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# A Time-Series Analysis of Mergers and Acquisitions in the U.S. Economy

Devra L. Golbe and Lawrence J. White

## 9.1 Introduction

The aggregate numbers and values of mergers and acquisitions in the U.S. economy of the 1980s have attracted a considerable amount of professional, political, and popular attention. Periodic announcements of large mergers or hostile tender offers continue to command media space and time. Something appears to be afoot in the American economy.

Surprisingly (at least to us), the widespread interest in takeovers has spawned relatively little effort to place the current wave in a proper historical context or to perform time-series analysis of the available merger and acquisition data.<sup>1</sup> Moreover, there has been virtually no effort to discuss the limitations of the available mergers and acquisitions data.

In this paper we attempt to help fill these gaps in our understanding of the topic. We first discuss the available time-series data on mergers and acquisitions and their suitability and limitations for time-series analysis; we also offer a historical perspective on the current merger wave. In section 9.3 we review the handful of previous time-series analyses of mergers and acquisitions. Section 9.4 develops a series of hypotheses on mergers that can be tested econometrically. In section 9.5 we discuss the specific methodology of our econometric tests,

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describe our data sources, and provide the results of the tests. We conclude in section 9.6.

## 9.2 Data Series, Their Limitations, and Some Historical Patterns

### 9.2.1 Overview

Ideally, a time series on mergers and acquisitions should be comprehensive and consistent and should contain data that cover a long period of time. Unfortunately, none of the available series meets these criteria, and compromises must be made.

One limitation to all of the available series is especially serious and warrants preliminary discussion: No data series includes *every* merger and acquisition in the U.S. economy; all series have a lower limit on the nominal dollar size of the transactions reported. For example, one data series discussed below includes only those mergers in which the acquired firm had assets of \$10 million or more. Thus, the purchase of Mabel's Coffee Shop by Sam's Garage—or even the “leveraged buy-out” of Mabel's Coffee Shop by Mabel's manager and cashier, Doris—will not be reported in any data series.

This kind of limitation has four consequences. First and most obviously, the smaller transactions are neglected. If these smaller transactions are highly correlated with the larger, reported ones, or if the former are relatively unimportant in the aggregate, then little has been lost. But if otherwise, the series may provide a misleading picture of merger activity over time. (And, since the transactions below the lower limit are not recorded, there is no way to tell.)

Second, if the period covered by the time series was one of significant inflation, the fixed lower limit on dollar size will artificially inflate the number of recorded transactions over time. In essence, the pattern of rising prices over the time period covered by the series will mean that some transactions of a given real size will fall below the fixed cutoff point in the early years and hence not be recorded, whereas in later years inflation will drive the nominal value of identical transactions above the cutoff point and thus cause them to be recorded. The longer the time period covered by a series and the greater the inflation, the more substantial is this problem of a spurious increase in the number of recorded transactions. In addition, this problem is not easily corrected with a simple adjustment for inflation (for example, through the use of a price index or deflator), since one needs to know the shape of the distribution of the real size of merger transactions (and, as a further complication, the shape of that distribution may change over time).<sup>2</sup>

Third, a time series of the aggregate *value* of the reported transactions will be biased upward because of both a pure inflation effect<sup>3</sup> and the cutoff point problem just discussed.

Fourth, many merger announcements (especially those for smaller transactions involving privately held companies) do not provide specific merger terms or values. Consequently, the reporting services may have to guess whether a transaction should be included in their data series. And even if the reporting service is confident that a transaction is large enough to warrant inclusion in its series on the number of mergers and acquisitions, the absence of value information usually causes the service to exclude the transaction from its series on the aggregate value of those mergers and acquisitions. Accordingly, the time series on the aggregate value of the transactions are even less complete than the time series on the number of transactions.

### 9.2.2 The Available Data Series

Our discussion will first focus on the data available for the period after World War II and then discuss the data for the prewar period.

#### *Post-World War II Data*

There are three basic sources of time-series data on mergers and acquisitions for the postwar period: the U.S. Federal Trade Commission (FTC), the periodical *Mergers & Acquisitions*, and the annual reports of W.T. Grimm & Co. We will discuss each of these sources, the nature of the data, and their strengths and drawbacks, in turn.

*FTC Data.* The FTC collected and published data on mergers in the manufacturing and mining sectors of the U.S. economy for the years 1948–1979.<sup>4</sup> One basic data set covered all mergers in which the acquired firm was in the manufacturing or mining sectors and had at least \$10 million in assets (book value) and for which information on the acquisition was publicly available.<sup>5</sup> The FTC published annual figures for both the number of mergers and the book value of the assets acquired. It also provided the relevant information on each transaction, so that quarterly series on numbers of mergers and their value could be constructed.

A second FTC series, which also covered the manufacturing and mining sectors, gave annual numbers of merger transactions extending from 1940 through 1979 and quarterly numbers extending from 1940 through 1954.<sup>6</sup> This second series appears to have been more inclusive than the first, since a far larger number of transactions were registered. But, unfortunately, the FTC did not indicate the inclusion criteria for this series.

The FTC data have a number of shortcomings. First, they cover only the manufacturing and mining sectors, which declined substantially in relative importance in the economy over the 1948–79 period and now constitute only a quarter of U.S. gross national product. Second, the \$10 million lower limit obviously created an upward bias, since the

general price level (as measured by the GNP deflator) tripled over the 32 years covered by the series. Third, the series excluded acquisitions by an individual or groups of individuals and hence would appear to exclude most leveraged buyouts of divisions or of whole companies. And finally, the FTC ceased collecting and publishing these data in 1981 (with 1979 as the last year for which data were made available), so the series do not cover the merger wave of the 1980s.

*Mergers & Acquisitions Data.* Quarterly issues of the periodical *Mergers & Acquisitions (M&A)* list the number of mergers and acquisitions consummated in recent quarters for the entire U.S. economy. Before the fourth quarter of 1980 the lower limit for inclusion in the series was a purchase price of at least \$700,000; in that quarter the lower limit was raised to \$1,000,000. A quarterly series on domestic companies being purchased (by either domestic or foreign companies) extends from the first quarter of 1967 to the present. Another series that also includes domestic companies' purchases of foreign companies extends from the fourth quarter of 1972 to the present. Both series include leveraged buyouts.

The *M&A* series have a number of drawbacks. First, they do not extend as far back in time as the FTC series. Second, the lower limit for inclusion changed abruptly in the middle of the series and, even so, did not properly adjust for the tripling of prices that occurred over the period covered. Third, efforts at integrating or splicing the *M&A* series with the FTC series (to create a longer overall series that would be up-to-date) pose problems of compatibility, since the series cover different universes and have different criteria for inclusion.

*The Grimm Data.* W.T. Grimm & Co. publishes data on the number of merger and acquisition announcements in the entire U.S. economy. The company's published annual series extends from 1963 through the present; its quarterly series extends from the first quarter of 1974 through the present. The lower limit for inclusion is a transaction involving at least a \$500,000 purchase price.

The Grimm data have the same problems as the *M&A* data: a limited historical reach; a fixed lower limit for inclusion; and difficulties of integration with the FTC data. In addition, the Grimm data pertain to announcements rather than consummations.

#### *Pre-World War II Data*

The major source of merger data for the years 1895-1920 is the study conducted by Ralph Nelson (1959). Nelson's data appear to cover only the manufacturing and mining sectors. The cutoff limits are not explicit; rather, Nelson relied on financial reporting during the period covered.

Nelson provided annual and quarterly series<sup>7</sup> for the number of transactions and the book value of the acquired firms.<sup>8</sup>

For the years 1919–39 Willard Thorpe compiled a quarterly series on the number of mergers in the manufacturing and mining sectors, a series that was reproduced by Nelson (1959, 166–67). The criteria for inclusion in the series are unclear. The Thorpe series was continued in 1940 by the broad FTC series discussed above, and the two series appear to be consistent and compatible.

### *A Summing Up*

Although data series are available that include the merger and acquisition experience of the 1980s, these series do not extend back far enough to provide an adequate historical perspective. The FTC data do provide historical reach, but they end in 1979. Furthermore, the FTC data exclude the services sectors, which are an increasingly important part of the U.S. economy. Finally, the inconsistencies between the more recent data series and the FTC data complicate any efforts at statistical inference. These problems will necessarily color the discussion and analysis below.

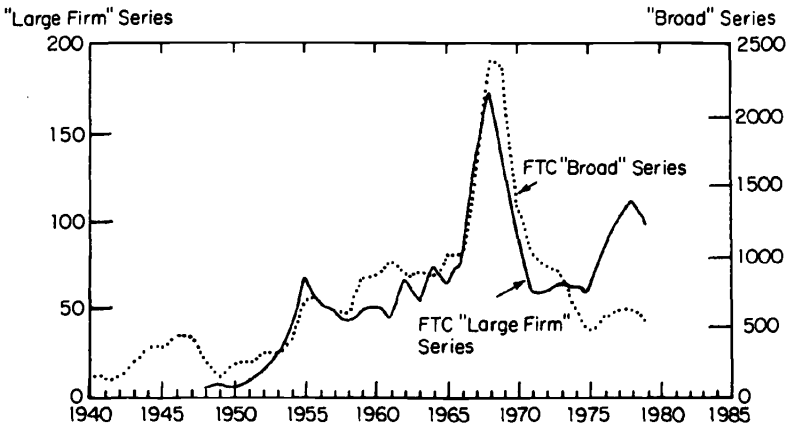
### 9.2.3 Some Historical Patterns

Having described the data series (and their drawbacks), we now present a summary of the historical patterns they suggest. The graphs below provide some indication of the consistency of the various data sources as well as a historical perspective on mergers and acquisitions.

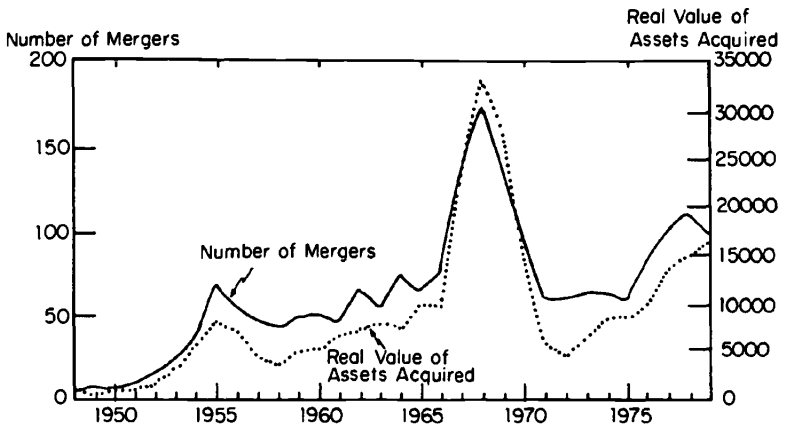
The FTC data are a basic source for research on merger activity. Figure 9.1 shows the annual FTC data for the number of large mining and manufacturing mergers and for “all” mining and manufacturing mergers, that is, the broader series. As can be seen, the two series track each other reasonably well. Both show a rise in the mid-1950s, a more gradual rise in the late 1950s and early 1960s, and then a sharp rise in the late 1960s (the “go-go years”<sup>9</sup>), followed by a steep decline in the early 1970s and another increase in the late 1970s.

It is sometimes suggested that the values of the transactions matter as much as, if not more than, the number of transactions. In fact, as figure 9.2 suggests, both sets of FTC data indicate similar patterns. This figure shows annual data for both the number of mergers and the real value (in 1982 dollars<sup>10</sup>) of the assets acquired, as measured by the FTC “large firm” series. Movements in the two series are fairly closely correlated, and both series clearly show the peak of the “go-go years.”

As noted above, a major drawback of the FTC series for our purposes is their failure to include data on the current merger wave. To place the recent experience in perspective, we need to splice more recent



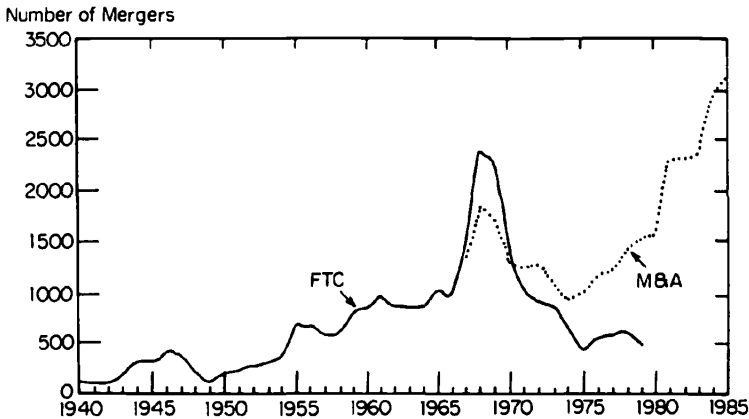
**Fig. 9.1** Annual number of mergers and acquisitions: FTC "Large Firm" and "Broad" series for manufacturing and mining



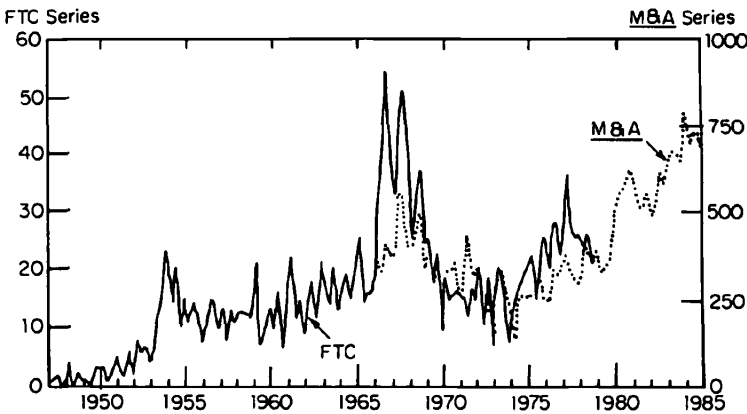
**Fig. 9.2** Annual number of mergers and acquisitions and real value of assets acquired (in millions of 1982 dollars): FTC "Large Firm" series for manufacturing and mining

data together with an appropriate FTC series. Figure 9.3 shows the annual number of mergers measured by the "broad" FTC series and by the annual *M&A* series covering purchases of domestic companies. These two series appear to track each other reasonably well, with both showing the peak in the late 1960s. The *M&A* data clearly depict the boom of the 1980s.

Similarly, figure 9.4 presents quarterly data for the number of mergers measured by the FTC "large firm" series and by the *M&A* "domestic" series. These series, too, appear to track each other well.



**Fig. 9.3** Annual number of mergers and acquisitions: FTC "Broad" series and M&A "Domestic" series



**Fig. 9.4** Quarterly number of mergers and acquisitions: FTC "Large Firm" series and M&A "Domestic" series

Figure 9.5 allows us to compare the quarterly data in the current sources. It presents the quarterly Grimm data on the number of mergers, along with the "domestic" quarterly series from M&A and the more comprehensive quarterly series from M&A. The two M&A series track each other quite well, but the Grimm data for the 1970s diverge markedly from those in the other two series. The reasons for this divergence are unclear. As was explained above, the Grimm data have a lower cutoff point and pertain to announcements rather than completions. But it seems unlikely that these differences could account for the divergence.



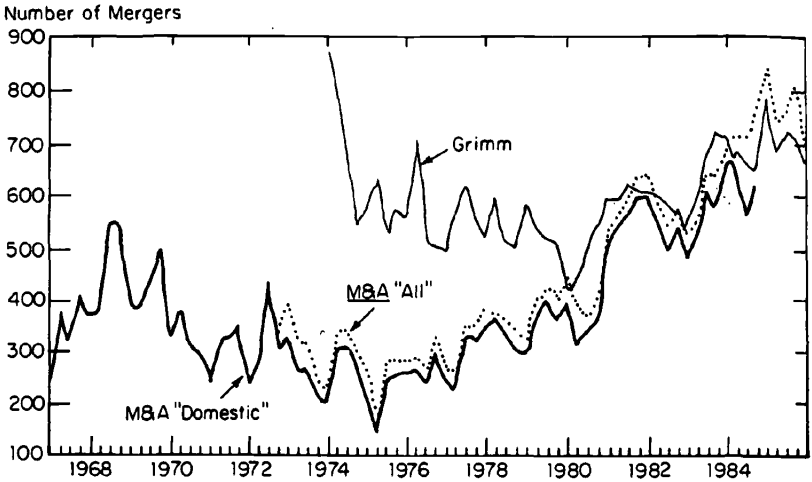


Fig. 9.5 Quarterly number of mergers and acquisitions: M&A "Domestic" series, M&A "All" series, and Grimm series

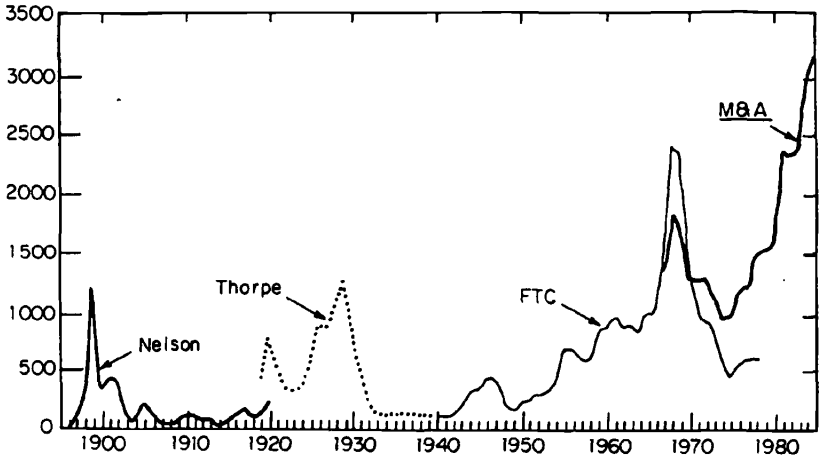


Fig. 9.6 Annual number of mergers and acquisitions: Nelson series, Thorpe series, FTC "Broad" series, and M&A "Domestic" series

A longer perspective appears in figure 9.6, which presents annual data on the number of mergers from the Nelson, Thorpe, FTC, and M&A "domestic" series. The data show four noticeable peaks or "waves":<sup>11</sup> around the turn of the century, in the late 1920s, in the late 1960s, and in the 1980s. Thus, the merger wave of the 1980s is not an entirely new phenomenon. Merger activity was significant in earlier

periods. The previous graphs have provided merger data in terms of absolute numbers and real values. But the real size of the U.S. economy has grown substantially over the period covered. Consequently, the opportunities for mergers may have increased, and the relative importance of any particular merger of a given real size has clearly diminished over time. Accordingly, the merger data should be placed in a suitable historical context.

One possible measure for comparison would be a consistent time series on the number of business enterprises in the United States. This measure might proxy the possible opportunities for mergers among firms. Unfortunately, we were unable to find a satisfactory series that covers the entire period.

Instead, we have used real GNP as our comparison measure. By dividing the absolute number of mergers each year by the real GNP of that year, we achieve a relative measure that is the ratio of two flow measures: the annual number of mergers and acquisitions per billion dollars of real GNP. Figure 9.7 provides the time series for this relative measure (with real GNP measured in terms of billions of 1982 dollars). As can be seen, the peaks of merger activity at the turn of the century and in the late 1920s were much more important relative to the size of the economy at those times than has been true in the 1980s.<sup>12</sup>

The pattern displayed in figure 9.7 does not incorporate information on the size of the pool of companies that were candidates for mergers or the sizes of those firms. As we noted above, a time series covering

Number of Mergers per  
Billion Dollars of Real GNP

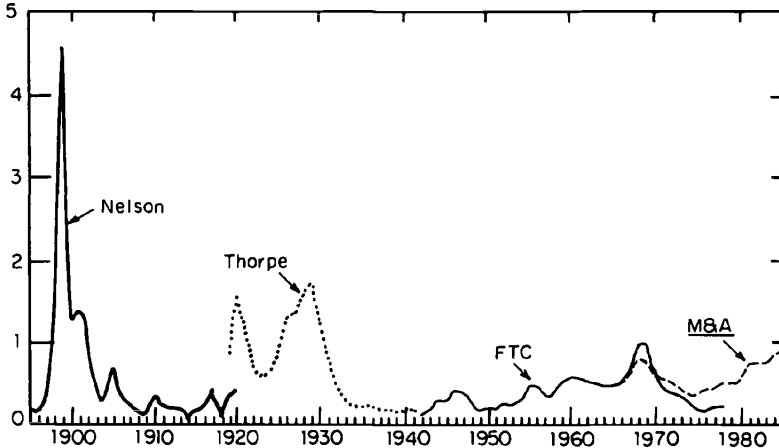


Fig. 9.7

Annual number of mergers and acquisitions per billion dollars of Real GNP (in 1982 dollars): Nelson series, Thorpe series, FTC "Broad" series, and M&A "Domestic" series

these characteristics is not available for a suitably long period. But data are available for the period since the late 1930s. As can be seen in table 9.1, the number of registered corporations in the U.S. economy has increased appreciably faster since 1939 than has the level of real GNP.<sup>13</sup> These relative increases held equally true for the period of the 1960s (the previous merger boom) through the early 1980s. Thus, the pattern shown in figure 9.7 *overstates* the relative importance of mergers in the 1980s as compared with the previous four decades if the pool of available merger partners is used as the basis of comparison. Because we do not have comparable data for the period before 1939, we can make no definitive statements about comparisons with the earlier merger peaks. But we strongly suspect that similar conclusions would hold for a longer period of comparison.

Further, the data in table 9.1 indicate that the average real size (as represented by sales expressed in 1982 dollars) of the firms in the available pool has been remarkably stable, except for a temporary increase in the mid-1940s that lasted until the mid-1950s. Thus, the conclusions that we drew with respect to the size of the available pool of merger partners are equally valid with respect to the size of the pool expressed in terms of the real value of sales.

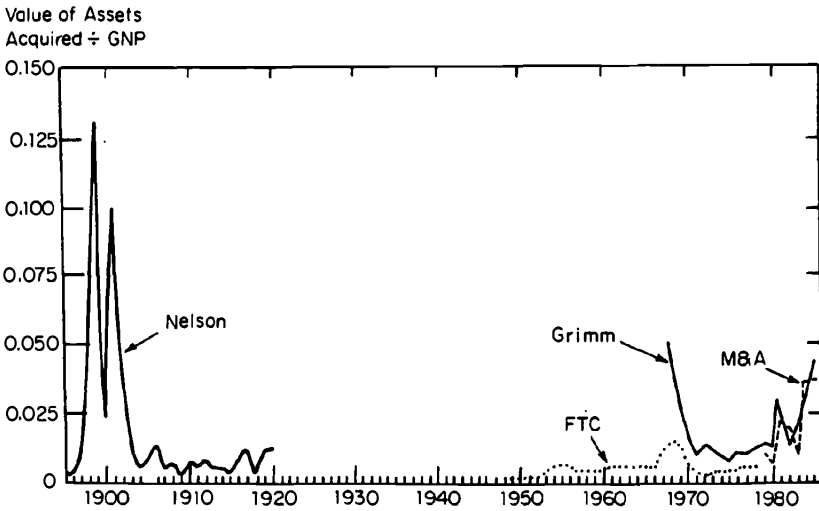
A more direct measure of the relative importance of mergers, as measured by the annual value of merger transactions, is presented in figure 9.8. Here we have used the GNP deflator to achieve a measure

**Table 9.1**                      **Numbers of Corporations, Their Real Sizes, and Real GNP, 1939-82**

Year	Number of corporations (in thousands)	Average sales per corporation (in millions of 1982 dollar†)	Real GNP (in billions of 1982 dollars)
1939	470	2.23	717
1940	473	2.41	773
1945	421	3.86	1,355
1950	629	3.05	1,204
1955	807	2.92	1,495
1960	1,141	2.40	1,665
1965	1,424	2.48	2,088
1970	1,665	2.50	2,416
1975	2,024	2.66	2,695
1980	2,711	2.74	3,187
1982	2,926	2.40	3,166
1983	2,999	2.23	3,279

Sources: U.S. Department of Commerce (1976); U.S. Department of Commerce, *Statistical Abstract*, various years.

†GNP deflator used, with 1982 = 1.00.



**Fig. 9.8** Annual value of assets acquired relative to GNP: Nelson series, FTC "Large Firm" series, Grimm series, and M&A series

of the real annual value of mergers and have then divided that by real GNP.<sup>14</sup> The pattern shown in figure 9.8 is consistent with that of figure 9.7: The merger wave at the turn of the century was much larger relative to the size of the economy than was the wave of the late 1960s or the wave, thus far, of the 1980s.

#### 9.2.4 Data on Aggregate Concentration

The time series in figures 9.7 and 9.8, which show that the data on the absolute numbers and values of mergers and acquisitions in the 1980s may give a misleading impression as to their relative importance in the U.S. economy, are echoed by another set of data: recent calculations of the trends in aggregate concentration in the U.S. economy.

Aggregate concentration is a measure of the percentage of some aggregate economic variable (such as assets, employment, sales, value added) accounted for by the largest  $X$  (such as 100, 200, . . .) firms in the nation's economy. Comparisons of aggregate concentration over time indicate the rate at which the largest firms in the economy have been growing (including growth through merger) relative to the size of the overall economy. Since the aggregate concentration measure transcends (by far) the boundaries of economic markets, it has no use as an indication of competitiveness. Instead, it may provide some indication of the concentration (and trends in concentration over time) of social and political power that may reside in a comparative handful of

**Table 9.2** Aggregate Concentration in the Manufacturing Sector, as Measured by Value Added, 1947-82 (in percent)

Largest companies	1947	1954	1958	1963	1967	1972	1977	1982
50	17	23	23	25	25	25	24	24
100	23	30	30	33	33	33	33	33
200	30	37	38	41	42	43	44	44

Source: U.S. Department of Commerce, Bureau of the Census, *Census of Manufactures*, various years.

large companies and their managers—one of the main concerns that have been expressed about mergers.<sup>15</sup>

Since aggregate concentration measures are affected by internal growth as well as by mergers, there is no simple linkage between mergers and aggregate concentration. Nevertheless, aggregate concentration data may yield some support for the impressions we have gained from the merger data.

Table 9.2 provides data on postwar aggregate concentration (as measured by value added) for the manufacturing sector of the U.S. economy. Aggregate concentration rose through the early 1960s but has remained stable since then, despite the merger wave of the 1960s and the early 1980s. (The increases through the early 1960s were primarily the result of internal growth by large firms in industries that were expanding—for example, motor vehicles, petroleum, tires, chemicals, electrical equipment—rather than of mergers.) This stability, then, is consistent with the relatively modest role that mergers seem to have recently played in the U.S. economy.

The manufacturing sector, however, is only a quarter of U.S. GNP and has been declining in relative importance. Thus, a wider measure of aggregate concentration would be useful.

Table 9.3 provides data on aggregate concentration across the entire private sector of the U.S. economy, as measured by employment and by corporate profits.<sup>16</sup> The data, compiled from the *Fortune* magazine lists of the 1,000 largest manufacturing and mining companies and the 50 largest companies in each of six services areas, indicate that aggregate concentration as measured by employment declined over the period 1972-80. The profits measure shows a general decline through 1979 but then a sharp increase in 1980. It is likely that this last movement was simply a temporary consequence of the increase in oil prices in 1979 and their effects on oil company profits, rather than a reversal of the trend. (The continued downward trend in employment concentration in 1980 supports this interpretation.)

**Table 9.3** Aggregate Concentration in the Entire Private Sector, as Measured by Employment and by Profits, 1972-80 (in percent)

Largest companies	1972	1973	1974	1975	1976	1977	1978	1979	1980
<i>Share of nonfarm private sector employment</i>									
100	18.2	—	—	—	—	17.3	—	16.7	16.6
200	23.9	—	—	—	—	22.7	—	22.6	22.1
1,300	37.3	37.4	37.0	36.5	36.1	35.5	34.7	34.2	34.0
<i>Share of corporate profits after taxes</i>									
100	43.3	—	—	—	—	39.8	—	39.4	44.9
200	55.4	—	—	—	—	50.2	—	49.9	56.5
1,300	76.6	75.1	72.6	71.4	73.8	71.4	70.4	71.1	75.6

Source: White (1981b).

**Table 9.4** Aggregate Concentration in the Entire Private Sector, as Measured by Employment and by Assets, 1970-84 (in percent)

Largest companies	1970	1975	1980	1984
<i>Share of nonfarm private sector employment</i>				
25	10.2	9.9	8.9	7.4
100	18.8	17.7	16.6	15.1
200	24.5	23.3	22.1	20.5
<i>Share of assets of nonfinancial corporations</i>				
25	16.9	17.0	16.0	12.7
100	29.1	29.2	28.0	26.6
200	37.9	37.7	35.9	34.1

Source: Ginsberg (1986); U.S. Department of Justice (1986).

Unfortunately, subsequent changes in the way the *Fortune* lists are compiled make extensions of the 1972-80 data difficult. But the U.S. Department of Justice has recently compiled similar aggregate concentration calculations that yield comparisons through 1984. These data are shown in table 9.4.<sup>17</sup> The data in this table tell a similar story to that told by the data covering the 1970s: Aggregate concentration has not risen, and probably has declined modestly, despite the merger wave of the 1980s.

In sum, aggregate concentration data, both for the manufacturing sector alone and for the entire private business sector, are consistent with the merger data in figures 9.7 and 9.8. Thus, although the absolute numbers and values of mergers in the 1980s are impressive, they are

still relatively modest when placed in the context of the size of the U.S. economy of the 1980s.

### 9.3 Previous Time-Series Studies of Mergers and Acquisitions

As we noted in the introduction, the previous literature that employed time-series analyses of mergers and acquisitions has been sparse. We now offer a brief review of that literature.<sup>18</sup>

#### 9.3.1 Weston

Weston (1953) examined annual merger data for the period between the two World Wars. Employing a multiple regression analysis, he found that mergers were significantly and positively related to securities prices and to wholesale commodity prices but were not significantly related to industrial production levels.

#### 9.3.2 Nelson

Nelson (1959) looked at quarterly merger data stretching from 1895 through 1956, with his primary focus on the years 1895–1920. Much of his book is spent on describing the sources and methodology he used in compiling his 1895–1920 data and the descriptive qualities of those data. Nelson did, however, explore a number of hypotheses concerning the origins and motives underlying the mergers of the period. He rejected the propositions that the mergers were a consequence of a slowdown in growth of the U.S. economy or of decreases in transportation costs. He did find that the achievement of market power and the development of the U.S. securities markets appeared to have played a role in encouraging the mergers. As an “indirect” way of testing this proposition, Nelson calculated and discovered a significant positive correlation between quarterly merger data and the level of securities prices.<sup>19</sup> He also calculated the correlation between mergers and the level of industrial production, but here he found an insignificant relationship between the two. When Nelson extended his analysis to quarterly merger data for the longer period 1895–1954, he uncovered the same quantitative results: Securities prices were significantly and positively related to the mergers, but the relationship between mergers and industrial production was insignificant.

#### 9.3.3 Steiner

Steiner (1975, chap. 8) used multiple regression analysis to try to explain annual merger activity (numbers and value) from 1949 through the early 1970s. For the years 1949–71 he found that GNP and the change in the level of securities prices both had significant positive influences; the prime rate of interest had a positive but insignificant effect.<sup>20</sup> When he added data for 1972 to the analysis, Steiner saw the

change in securities prices variable become insignificant, and the prime rate of interest showed a significant positive effect.

#### 9.3.4 Beckenstein

Beckenstein (1979) examined annual data on merger numbers and values for the years 1949–75. Using multiple regression analysis and trying a number of variables, he found that only the nominal level of securities prices and the nominal interest rate had consistently significant effects; but the interest rate effects were consistently positive.

#### 9.3.5 Chung and Weston

Chung and Weston (1982) employed multiple regression analysis to explore the determinants of the annual number of large conglomerate mergers. They found that these mergers were positively and significantly related to the difference between yields on lower and higher grade corporate bonds, the ratio of short- to long-term bond yields, and the rate of growth of GNP; the mergers were negatively related to the rate of return on corporate bonds. When they used Tobin's  $q$  instead of the last two variables, the authors found a positive and significant effect.

#### 9.3.6 Melicher, Ledolter, and D'Antonio

Melicher and his colleagues (1983) examined quarterly merger data between 1947 and 1977. Using "prewhitened" logarithmic first difference transformations, they found that mergers were significantly related to lagged stock prices (positively) and to lagged bond yields (negatively) but not to industrial activity or to business failure levels.<sup>21</sup>

#### 9.3.7 Shugart and Tollison

In an analysis of annual merger data for the years 1895–1920 and 1947–79, Shugart and Tollison (1984) concluded that the series could best be described as generated by a "white-noise process with possible drift" or by a "stable first-order autoregressive scheme," and they rejected the characterization of the merger data as occurring in waves. They did not, however, explicitly test a wave hypothesis, nor did they specifically show why their findings were inconsistent with a wave characterization. We will offer a more specific test of a wave hypothesis at the end of section 9.5.

#### 9.3.8 Guerard

Using procedures similar to those of Melicher and his colleagues, Guerard (1985) examined quarterly merger data for the years 1895–1950. He found that mergers were positively related to stock prices but unrelated to the level of industrial production.



### 9.3.9 Becketti

Becketti (1986) used quarterly data on the number and value of mergers from 1960 through 1985. Using ordinary least squares regressions and emphasizing the lagged values of the explanatory variables, he found that mergers and acquisitions were in general influenced positively by securities prices, negatively by real interest rates, positively by the general level of debt in the economy, positively by the level of capital utilization, and negatively by real GNP; but the statistical significance of his findings was not strong, except for the influence of GNP.

### 9.3.10 A Summing Up

For a period of more than 30 years, the literature devoted to time-series analysis of mergers and acquisitions has not been large. A few variables have consistently appeared as potential explanatory influences: measures of economic activity (for example, GNP or industrial production), interest rates (or bond yields), and securities prices. The first and third variables have usually been found to be positively related to merger activity, while the second has exhibited both signs. In most instances, however, the theoretical justifications offered for the inclusion of these (and other) variables in the analyses conducted have not been strong.

In the next section we offer a more complete theoretical model of the merger and acquisition process. We will agree that aggregate activity and interest rates should influence merger activity, with a positive effect for the first and a negative effect for the second. But we are suspicious of the role usually assigned to securities prices. We now turn to the development of our hypotheses.

## 9.4 Developing Hypotheses

### 9.4.1 The Determinants of Merger and Acquisition Activity

A merger or acquisition usually constitutes an act of investment by the purchasing firm or individuals. But a merger or acquisition is also an *exchange of existing* assets (for example, a purchaser pays cash for the plant, equipment, personnel, and goodwill of an existing firm), whereas investment flows (at least, as defined by the GNP accounts) involve the creation of *new* plant and equipment. Consequently, we will focus primarily on the forces that cause individuals or firms to exchange assets among themselves, and we will draw somewhat on the existing literature on asset exchanges.<sup>22</sup>

### *Bargains*

Asset exchanges should occur when potential purchasers believe that the current prices for the assets constitute "bargains." One rough indicator of whether a company can be purchased at a bargain price would be a comparison of the company's purchase price (for instance, market value) with the likely replacement costs of the company's assets—that is, Tobin's  $q$ .<sup>23</sup> The lower the ratio of market value to replacement cost (other things being equal), the greater the bargain and hence the greater the likelihood that some potential purchaser will step forward and make the purchase. Equivalently, for a given level of desired aggregate investment, merger activity is likely to be greater when the prices of existing firms are low relative to the prices of new assets, since mergers and acquisitions are alternatives to purchases of new assets. Thus, the level of  $q$  for the economy should be an important negative influence on the aggregate level of merger and acquisition activity.<sup>24</sup>

Our approach focuses on the demand side of merger transactions, somewhat neglecting the supply side. For simpler asset exchanges—such as of an office building—this neglect might not be justified. When the prices of office buildings fall below their replacement costs (that is, this  $q$  is below 1.0), potential buyers should be looking for bargains; but when their prices rise above their replacement costs, potential sellers should be looking for possibilities to sell out at favorable prices. In the former case, the buyers may be willing to offer prices that are slightly above prevailing levels in order to expedite a sale; in the latter case, the sellers may be willing to shade their prices below prevailing levels to expedite sales. In any event, the volume of transactions and  $q$  for these kinds of simple assets are unlikely to be correlated.

For the case of publicly traded firms, the process we have just described should hold when  $q$  falls below 1.0. Indeed, to achieve mergers, prospective buyers appear to be willing to offer substantial premiums above preannouncement market prices. By contrast, however, if a company's securities are selling at a  $q$  above 1.0 and the company's managers believe that the times are propitious for selling the company (because, for example, they have inside information or strong beliefs that the future prospects of the company are not as rosy as the market believes), they will have trouble expediting the sale by offering to sell the company at a price below the current market value.<sup>25</sup> Accordingly, we believe that focusing on reported mergers as driven largely by the buyers' side of the transaction is justified.

This expectation that  $q$  should be an important (and negative) determinant of merger activity is consistent with recent cross-sectional findings on the characteristics of takeover targets.<sup>26</sup> It should be

noted that this negative relationship implies that, *ceteris paribus*, there should be a negative relationship between mergers and securities prices. This prediction is in sharp contrast to the expectations expressed in (and empirical findings of) the earlier literature that mergers and securities prices should be positively related. Our examination of that literature has uncovered few valid theoretical arguments for a positive relationship.<sup>27</sup> Melicher, Ledolter, and D'Antonio, for example, posited that securities prices are indicators of "expectations of economic growth" and hence that higher levels of securities prices should be conducive to mergers. Since a merger requires a price that is satisfactory to both buyer and seller, this hypothesis implicitly assumes that buyers are more influenced by the expectations provided by securities prices than are sellers. We see no necessary reason why this should be so.

Our hypothesis that a low value of  $q$  should indicate a bargain is at hand and hence encourage mergers implies a simultaneous relationship between  $q$  and mergers: A high level of mergers (*ceteris paribus*) should cause  $q$  to increase.<sup>28</sup> Consequently, in our estimation procedures below we include simultaneous equations methods that incorporate the determinants of  $q$ . We should note here that it is not within the scope of this paper to try to develop and estimate a complete model of  $q$ . Rather, the important insight is that when  $q$  is relatively low (for whatever reason, including a low level of mergers) bargains will appear; this in turn will encourage mergers, which will tend to increase  $q$ ; and so on.

#### *Unexpected Changes in Economic Circumstances*

As economic circumstances change unexpectedly<sup>29</sup>—for instance, as relative prices among the major sectors of the economy change—different entrepreneurial skills may become valuable and differential profit opportunities may arise.<sup>30</sup> For example, as relative energy prices increase, the skills required to operate an airline, a chemical factory, a petroleum refinery, or a gasoline marketing facility may change. Further, opportunities for greater (or lesser) economies of scale, economies of scope, or economies of vertical integration may arise. Mergers and acquisitions are one way of achieving the changes in ownership and management that can take advantage of these changed opportunities.

#### *Divergences of Opinion*

As noted above, mergers require buyers and sellers to agree upon a mutually satisfactory price. If differences of opinion about future profit prospects widen, two effects are possible: First, there is a greater likelihood that a relatively optimistic buyer will find a relatively pessimistic seller and a transaction can be completed. Second, however,

there is also a greater likelihood that a buyer-seller pair that previously would have found a merger worthwhile will find that the buyer has become relatively pessimistic or the seller has become relatively optimistic about its own future profit prospects, and the merger is less likely to be completed.<sup>31</sup> Since the two effects offset each other, we cannot offer a precise theoretical prediction as to the net effect of divergences of opinion on mergers. Our prior expectations, however, lead us to predict that the first effect should dominate the second. Accordingly, we expect that periods with increased flows of new information that create divergent opinions<sup>32</sup> or periods of greater changes in relative prices (which could yield differential expectations about the future) should be periods with larger numbers of mergers.

### *The Real Cost of Capital*

The real cost of capital can influence the timing, financing costs, and expected profitability of mergers and acquisitions and hence should have a negative relationship with the volume of these transactions. It might also be the case, however, that in credit crunches small firms that face liquidity problems may become takeover targets by larger firms that have easier access to capital markets;<sup>33</sup> this latter hypothesis would imply a positive relationship between mergers and the cost of capital. Our prior is that the former effect should dominate. A measure of the real rate of interest is likely to be a good proxy for the cost of capital.

### *The Size of the Economy*

A larger economy is likely to have more companies that could merge with each other and hence to have a positive influence on mergers and acquisitions.

### *Tax Laws*

In addition to the effects that *changes* in the tax laws can have in inducing mergers and acquisitions over a short- to medium-run period, alternative tax regimes can make asset exchanges more or less costly and hence have steady-state consequences for the volume of mergers and acquisitions. Tax laws involving inheritances and capital gains are obvious examples.

### *A Correction Factor for the Fixed Cutoff Point Problem*

As we discussed in section 9.2 above, in the presence of inflation a fixed lower cutoff point for the inclusion of a merger or acquisition into a recorded data series creates an upward bias in that series over time. Any empirical testing of the previous hypotheses must include a correction factor for this upward bias.

### *A Summing Up*

The exchange-of-assets view of mergers developed above indicates that the following general factors should influence the observed pattern of mergers and acquisitions:

1. Tobin's  $q$
2. Changes in economic circumstances (including changes in relative prices and changes in tax regimes)
3. Greater divergences of opinions about future economic prospects
4. The real cost of capital
5. The size of the economy
6. The tax regime
7. A corrective factor for the cutoff point bias

## **9.5 Methodology, Data, and Results**

To test the hypotheses advanced in the previous section, we employed standard time-series regression analysis using some of the data series described in section 9.2.

### **9.5.1 The Dependent Variables**

The FTC "large firm" series, reporting the number of mergers in the manufacturing and mining sectors in which the assets of the acquired company were at least \$10 million and information concerning the merger was publicly available, was our choice for the dependent variable in our analyses of quarterly data. This is a widely used series, and it offers the maximum number of observations and overlap with potential explanatory variables. These data cover the quarters 1948.1 through 1979.4. For our analyses of annual data we chose the FTC "broad" series. These data cover the years 1940-79. In an effort to extend both these series and include data that cover the merger wave of the 1980s, we spliced each of the FTC series with the "domestic merger" series from *Mergers & Acquisitions*. In each case we isolated the overlapping data of the FTC and *M&A* series and ran least squares regressions (including a first order autoregressive term). These regression equations are shown in table 9.5. We then employed the coefficients from these regressions to extrapolate the FTC series forward through the end of 1985.

### **9.5.2 Independent Variables**

#### *The Ratio of Market Value to Replacement Cost ( $q$ )*

This variable represents our bargain hypothesis. For the quarterly regressions we tried both unadjusted and tax-adjusted measures of

**Table 9.5** OLS Regressions Used to Splice the FTC and M&A Time Series on Mergers

1. Quarterly data:

1967.2–1979.4 (51 observations)

$$FTC = 3.17 + 0.06 \cdot MA + 0.58 \cdot AR(1)$$

(0.6)    (4.3)                    (4.8)

$$D-W = 2.3$$

$$\bar{R}^2 = 0.63$$

2. Annual data:

1969–1979 (11 observations)

$$FTC = -1349.71 + 1.00 \cdot MA + 0.87 \cdot AR(1)$$

(1.7)            (2.2)                    (4.4)

$$D-W = 1.9$$

$$\bar{R}^2 = 0.88$$

Note: *t*-statistics in parentheses.

$q$ .<sup>34</sup> For the annual regressions we used only unadjusted measures of  $q$ .<sup>35</sup> We expect this variable to have a negative effect on merger activity.

### *The Real Rate of Interest*

This variable represents our cost-of-capital hypothesis. To construct this variable, we used the interest rate on seasoned, Aaa-rated corporate bonds during a quarter (or a year) and then subtracted the concurrent inflation rate (as measured by the percentage change in the GNP deflator). We expect this variable to have a negative effect on mergers.

### *Nominal GNP*

This variable represents both the size of the real economy and a correction factor for the upward bias in the construction of the merger series. In addition, we decomposed this variable into its separate components—real GNP and the GNP deflator—and entered them separately into the regressions.<sup>36</sup> We expect this variable (and its components) to have a positive effect on mergers.

### *Tax Regimes*

When unadjusted  $q$  was included in the regressions, we also included dummy variables to capture the possible effects of different tax regimes on mergers. We believe that the tax laws of 1954, 1963, and 1981 represent the major new regimes in the period covered by our data. Accordingly, we included 0,1 dummy variables separately for 1954 and all subsequent quarters or years, for 1963 and all subsequent periods, and for 1981 and all subsequent periods:

*Changes in Relative Prices*

This variable represents our hypothesis concerning changed economic circumstances. For each month we computed the variance of the percentage price changes of the major components of the U.S. Bureau of Labor Statistics wholesale price index (and, subsequently, the producer price index).<sup>37</sup> We then averaged these monthly variances into quarterly values.<sup>38</sup> Since larger variances should represent greater changes in economic circumstances, we expect this variable to have a positive effect on mergers.

*Divergences of Opinion*

This variable represents our effort to capture the effects of new information that creates divergences of opinion. To construct this variable, we used the Livingston data base, which contains a semiannual time series of separate forecasts for a number of macroeconomic variables by a panel of forecasters.<sup>39</sup> We computed the cross-sectional variance of the one-year-out forecasts of the consumer price index<sup>40</sup> for each semiannual period and then computed the coefficient of variation for each semiannual period. For our quarterly estimates we used these semiannual observations or interpolated the in-between quarters by averaging the semiannual observations for the preceding and following quarters. Since a higher value for this variable indicates greater divergences of opinion among forecasters, we expect this variable to have a positive effect on mergers.

9.5.3 The Simultaneity between Mergers and  $q$ .

To the extent that the aggregate level of merger and acquisition activity affects the market value of companies (the numerator of  $q$ ), there is a simultaneous relationship between mergers and  $q$ . Accordingly, some discussion of this simultaneity is warranted.

Since  $q$  is a ratio of prices at discrete points in time, whereas merger and acquisition activity is measured as a flow over time, it is the *change* in  $q$  that should be affected by the flow of mergers. It is easy to show that

$$\Delta q \equiv q_t - q_{t-1} \equiv (\Delta V - q_{t-1} \Delta K)/K_t,$$

where  $V$  is the market value of the capital stock, and  $K$  is the replacement cost of that capital stock. Since  $\Delta K$  is current investment, we can posit a simple accelerator or capital stock adjustment model of investment, in which real GNP and real interest rates are the primary determinants of investment. The change in market value should be related to merger activity and to unexpected changes in future profits and in interest rates.

Since real GNP and real interest rates are already in the model as exogenous variables explaining mergers, we used estimates of the unexpected changes in future profits and in interest rates as our excluded exogenous instruments for the purposes of simultaneous equations estimation of the merger model. To obtain these estimates, we used the residuals from first order ARIMA estimation models involving real GNP and real interest rates.<sup>41</sup>

#### 9.5.4 Regression Results

Table 9.6 provides the list of variables, their symbols, and their average values for the quarterly observations 1948.3 through 1984.1 (For the dependent variables, annual averages are also provided.)

Tables 9.7 and 9.8 present our main regression results for the quarterly data. The first table provides OLS regressions using the FTC merger data for 1948.3–1979.4 and using the spliced FTC–M&A merger data for 1948.3–1984.1; the second table presents two-stage least squares

**Table 9.6** A List of the Variables

Variable symbol	Definition	Mean value, 1948.3–1984.1
<i>NFTC</i>	Quarterly number of mergers, FTC "large firm" series	16.1 <sup>a</sup>
<i>NFTCMA</i>	<i>NFTC</i> spliced with the quarterly "domestic" series from <i>M&amp;A</i>	16.1
<i>BFTC</i>	Annual number of mergers, FTC "broad" series	787.0 <sup>b</sup>
<i>BFTCMA</i>	<i>BFTC</i> spliced with the annual "domestic" series from <i>M&amp;A</i>	733.9 <sup>c</sup>
<i>taxadjq</i>	Tax-adjusted Tobin's <i>q</i>	0.41
<i>unadjq</i>	Unadjusted <i>q</i>	0.91
<i>ri</i>	Real interest rate	1.88
<i>NGNP</i>	Nominal GNP, in billions of dollars	\$1,145
<i>RGNP</i>	Real GNP, in billions of 1982 dollars	\$2,184
<i>DEFL</i>	GNP deflator, 1982 = 1.0	0.46
<i>VRPC</i>	Variance of the relative price changes of the industrial components of the wholesale price index	0.79
<i>CVLFC</i>	Coefficient of variation of the Livingston panel forecasts of the consumer price index	0.02
<i>D1954</i> , etc.	Dummy variable taking the value of 1 for all quarters (or years) in 1954 and after; 0 otherwise	

<sup>a</sup>1948.3–1979.4 only.

<sup>b</sup>1948–79 annual data.

<sup>c</sup>1948–85 annual data.



Table 9.7 Quarterly OLS Results, with *NFTC* and *NFTCMA* as Dependent Variables

Independent variable	<i>NFTC</i> (1948.3-1979.4)				<i>NFTCMA</i> (1948.3-1984.1)			
	7A	7B	7C	7D	7E	7F	7G	7H
Constant	2.25 (0.6)	2.48 (0.6)	-10.71 (1.5)	-13.81 (1.9)	5.14 (1.3)	5.65 (1.4)	-12.20 (1.8)	-9.32 (1.3)
<i>taxadaq</i>	10.32 (3.8)	10.14 (3.8)	7.81 (2.4)	—	10.47 (3.8)	10.10 (3.8)	7.51 (2.8)	—
<i>unadaq</i>	—	—	—	23.68 (3.8)	—	—	—	22.71 (3.8)
<i>ri</i>	-0.04 (0.2)	-0.03 (0.1)	-0.06 (0.3)	-0.03 (0.2)	-0.03 (0.4)	-0.08 (0.4)	-0.02 (0.1)	-0.06 (0.3)
<i>NGNP</i>	0.01 (3.2)	0.01 (3.2)	—	0.01 (2.8)	0.01 (2.5)	0.01 (2.6)	—	.005 (1.6)
<i>RGNP</i>	—	—	0.01 (1.4)	—	—	—	0.02 (2.7)	—
<i>DEFL</i>	—	—	-0.11 (0.3)	—	—	—	-0.23 (1.3)	—

<i>VRPC</i>	-0.34 (0.6)	—	—	—	-0.09 (0.2)	—	—	—
<i>CVLFC</i>	23.12 (0.6)	—	—	—	26.44 (0.7)	—	—	—
<i>D1954</i>	—	—	—	-1.54 (0.3)	—	—	—	-1.16 (0.2)
<i>D1963</i>	—	—	—	-2.06 (0.5)	—	—	—	-0.02 (0.01)
<i>D1981</i>	—	—	—	—	—	—	—	2.72 (0.5)
<i>AR(1)</i>	0.45 (5.1)	0.45 (5.2)	0.44 (5.0)	0.46 (5.2)	0.46 (5.6)	0.46 (5.7)	0.43 (5.2)	0.47 (5.7)
<i>AR(2)</i>	0.30 (3.4)	0.31 (3.5)	0.30 (3.4)	0.31 (3.5)	0.33 (4.0)	0.33 (4.0)	0.30 (3.6)	0.33 (3.9)
<i>D-W</i>	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
$\bar{R}^2$	0.73	0.73	0.73	0.74	0.71	0.71	0.72	0.71

Note: *t*-statistics in parentheses

**Table 9.8** Quarterly 2SLS Results, with *NFTC* and *NFTCMA* as Dependent Variables

Independent variable	<i>NFTC</i> (1948.3-1979.4)				<i>NFTCMA</i> (1948.3-1984.1)			
	8A	8B	8C	8D	8E	8F	8G	8H
Constant	0.73 (0.2)	0.74 (0.2)	-9.96 (1.2)	-17.18 (1.9)	3.15 (0.7)	3.44 (0.8)	-12.32 (1.7)	-13.78 (1.5)
<i>taxadq</i>	12.27 (3.5)	12.48 (3.5)	13.41 (2.5)	—	12.97 (3.5)	13.23 (3.4)	10.65 (2.6)	—
<i>unadq</i>	—	—	—	27.56 (3.4)	—	—	—	27.56 (3.4)
<i>ri</i>	-0.01 (0.1)	0.003 (0.0)	0.01 (0.0)	-0.01 (0.1)	-0.02 (0.1)	-0.01 (0.0)	0.003 (0.0)	-0.03 (0.2)
<i>NGNP</i>	0.01 (3.3)	0.01 (3.3)	—	0.01 (2.8)	0.01 (2.7)	0.01 (2.7)	—	0.01 (1.8)
<i>RGNP</i>	—	—	0.004 (0.3)	—	—	—	0.01 (2.0)	—
<i>DEFL</i>	—	—	0.27 (0.6)	—	—	—	-0.13 (0.6)	—

<i>VRPC</i>	-0.36 (0.7)	-	-	-	0.10 (0.2)	-	-	-
<i>CVLFC</i>	27.20 (0.7)	-	-	-	33.93 (0.9)	-	-	-
<i>D/954</i>	-	-	-	-2.43 (0.5)	-	-	-	-1.93 (0.4)
<i>D/963</i>	-	-	-	-2.95 (0.6)	-	-	-	-0.89 (0.2)
<i>D/981</i>	-	-	-	-	-	-	-	1.94 (0.4)
<i>AR(1)</i>	0.45 (5.0)	0.45 (5.1)	0.46 (5.0)	0.46 (5.1)	0.46 (5.5)	0.47 (5.6)	0.44 (5.2)	0.48 (5.6)
<i>AR(2)</i>	0.30 (3.3)	0.30 (3.4)	0.31 (3.4)	0.30 (3.4)	0.32 (3.9)	0.32 (3.9)	0.31 (3.7)	0.32 (3.8)
<i>D-W</i>	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1

Note: t-statistics in parentheses

estimates of the same models. In all cases we included first and second order autoregressive terms.<sup>42</sup>

The OLS results in table 9.7 indicate that the autoregressive terms are the most powerful explanatory factors. Nominal GNP always has a positive effect and is usually significant; when it is broken into its two constituent components, neither has a significant effect (and the price level even has a slight negative effect). Real interest rates always have a negative effect, but are never significant. The  $q$  variable, whether in its tax-adjusted or -unadjusted form, always has a positive effect—contrary to our expectations—and is significant. And the relative price variation and Livingston forecast variation variables are never significant, although the forecast variable has the expected sign. The dummy variables constructed to capture the differing tax regimes (when the unadjusted  $q$  is used) do not add any explanatory power to the equations.

The two-stage least squares results in table 9.8 yield similar conclusions. Indeed, the coefficients for the 2SLS estimations are quite similar to their OLS counterparts, indicating that the instrumental values for  $q$  are quite close to their actual values.<sup>43</sup> Thus, the 2SLS estimations do not appreciably affect or improve the explanatory power of the models.

In table 9.9 we provide results of OLS estimations based on annual data.<sup>44</sup> Again, the same basic conclusions emerge. For the annual data, though, nominal GNP is insignificant as well, but real GNP does have the expected significant positive effect.

When we transform all of the relevant quarterly data series into logarithms and reestimate the models of tables 9.7 and 9.8, we again find the same basic results. When we transform the annual series, however, we find somewhat stronger results. Table 9.10 shows these annual log-log OLS estimations. Nominal GNP now has a strong and significant positive effect, and real interest rates have a significant negative effect for the full 1948–85 period.

We estimated the same models for quarterly and annual data, with the value of mergers as the dependent variable, with the same basic results. We also tried logged values of the independent variables, again with the same basic results.

A number of conclusions can be drawn from the results presented in tables 9.7–9.10. First, the merger series follow a strongly autoregressive pattern. But our efforts to uncover the more fundamental economic forces underlying this pattern have been only moderately successful. The size of the economy has a positive effect on mergers, as expected, and real interest rates appear to have a negative effect, especially when the model is estimated using annual data. But  $q$  has a

significant positive effect, contrary to our hypotheses. And our efforts to capture the effects of changes in the structure of the economy and of new information that could yield divergences of opinion do not yield satisfactory results.

#### 9.5.5 Are There Merger Waves?

The data we described in section 9.2 suggest to us, and to others, that mergers occur in waves. Indeed, Brealey and Myers (1984) have listed the lack of an explanation for merger waves as one of ten significant unsolved problems in finance. But as we noted in section 9.3, Shugart and Tollison (1984) argued that the merger time-series data are inconsistent with a wave characterization. Their statistical results imply that merger levels follow a random walk or, at most, a first order autoregressive process. From this the authors concluded that mergers do not occur in waves. Implicit in their reasoning is an analogy to stock price data. Although a cursory look suggests that stock prices move in a nonrandom pattern, the statistical evidence indicates that stock prices follow a random walk: Price changes are uncorrelated from one period to the next, so that the best estimate of tomorrow's price is today's price.

Shugart and Tollison appear to have adopted this reasoning in analyzing merger data. They concluded that, since the best estimate of next year's level of mergers is this year's level, the patterns of merger levels are also meaningless.

We believe, however, that the analogy is flawed. The question with respect to stock prices is, can we predict tomorrow's price *change* by knowing today's price *change*? The relevant question with respect to mergers is, instead, if the *number* of mergers this year is high, can we predict that the *number* of mergers next year will also be high? Surely, if stock price changes are uncorrelated over time, the answer to the first question is no. It is not true, however, that if changes in merger levels over time are uncorrelated the answer to the second question is no. Indeed, one could argue that, if the best predictor of the number of mergers in year  $t$  is the number in year  $t - 1$ , mergers do come in waves.

As an alternative test of this hypothesis, we employed a nonparametric "runs" test. Arguably, the pattern of mergers would be consistent with a wave hypothesis if the periods when the numbers of mergers were relatively high and relatively low were not distributed randomly but instead were bunched in adjoining periods of relatively high and relatively low activity. To test this proposition, we regressed each quarterly and annual merger series against a simple time trend. These results are shown in table 9.11. We examined the residuals from

Table 9.9 Annual OLS Results, with *NFTC* and *NFTCMA* as Dependent Variables

Independent variable	<i>NFTC</i> (1948-79)					<i>NFTCMA</i> (1948-85)				
	9A	9B	9C	9D	9E	9F	9G	9H	9I	
Constant	-186.66 (0.6)	-937.81 (2.6)	-112.72 (0.3)	-806.05 (3.4)	-47.59 (0.1)	-1028.06 (2.5)	68.23 (0.2)	-853.73 (2.5)		
<i>unadaq</i>	10.47 (2.4)	7.91 (2.7)	10.20 (2.9)	7.09 (3.0)	8.31 (1.9)	8.14 (2.5)	9.61 (2.3)	7.21 (2.2)		
<i>ri</i>	-15.39 (0.6)	-14.34 (0.8)	-15.01 (0.6)	-15.82 (1.0)	-31.19 (1.0)	-3.93 (0.2)	-32.66 (1.2)	-0.56 (0.0)		
<i>NGNP</i>	-0.003 (0.0)	—	0.19 (1.0)	—	-0.27 (1.6)	—	0.06 (0.4)	—		
<i>RGNP</i>	—	1.64 (4.7)	—	1.54 (5.5)	—	1.57 (4.6)	—	1.13 (4.2)		
<i>DEFL</i>	—	-53.20 (4.3)	—	-52.79 (4.5)	—	-45.93 (5.5)	—	-29.99 (3.6)		

<i>D</i> 1954	64.07 (0.3)	-73.97 (0.4)	—	—	246.39 (1.0)	-111.19 (0.6)	—	—
<i>D</i> 1963	337.33 (1.5)	-79.40 (0.4)	—	—	549.33 (2.6)	-150.39 (0.7)	—	—
<i>D</i> 1981	—	—	—	—	498.39 (1.6)	754.77 (3.3)	—	—
<i>AR</i> (1)	0.97 (5.4)	1.08 (7.2)	1.09 (6.2)	1.09 (7.6)	0.78 (4.7)	0.93 (5.8)	0.84 (4.7)	0.88 (5.2)
<i>AR</i> (2)	-0.53 (2.9)	-0.69 (4.5)	-0.46 (2.5)	-0.70 (4.8)	-0.46 (2.7)	-0.58 (3.5)	-0.21 (1.2)	-0.45 (2.6)
<i>D-W</i>	1.9	2.0	1.7	2.0	1.9	1.9	1.8	1.9
$\bar{R}^2$	0.78	0.88	0.79	0.89	0.70	0.83	0.68	0.78

Note: *t*-statistics in parentheses



Table 9.10 Annual OLS Results, with All Relevant Variables in Logs

Independent variable	log <i>BFTC</i> (1948-79)		log <i>BFTCMA</i> (1948-85)	
	10A	10B	10C	10D
Constant	-3.01 (1.3)	-3.84 (4.0)	-7.61 (3.2)	-6.29 (5.7)
log <i>unadq</i>	1.46 (5.1)	1.58 (9.3)	2.1 (7.2)	2.1 (12.2)
<i>ri</i>	-0.02 (0.6)	-0.02 (0.5)	-0.10 (3.5)	-0.15 (5.5)
log <i>NGNP</i>	0.49 (2.0)	0.56 (7.4)	0.86 (3.7)	0.62 (7.0)
<i>D1954</i>	0.18 (0.7)	—	-0.05 (0.2)	—
<i>D1963</i>	0.01 (0.0)	—	-0.30 (1.4)	—
<i>D1981</i>	—	—	-0.80 (3.8)	—
<i>AR(1)</i>	0.36 (1.7)	0.37 (2.0)	-0.41 (2.6)	-0.09 (0.6)
<i>AR(2)</i>	-0.31 (1.6)	-0.33 (1.8)	-0.58 (3.4)	-0.31 (2.0)
<i>D-W</i>	2.1	2.1	2.0	2.0
$\bar{R}^2$	0.86	0.87	0.75	0.69

Note: *t*-statistics in parentheses

each equation and counted any positive deviation as a "plus" and any negative deviation as a "minus." We then counted the number of runs of pluses and minuses and compared the number found to the number that would be expected from a random distribution. For all four cases the number of runs was significantly below the expected number.<sup>45</sup> These results are also shown in table 9.11.

Accordingly, we believe, contrary to Shugart and Tollison, that the merger data are consistent with a wave characterization.

## 9.6 Conclusions

In this paper we have developed hypotheses concerning the economic factors that should explain the pattern of mergers and acquisitions and subjected those hypotheses to econometric tests on postwar merger data. Along the way we reviewed the previous literature, described the strengths and weaknesses of the various merger series that are available for analysis, and provided a historical perspective on the long-run pattern of mergers in the U.S. economy.

**Table 9.11** Runs Tests of a Merger Wave Hypothesis

Quarterly data:

1. 1948.1–1979.4 (128 observations)

$$NFTC = 3.12 + 0.19 \cdot TIME$$

$$(2.0) \quad (9.4)$$

$$D-W = 0.58$$

$$\bar{R}^2 = 0.41$$

Expected number of runs = 61; standard deviation = 5.3

Actual number of runs = 37

2. 1948.1–1985.4 (152 observations)

$$NFTCMA = 6.31 + 0.12 \cdot TIME$$

$$(4.4) \quad (7.8)$$

$$D-W = 0.54$$

$$\bar{R}^2 = 0.28$$

Expected number of runs = 74; standard deviation = 5.9.

Actual number of runs = 47

Annual data:

3. 1940–79 (40 observations)

$$BFTC = 186.31 + 24.14 \cdot TIME$$

$$(1.3) \quad (4.0)$$

$$D-W = 0.35$$

$$\bar{R}^2 = 0.28$$

Expected number of runs = 21; standard deviation = 3.1.

Actual number of runs = 7

4. 1940–85 (46 observations)

$$BFTCMA = 359.11 + 12.43 \cdot TIME$$

$$(2.5) \quad (2.4)$$

$$D-W = 0.36$$

$$\bar{R}^2 = 0.09$$

Expected number of runs = 23; standard deviation = 3.2

Actual number of runs = 5

*Note:* *t*-statistics in parentheses

Our econometric results are only mildly encouraging. Especially puzzling to us is the apparently strong positive effect of Tobin's  $q$  on mergers. Although this result is consistent with the other researchers' empirical findings that securities prices have a positive effect on mergers, we believe it to be inconsistent with the predictions of economic theory. We are thus left with an unresolved puzzle.

We have, however, offered a more specific test of a wave hypothesis for time-series merger activity, and we believe that, contrary to the claims of others, the time-series pattern of mergers is consistent with a wave characterization.

But the task of achieving a better understanding of the economic forces underlying that pattern still lies ahead.

## Notes

1. There has been a more extensive cross-section literature. For recent cross-section studies see Harris, Steward, and Carleton (1982); Wansley, Roenfeldt, and Cooley (1983); Hasbrouck (1985); and Knoeber (1986).

2. A simple price index or deflator would work properly only if real merger sizes were distributed uniformly.

3. To the extent that merger values are recorded in terms of historical book value (as is true for the FTC series discussed below), the bias due to the pure inflation effect will not be as severe.

4. The last report, covering 1979 and earlier years, is U.S. FTC (1981).

5. Curiously, the FTC also published information on the value of the acquired assets in mergers for which public information was *not* available, but it did not publish annual data on the numbers of these mergers.

6. The annual data can be found in U.S. Department of Commerce (1976) and in various annual issues of the FTC's *Statistical Report on Mergers and Acquisitions*. The quarterly data can be found in Nelson (1959, 167-69).

7. Unfortunately, the annual and quarterly series are not consistent with each other. The annual series appears to be more complete.

8. Nelson described the transactions as "disappearances" and the book value as "capitalizations".

9. See Brooks (1973).

10. The GNP deflator, with 1982 = 1.0, was used to deflate the nominal dollar series. This procedure is imperfect, for the reasons discussed in the text above.

11. Shugart and Tollison (1984) argue that waves are not a good characterization of the historical pattern of mergers and acquisitions. For our discussion of their article, see Section III below.

12. As Nelson (1959, 25-29) pointed out, the Thorpe data appear to be more inclusive than are Nelson's. Thus, if Nelson's raw data were adjusted upward to correspond roughly with the Thorpe and FTC series, the merger wave at the turn of the century would appear to be even larger in relation to the economy at that time and hence would also be yet larger in comparison with the merger waves later in this century.

13. We chose the number of corporations, rather than the larger number of business enterprises (including sole proprietorships and partnerships), for two reasons. First, the data for the former are more complete. Second, and more important, as we noted in the text the reported merger data include only transactions that are above a given size; since corporations are generally larger than sole proprietorships and partnerships, the former series appeared to be more comparable to the merger data.

14. We can divide the nominal values of mergers in a given year by the nominal GNP of that same year, or, equivalently, we can use the ratio of real values.

15. It is worth noting that the political concerns raised about the merger wave of the 1960s were of the same kind as those being raised in the 1980s. See U.S. Federal Trade Commission (1969) and Mueller (1986).

16. Employment (when multiplied by wages) and profits are the two most important elements of value added. For further details on the computations that underlie table 9.3, see White (1981a, 1982).

17. The data on employment in table 9.4 were collected in a slightly different manner from those in table 9.3 and hence are not strictly comparable.

18. In addition to the studies discussed below, we should also mention the survey article by Markham (1955), the effort by Eis (1969) to compile merger number and value data for the 1920s, and the less quantitative analyses by Nelson (1966), Maule (1968), and Eis (1970).

19. Nelson found this positive relationship for both the number of mergers and the capitalization value of the mergers.

20. Steiner appears to have used nominal values in all instances.

21. Melicher, Ledolter, and D'Antonio appear to have used nominal values for stock prices and bond yields.

22. A merger or acquisition of a firm usually entails one extra element—control over management—that other exchanges of assets (such as purchases of smaller blocks of shares in a company) do not have. For a discussion of the influences on the trading volume of shares of stock, see Epps (1975), Epps and Epps (1976), Verrecchia (1981), Tauchen and Pitts (1983), and Smirlock and Starks (1985).

23. See Tobin (1969). To the extent that replacement costs encompass only physical assets, this type of measure will ignore intangible goodwill.

24. Robert Taggart has pointed out that the bargain hypothesis may explain cross-section results but may not apply to time-series data.

25. The owners and potential sellers of family-owned or closely held companies might be able to shade selling prices so as to expedite mergers.

26. See Hasbrouck (1985). In addition, our expectations about the role of  $q$  seem to be consistent with the implications of the "free cash flow theory" of Jensen (1986). To the extent that corporations are heavily laden with cash, financial markets are likely to value them at  $q$  levels that either are close to 1.0 (because the replacement cost of a dollar of cash is one dollar) or are below 1.0 (because the market expects that many managers are likely to make foolish purchases with the cash). In the latter case mergers and  $q$  will be negatively correlated, either because managers have indeed embarked on foolish mergers that are financed by their free cash flow or because other firms have realized that now is a good time to buy the targeted firms and put the cash to better uses—ones that will yield higher returns for stockholders.

27. The "trapped equity" model—as offered, for example, by King (1986)—may be an exception.

28. This increase in  $q$  is a pure price reaction and need not be a reflection of increased market power. If mergers were also to yield increased market power, there might be a yet greater rise in  $q$ .

29. This hypothesis and the one that follows it are similar to that advanced by Gort (1969).

30. Note that it is not the changed profit levels for different sectors that are important but rather the new profit opportunities that may arise for different skills.

31. This point was suggested to us by Steven Salop.

32. As an oversimplification, new information that has implications on which everyone agrees should have effects solely on prices, with little or no trading. But as Verrecchia (1981) pointed out, if individuals have different incomes, tastes, or portfolio goals, then even a consensus as to the implications of new information can lead to trading.

33. This point was suggested to us by Alan Auerbach.

34. The tax-adjusted  $q$  series come from Bernanke, Bohn, and Reiss (1985); the unadjusted series was provided by the authors of that paper.

35. This series is constructed from the data provided in U.S. Board of Governors (1986).

36. As we noted in section 9.2, the simple use of the deflator is probably an imperfect correction factor.

37. We defined the percentage price changes to be differences in the natural logarithms of the prices in two periods. We then computed a Divisia index of the weighted average of the percentage changes of the individual components. Finally, we computed the weighted variance of the individual rates of change around this average. See Parks (1978).

38. The regressions reported here include a relative price change variable based only on the "industrial commodity" components of the wholesale price index and the producer price index. Including the raw materials components—specifically, the energy sector—produced extremely large spikes in relative price changes in the 1970s, and we were concerned that these observations might be true outliers. When these components were included in the regressions, however, the basic results reported below were unchanged.

39. For further discussion of the Livingston data base, see Carlson (1977), Cukierman and Wachtel (1979) and Cukierman and Wachtel (1982).

40. We also computed the variance of the forecasts for the wholesale price index and for the Federal Reserve Board index of industrial production. When these alternative variables were included in the regressions reported below, the basic results were unchanged.

41. Further details on these equations are available from the authors.

42. As suggested by Fair (1970), in the 2SLS estimations we also included the lagged values of all the exogenous and endogenous variables.

43. We suspect that the use of the lagged variables as instruments, especially lagged  $q$ , may have caused this result.

44. Since the OLS and 2SLS results for the quarterly data were so similar, we present only the OLS results for the annual data.

45. The spliced data have an autoregressive structure imposed on the extrapolated observations of the 1980s, which might bias the series toward showing fewer runs. We doubt that this bias explains the strongly significant effects that we find.

## References

- Beckett, Sean. 1986. Corporate mergers and the business cycle. *Economic Review*, Federal Reserve Bank of Kansas City, pp. 13–26.
- Beckenstein, Alan R. 1979. Merger activity and merger theories: An empirical investigation. *Antitrust Bulletin* 24: 105–28.
- Bernanke, Ben, Henning Bohn, and Peter C. Reiss. 1985. Alternative nonnested specification tests of time series investment models, photocopy. Stanford: Stanford University.
- Brealey, Richard, and Stewart Myers. 1984. *Principles of corporate finance*, 2d ed. New York: McGraw-Hill.

- Brooks, John. 1973. *The go-go Years*. New York: Waybright and Talley.
- Carlson, John A. 1977. A study of price forecasts. *Annals of Economic and Social Measurement* 6: 27-56.
- Chung, Kwang S., and J. Fred Weston. 1982. Diversification and mergers in a strategic long-range-planning framework. In *Mergers and acquisitions: Current problems in perspective*, ed. Michael Keenan and Lawrence J. White, 315-47. Lexington, Mass.: D.C. Heath.
- Cukierman, Alex., and Paul Wachtel. 1979. Differential inflationary expectations and the variability of the rate of inflation: Theory and evidence. *American Economic Review* 69: 595-609.
- \_\_\_\_\_. 1982. Relative price variability and nonuniform inflationary expectations. *Journal of Political Economy* 90: 146-57.
- Eis, Carl. 1969. The 1919-1930 merger movement in American industry. *Journal of Law and Economics* 10: 267-96.
- \_\_\_\_\_. 1970. A note on mergers and the business cycle: Comment. *Journal of Industrial Economics* 19: 89-92.
- Epps, Thomas W. 1975. Security price changes and transaction volumes: Theory and evidence. *American Economic Review* 65: 586-97.
- Epps, Thomas W., and Mary L. Epps. 1976. The stochastic dependence of security price changes and transaction volumes: Implications for the mixture-of-distributions hypothesis. *Econometrica* 44: 305-21.
- Fair, Ray C. 1970. The estimation of simultaneous equations models with lagged endogeneous variables and first order serially correlated errors. *Econometrica* 38: 507-16.
- Ginsburg, Douglas H. 1986. Statement before the Subcommittee on Monopolies and Commercial Law, Committee on the Judiciary, U.S. House of Representatives, 5 March 1986.
- Gort, Michael. 1969. An economic disturbance theory of mergers. *Quarterly Journal of Economics* 83: 624-42.
- Guerard, John B., Jr. 1985. Mergers, stock prices, and industrial production: An empirical test of the Nelson hypothesis. In *Time series analysis: Theory and practice*, vol. 7, ed. O. D. Anderson, 239-47. Amsterdam: Elsevier.
- Harris, Robert S., John F. Stewart, and Willard T. Carleton. 1982. Financial characteristics of acquired firms. In *Mergers and acquisitions: Current problems in perspective*, ed. Michael Keenan and Lawrence J. White, 223-41. Lexington, Mass.: D.C. Heath.
- Hasbrouck, Joel. 1985. The characteristics of takeover targets. *Journal of Banking and Finance* 9: 351-62.
- Jensen, Michael C. 1986. Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* 76: 323-29.
- King, Mervyn. 1986. Take-overs, taxes and the stock market, photocopy. London: London School of Economics.
- Knoeber, Charles R. 1986. Golden parachutes, shark repellents, and hostile tender offers. *American Economic Review* 76: 155-67.
- Markham, Jesse. 1955. Survey of the evidence and findings on mergers. In *Business concentration and price policy*, National Bureau of Economic Research, 141-82. Princeton: Princeton University Press.
- Maule, C. J. 1968. A note on mergers and the business cycle. *Journal of Industrial Economics* 16: 99-105.
- Melicher, Ronald W., Johannes Ledolter, and Louis J. D'Antonio. 1983. A time series analysis of aggregate merger activity. *Review of Economics and Statistics* 65: 423-30.

- Mueller, Willard F. 1986. Wrong Signals on Antitrust. *New York Times*, 4 August 1986, 17.
- Nelson, Ralph L. 1959. *Merger movement in American industry, 1895-1956*. Princeton: Princeton University Press.
- Nelson, Ralph L. 1966. Business cycle factors in the choice between internal and external growth. In *The corporate merger*, ed. William W. Alperets and Joel E. Segall, 52-66. Chicago: University of Chicago Press.
- Parks, Richard W. 1978. Inflation and relative price variability. *Journal of Political Economy* 86: 79-95.
- Shugart, William F., II, and Robert D. Tollison. 1984. The random character of merger activity. *Rand Journal of Economics* 15: 500-509.
- Smirlock, Michael, and Laura Starks. 1985. A further examination of stock price changes and transaction volume. *Journal of Financial Research* 8: 217-25.
- Steiner, Peter O. 1975. *Mergers: Motives, effects, policies*. Ann Arbor: University of Michigan Press.
- Tauchen, George E., and Mark Pitts. 1983. The price variability-volume relationship on speculative markets. *Econometrica* 51: 485-505.
- Tobin, James. 1969. A general equilibrium approach to monetary theory. *Journal of Money, Credit, and Banking* 1: 15-29.
- U.S. Board of Governors of the Federal Reserve System. 1986. Balance sheets for the U.S. economy, 1946-85, photocopies. Washington, D.C.: FRS.
- U.S. Department of Commerce. 1976. *Historical statistics of the United States, Colonial times to 1970*. Washington, D.C.: GPO.
- U.S. Department of Justice. 1986. Untitled tables and discussion on aggregate concentration, photocopies. Washington, D.C.: USDJ.
- U.S. Federal Trade Commission. 1969. *Economic report on corporate mergers*. Washington, D.C.: FTC.
- U.S. Federal Trade Commission. Bureau of Economics. 1981. *Statistical report on mergers and acquisitions, 1979*. Washington, D.C.: FTC.
- Verrecchia, Robert E. 1981. On the relationship between volume reaction and consensus of investors: Implications for interpreting tests of information content. *Journal of Accounting Research* 19: 271-83.
- Wansley, James W., Rodney L. Roenfeldt, and Philip L. Cooley. 1983. Abnormal returns from merger profiles. *Journal of Financial and Quantitative Analysis* 18: 149-62.
- Weston, J. Fred. 1953. *The role of mergers in the growth of large firms*. Berkeley: University of California Press.
- White, Lawrence J. 1981a. What has been happening to aggregate concentration in the United States? *Journal of Industrial Economics* 29: 223-30.
- \_\_\_\_\_. 1981b. The merger wave: Is it a problem? *Wall Street Journal*, 11 December 1981, 26.
- \_\_\_\_\_. 1982. Mergers and aggregate concentration. In *Mergers and acquisitions: Current problems in perspective*, ed. Michael Keenan and Lawrence J. White, 97-111. Lexington, Mass.: D.C. Heath.

## Comment Steven C. Salop

The Golbe-White paper is, in a sense, two separate papers. The first presents an overview of the available time-series data on mergers and acquisitions. The second provides an empirical study of the determinants of merger activity over the past 35 years. After a few initial comments on the overview, my main comments will focus on the empirical study.

The time-series overview is a very useful piece of work. Golbe and White set out the various data series and work to splice the data sets together. This was not a trivial task. Their resulting series allows us to see the historical patterns more easily.

I found the most interesting result in this section to be that mergers have not been as significant in the recent economy as they were in the past. The authors compare the number of mergers to real GNP and show that this ratio was larger at the beginning of the century than in the recent past. One can quibble about the proper ratio to calculate here. The number of mergers does not control for the size of the average merger; perhaps a better deflator would be a stock measure (for example, total domestic wealth) rather than a flow measure like real GNP. Nonetheless, the result is striking.

Golbe and White's empirical study focuses on the determinants of aggregate merger activity. In contrast to most of the other papers in this volume that analyze *which* mergers occur, Golbe and White study *how many* mergers occur. Their study is thought provoking, but still very preliminary.

More work is needed before we can draw strong conclusions about the determinants of aggregate merger activity, for two reasons. First, the authors' results are fairly weak. Many of the results were negative; no relationship could be found. Second, the theory underlying the empirical analysis was not fully developed.

This was primarily an empirical paper. The theory section consisted of a list of independent variables and their expected signs. No model was developed beyond this list. In particular, the hypotheses did not flow from a general equilibrium model of financial markets with imperfect information about a stochastic economy, although that apparently is the model underlying the analysis.

This problem can be illustrated with two of the variables. According to Golbe and White, asset exchanges occur when potential purchasers perceive that current asset prices represent "bargains" in the market. They measure this phenomenon by the economywide value of Tobin's



$q$ , the ratio of market value to replacement cost. Second, because buyers and sellers must agree on a price, substantial divergence of opinion in the economy should affect the likelihood of finding a mutually acceptable price. More divergence of opinion probably leads to more mergers. The authors measure divergence of opinion by the variance among macroeconomic forecasts. These two variables should not be treated as separate ones, discussed independently. They both should flow out of an equilibrium model of expectation formation, where expectations are endogenous and depend on public as well as private information.

An asset is a bargain if its price is low relative to its expected price in the future, not relative to its replacement cost. Thus, the Tobin  $q$  is the correct variable for measuring bargains only if one believes that buyers and sellers expect  $q$  to equal one in the near future. Instead, at the least, a proxy for expected  $q$  in the near future should have been formulated. That should come out of a model of expectation formation. An assumption of perfect foresight and thus the measurement of the ratio of the current value of  $q$  relative to its actual future value would have been a superior variable to examine.

Of course, this approach creates two additional simultaneity problems in expectation formation, even beyond the simultaneity problem raised by the authors: that current merger activity raises future prices. First, expected future asset prices will determine current prices. Second, buyers' and sellers' expectations are not independent.

The theory of assets as bargains is incomplete without an analysis of these issues. Consider for example, the implications of the fact that sellers also have expectations. If the ratio of current to future  $q$  implies bargains, then it is true that purchasers would desire to buy assets. Yet if these same expectations were held by potential sellers as well, the transactions might not take place.

This possibility raises, of course, the issue of divergence of opinion. First, I think divergence of opinion is not measured with the best variable. Because the real issue is differences of opinion regarding the future value of the assets, divergence in macroeconomic forecasts is not the best proxy. Better proxies might be divergence in stock market forecasts. One simple variable might be the price of "straddle" options. In a market where volatility is expected, straddles are more expensive.

Second, Golbe and White treat that variable independently, rather than fundamentally connected to the "bargains" variable. Yet the two are intimately connected. A "bargain" means that the purchaser thinks the asset is undervalued at the price at which it is offered by the seller. The seller does not think it is a bargain, but a ripoff. In short, the two parties have a divergence of opinion.

The relationship between these variables can be seen in a model of asset exchanges with imperfect information. Golbe and White suggest that, though divergence could in principle reduce the number of exchanges, they expect greater divergence of opinion to lead to more mergers. Although I may agree with their empirical intuition, it still would be useful to set out a model to see the conditions under which the effect could go the other way.

Consider the following simple static model of exchange.<sup>1</sup> Suppose that there are  $n$  potential buyer-seller "transactional pairs," indexed by  $i = 1, 2, \dots, n$ .<sup>2</sup> A transactional pair will consummate an exchange if the buyer's value  $b_i$  exceeds the seller's reservation price  $s_i$ —that is, if net surplus  $z_i = b_i - s_i > 0$ . Even if there are no differences of opinion about the prospects for firms,  $b_i$  and  $s_i$  still could diverge, and some exchanges will occur, if the buyer has a comparative advantage in managing the assets. Indeed, Golbe and White capture this idea with a variable that measures structural changes in the economy that might lead to shifting comparative advantages.

Consider first an economy with shifting comparative advantages but no differences of opinion, and suppose that in this economy,  $m < n$  exchanges would occur, which we denote as the first  $m$  transactional pairs, that is,  $z_i > 0$  for  $i = 1, 2, \dots, m$ .

Now compare this to a more stochastic economy where the buyer's value is given by  $b_{ii} = b_i + \beta e_i$  and the seller's value is given by  $s_{ii} = s_i + \beta u_i$ , where  $e_i$  and  $u_i$  are random variables, each with a mean of zero, and  $\beta$  is a non-negative multiplier. (The initial economy is given for  $\beta = 0$ .) Consider the effect of increasing  $\beta$  to a positive number. In this new  $\beta > 0$  economy, exchanges occur only if  $z_{ii} = b_{ii} - s_{ii} > 0$ . As a result, some of the  $m$  exchanges would no longer occur and some of the  $n - m$  transactional pairs that failed to reach agreement now would succeed. Whether the aggregate number of exchanges rises or falls depends on the relative sizes of  $n$  and  $m$  and the underlying distribution of  $z_i$ , locally and globally.

Golbe and White's intuition is based on the idea that if  $m$  is small, the number of disrupted exchanges will be small; in contrast, the pool of potential new exchanges is large. In fact, for a small  $\beta$ , what is relevant is the relative numbers of *marginally* successful and marginally unsuccessful transactional pairs, not the aggregate numbers. For example, if the initial density of  $z_i$  were symmetric with a local maximum

1. This model draws heavily on the model of litigation settlement behavior devised by Klein and Priest (1984). See also Perloff and Rubinfeld (1988).

2. For simplicity, assume that each buyer and each seller are involved in only one transactional pair, that is, buyer  $i$  is interested *only* in the asset of seller  $i$ . He places no value on any other asset. This assumption simplifies the discussion by eliminating all competition among buyers and sellers.

at zero, the number of new exchanges created would just equal the number of old exchanges disrupted, irrespective of the global success rate. Only if the initial number of marginally unsuccessful transactional pairs exceeds the number of marginally successful pairs will increases in  $\beta$  raise the number of successes. Formally, denoting by  $f(z)$  the density of  $z$ , this means  $f'(z) < 0$ .

Because the number of asset exchanges in the economy is quite small relative to the potential number of transactions, Golbe and White probably also are correct that the density of  $z$  is downward sloping at the margin. As a result, greater differences in opinion would increase the number of successful deals. But this need not be so. Locally, the number of marginally successful pairs may exceed the number of marginally unsuccessful ones.

This formal model also suggests that the relationship is nonlinear. Even under the standard intuition, when the other determinants of merger activity lead to a high number of transactions, an increase in opinion divergence will lead to a smaller increase in the number of exchanges.

Finally, the paper could be improved by recognizing the interaction between the stock market and physical asset markets. I earlier identified one interaction, the fact that options prices may provide a gauge of opinion divergence. But other, more fundamental interactions occur. Acquisition of physical assets in a merger involves two elements—purchasing the existing profit stream of the acquired firm and purchasing the right to manage the acquired firm. A potential purchaser can acquire only the first right by purchasing a block of common stock. Thus, a more complete model would view stock purchases as a substitute for asset acquisition and estimate a general equilibrium model in which both are possible.

In this regard the Golbe and White paper would be improved if it simultaneously studied the determinants of stock market activity. That study would examine the same set of variables and raise the same set of questions. For example, is it true that stock market activity is positively correlated with stock prices? Is it true that stock market activity is positively correlated with divergence of opinion, say, as measured by the price of straddles?

In sum, I learned something from the paper. I also expect the paper to provoke additional research into time-series analysis of merger activity. My only wish is that the additional research had been carried out in the current paper.

## References

- Klein, Benjamin, and George L. Priest. 1984. The selection of disputes for litigation. *Journal of Legal Studies* 13: 1-55.

Perloff, Jeffrey, and Daniel Rubinfeld. 1988. Settlements in private antitrust litigation. In Lawrence White, ed., *Private antitrust litigation: New evidence, new learning*. Cambridge: MIT Press.

## Comment      Robert A. Taggart, Jr.

There is a natural tendency to focus on the dramatic aspects of current events. Thus, the highly publicized takeover battles of the past few years have led many observers to conclude that recent merger activity is more hostile, on a grander scale, and of more far-reaching significance for the economy than ever before.

Because of this tendency, the study by Golbe and White is an integral part of any comprehensive examination of mergers. If we are to understand mergers and their impact on the economy, we need to know if the current merger activity is, in fact, unusual.

An immediate contribution of this paper, therefore, is its finding that the current activity does not appear unusual when viewed in a historical context. The absolute number of mergers during the 1980s has been large, but once allowance is made for the size of the overall economy, the current merger wave does not stand out from the previous episodes, particularly that occurring around the turn of the century. In addition, the data suggest that recent mergers have not led to any significant increase in aggregate industrial concentration for the U.S. economy.

In reaching these conclusions, Golbe and White also perform a valuable ancillary service. They provide an excellent summary of the available data on aggregate merger activity in the U.S. economy since 1895. In particular, they carefully review various noncomparabilities and gaps in the data. This discussion should prove very useful to future students of long-run merger patterns.

Despite the problems with the data, the conclusion that current merger activity is less impressive in relative than in absolute terms seems well founded. That in turn leads to curiosity about the factors that determine the aggregate volume of mergers and how these factors are related to broad economic trends. It is to this issue that Golbe and White turn next.

Unfortunately, this effort is hampered by the fact that most available theory pertains to mergers as a micro phenomenon, whereas it is the aggregate level of mergers the authors seek to explain. What is needed is a theory of mergers at the macro level.

In the absence of such a theory Golbe and White have assembled a number of explanatory variables, which I will place in several categories.

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Certain macro-level variables, for example, can be guessed at relatively easily, even without an explicit theory. We would expect, for instance, that the volume of mergers is positively related to the overall level of economic activity.

The available micro-level theory does suggest certain other variables that should be related to the aggregate merger level. That theory implies simply that mergers take place when they are perceived to have positive net present values. Since those values are in turn a function of cash flows and discount rates, some measure of the cost of capital immediately arises as a potential explanatory variable.

Certain other variables are clearly implied by the theory, but they are very difficult to measure at the aggregate level. Changes in the tax code, for example, should significantly affect the perceived values of mergers. But tax considerations differ enough from one merger to the next that it is hard to recommend much except dummy variables to capture the aggregate effects of these tax changes. In a similar vein, it seems clear that periods in which market participants have sharp differences in expectations or in which industries are in a state of upheaval should be ripe for mergers, but exactly how such periods should be identified is far less clear.

Tobin's  $q$  falls into still another explanatory variable category, and it is here, I believe, that the problem of applying a micro theory at the macro level emerges most sharply. At the micro level it makes perfect sense that low values of  $q$  should stimulate merger activity. If a firm wishes to acquire a specific set of assets, and if several target firms possess those assets then, other things being equal, it will choose the target with the lowest  $q$ . Moreover, the low values of  $q$  should make mergers more attractive relative to the alternative of buying the same set of assets in the market for real capital. And indeed,  $q$  has exactly this predicted effect in cross-sectional regression studies by Hasbrouck (1985) and Bartley and Boardman (1986).

At the macro level, however, I am not sure what an aggregate measure of  $q$  implies for the aggregate level of mergers. Golbe and White argue that unusually low values of  $q$  are likely to be associated with larger numbers of undervalued firms and hence more attractive merger candidates. That proposition strikes me as quite plausible as long as the aggregate  $q$  primarily reflects these potential targets. Suppose, however that unusually high values of  $q$  reflect greater numbers of overvalued firms. For an acquiring firm this type of valuation error might actually encourage mergers, particularly if acquired firms' shareholders are willing to accept shares of the acquiring firm's stock.

Another possibility is that valuation errors are made primarily by acquiring firms' executives rather than by investors in the securities markets. Under Roll's (1986) "hubris hypothesis" of corporate take-

overs, for instance, capital markets are presumed efficient in the strong form, and hence acquisition bids at premium prices simply reflect overvaluations on the part of the bidders. Moreover, if the buoyant economic climate associated with high values of  $q$  is also conducive to greater bidder hubris, Golbe and White's finding of a positive relationship between  $q$  and merger activity may not seem so anomalous.

I do not claim that either of the possible linkages between  $q$  and merger activity that I have described above is inherently more plausible than the one described by Golbe and White. Nonetheless, I am not convinced they are less plausible, either, and so I do not find Golbe and White's empirical results necessarily puzzling.

The general difficulty that these remarks are intended to illustrate is that the available theory simply does not give us much guidance in seeking out the determinants of aggregate merger activity. The most appropriate variables and the expected direction to their effects are not very sharply delineated. When this problem is combined with some difficult measurement problems, we should perhaps not be too disappointed that we do not come away from a study of this type with a clear vision of the driving forces behind merger activity.

In the final analysis it may turn out that the volume of mergers does not reflect macroeconomic factors as much as it does industry or sectoral factors. Popular generalizations tend to associate the various merger "waves" with particular industry groups. Thus, the spurt in merger activity at the turn of the century is thought to reflect the consolidation of the steel, oil, and other mining and manufacturing industries; the rise in mergers in the 1920s is commonly linked to the public utility holding company movement; and the most recent increase in mergers is thought to reflect the restructuring of such diverse industries as oil, airlines, broadcasting, and food and consumer products. If there is some truth to these generalizations, it may be that further understanding of merger determinants must come from a more disaggregated analysis.

## References

- Bartley, Jon W., and Calvin M. Boardman. 1986. Replacement-cost-adjusted valuation ratio as a discriminator among takeover target and nontarget firms. *Journal of Economics and Business* 38: 44-55.
- Hasbrouck, Joel. 1985. The characteristics of takeover targets. *Journal of Banking and Finance* 9: 351-62.
- Roll, Richard. 1986. The hubris hypothesis of corporate takeovers. *Journal of Business* 59: 197-216.

