed vertical-horizontal merger activity	0.079
	(2.2)**
	[0.13]
Diversifying merger activity	0.012
	(0.8)
	[0.02]

Table 7

Changes in systematic risk around mergers

The table reports average pre- and post-merger asset betas, and changes in asset betas for the sample mergers classified by relatedness. The asset beta equals

$$\beta^{E} \times \frac{E}{D+E} + \beta^{D} \times \frac{D}{D+E}$$

where D is book value of debt in the year prior to the merger for pre-merger asset betas and the year after the completion for the post-merger asset betas; E is market value of equity at the fiscal-year end before the merger announcement for pre-merger asset betas and at the fiscal-end after the merger completion for post merger asset betas; β^{E} is the equity beta and β^{D} is the debt beta, which is assumed to equal 0.15. We calculate pre-merger equity betas for the bidder and the target using the market model and the value-weighted index from 270 trading days to 16 trading days before the merger announcement. We estimate post-merger equity betas for the merged firm using the market model and the Value-weighted index from 16 trading days to 270 trading days after the merger completion. We estimate the combined asset beta pre-merger by value-weighting the bidder and target asset betas, using weights based on market values of the bidder and target 15 days before the merger announcement. Panel B reports estimates from regressions of changes in asset beta around mergers on various relatedness and industry dummies.

Panel A: Change in asset β around mergers by relatedness

	All mergers (1)	Vertically related (2)	Pure vertical (3)	Pure horizontal (4)	Mixed vertical-and-horizontal (5)	Diversifying mergers (6)
Asset β combined- pre merger	0.822	0.893	0.863	0.784	0.924	0.777
Asset β combined- post merger	0.776	0.823	0.777	0.721	0.870	0.754
Change in asset β (Test: H_0=Change in asset β=0)	-0.045 (-4.1)***	-0.070 (-3.4)***	-0.086 (-3.3)***	-0.063 (-1.8)*	-0.054 (-1.7)*	-0.023 (-1.7)*

Panel B: Regression results for change in asset β

	Dependent variable: $\Delta\beta^A$			
	(1)	(2)	(3)	(4)
Vertical merger dummy	-0.039 (-1.7)*		-0.038 (-1.7)*	
Pure vertical merger dummy		-0.063 (-2.1)**		-0.060 (-2.0)**
Vertical-horizontal dummy		-0.031 (-1.0)		-0.025 (-0.8)
Pure horizontal dummy		-0.040 (-1.1)		-0.027 (-0.7)
Industry Dummies:				
Basic			0.061 (2.0)**	0.054 (1.6)
Manufacturing			-0.002 (-0.1)	-0.008 (-0.2)
Utilities			-0.001 (<0.0)	-0.012 (-0.3)
Constant	-0.030 (-2.2)**	-0.023 (-1.5)	-0.049 (-2.0)**	-0.039 (-1.2)
N	1255	1255	1255	1255
Adjusted R^2	0.002	0.002	0.005	0.004