Market Value, Mergers, and Market Share: Evidence from a Panel of US Firms*

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Abstract

Improving shareholder value through higher stock market valuation has often been cited as a key determinant for merger activities. However, there is limited evidence that offers a strong link between the consummation of a merger and subsequent stock market value. My contribution to the literature is premised on the construction of a panel data set of mergers among publicly traded U.S. manufacturing firms from 1980 to 2003. These data allow me to exploit cross-industry and time-series variation across mergers that occurred during the sample period and thus, minimize potentially confounding effects from unobserved heterogeneity. I find that mergers on average are significantly correlated with an increase in firm specific stock market value and market share, but have no statistically significant impact on overall market concentration. The effect with respect to profitability is inconclusive.

Keywords: Market Value, Market Structure, Market Share, Concentration, Merger, Patent, Citation, R&D, Profit, Stock Price

JEL Classification Numbers: L22, L44, L51, L60, L00, G34, C23, D43, O34

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1 Introduction

Jim Rogers, Duke Energy CEO, in a press release explained the goal of the announced merger between Duke Energy Corp. and Progress Energy Inc. in 2011 as: "By merging our companies, we can do that more economically for our customers, improve shareholder value and continue to grow." Progress Energy CEO, Bill Johnson, also said: "It makes clear, strategic sense and creates exceptional value for our shareholders."[1]

Firms use mergers as a strategy to increase market share, improve shareholder value, exploit efficiencies, diversify product portfolios, and obtain market power.[2] The theoretical literature in industrial organization has addressed the market outcomes of mergers extensively (e.g., Salant et al., 1983, Perry and Porter, 1985, Farrell and Shapiro, 1990, and McAfee and Williams, 1992). However, these studies do not offer a consensus.

The empirical literature is similarly ambiguous. These studies find that mergers are not that profitable for acquiring firms, and target firms tend to experience lower profitability over the period of merger (e.g., Mueller, 1985, Ravenscraft and Scherer, 1989, Maksimovic and Phillips, 2001, and Andrade et al., 2001).[3] Further, most empirical studies on merger effects focus on product prices of a single industry (Ashenfelter et al., 2009). Only a few of these papers investigate the impact of mergers on other outcome variables, such as market share, load factor, and capacity (e.g., Packalen and Sen, 2011, Coloma, 2002, and Borenstein, 1990).[4]

[1] "Duke, Progress to Merge" (http://www.elp.com/index/display/article-display/6142111616/articles/utility-automation-engineering-td/volume-16/issue-2/departments/notes/duke-progress-to-merge.html; last accessed 27 Sept. 2012). This merger was completed on July 2012 ("Duke Energy and Progress Energy Have Merged," https://www.duke-energy.com/corporate-merger/; last accessed 27 Sept. 2012).

[2] The merger mania during 1990s disappeared with the 9-11 attack and corporate scandals. Merger activities increased in early 2000, but again disappeared after the financial meltdown in 2007. As financial markets started to recover in 2010, merger activities increased once again (Peball et al., 2011, p.285).

[3] Mueller (1985) utilizes Federal Trade Commission surveys from 1950 to 1972. Ravenscraft and Scherer (1989) employ data on the U.S. manufacturing sector from 1957 to 1977. Maksimovic and Phillips (2001) use the longitudinal research database (LRD) from 1974 to 1992. Andrade et al. (2001) employ Compustat data from 1973 to 1998.

[4] Packalen and Sen (2011) examine market share in the gasoline industry from 1988 to 1998. Coloma

This paper examines the market outcome of mergers in a multi-industry context by investigating merger induced changes in firm specific market value, market share, market concentration, stock market prices, and profits. My paper adds to the empirical literature in several aspects. First, I construct a unique panel of more than 6,000 merging and non-merging publicly traded U.S. manufacturing firms from 1980 to 2003. This sample facilitates a multi-industry analysis of more than 1,000 mergers available from the Thompson Financial SDC Platinum data set, which contains firm specific information for both before and after merger periods. I also evaluate market outcomes of mergers in a different panel data sample based on the merger information from the Bloomberg data set as a robustness check. This sample contains information on more than 400 mergers.

According to Pautler (2003), most of the previous empirical literature on mergers across several industries are only focused on transactions that occurred prior to 1980, and the samples are not based on panel data (e.g., Ravenscraft and Scherer, 1989, Ravenscraft and Pascoe, 1989, and Mueller et al., 1980). Therefore, the findings of previous studies might be biased by potentially confounding effects of unobserved firm and industry heterogeneities. The panel nature of my data mitigates the potentially confounding effects of unobserved time invariant firm specific characteristics that might be correlated with the likelihood of merging. Such a multi-industry analysis based on longitudinal data makes an empirical basis for antitrust enforcements, and the results have the potential to be generalized to different cases.

The other distinguishing aspect of the constructed sample is the long time span (23 years), which allows me to examine the long-run effects of mergers. To my knowledge, the only other long-run multi-industry analysis of mergers on firm value is Malmendier et al. (2012), who examines the long-run impacts of mergers on abnormal returns using panel data on mergers for more than 20 years.[5] However, this study employs a sample of contested

(2002) investigates price, quantity, and market share in the gasoline industry from 1998 to 2000. Borenstein (1990) focuses on price, market share, load factor, and capacity of airline mergers from 1985 to 1987.

[5]Malmendier et al. (2012) obtain merger data from the SDC, and the time span of their analysis is from

mergers which might not be a representative for the merger population.

Second, my data contain information on innovative activities of firms, patenting and patent citations. This information allow me to control for the impact of intangible assets of firms in the examination of merger impacts on stock market valuation of firms.[6] Previous studies on merger induced changes in stock market value employ market event analysis around the time of merger.[7] These studies do not control for the important role of the intangible assets in firm valuations.

Further, literature only offers limited empirical studies on the impact of market structure on market value (e.g., Lindenberg and Ross, 1981 and Hirschey, 1985). These studies generally focus on a cross-section of firms and do not reach into a consensus on the market structure impact. As a result, my paper also contributes to the market structure literature by evaluating the impact of mergers on market value, while taking into account the effect of intangible assets. Moreover, I use an instrumental variables (IV) strategy to estimate market value impacts of mergers to correct for potential measurement errors arising from simultaneity bias. As far as I am aware, none of the previous studies employs the IV strategy in investigating the impact of mergers on market value using such a broad sample of manufacturing firms with more than 20 years of observations.[8]

Third, this paper also adds to the literature on merger induced changes in firms' market share in a multi-industry context. In the theoretical literature, McAfee and Williams (1992) find that the market share of the merged firm is smaller than the merging firms' combined pre-merger market share. Farrell and Shapiro (1990) show that when merger induced efficiencies

1985 to 2009.

[6]According to Griliches (1981), Hall et. al. (2005), Chauvin and Hirschey (1993), Hall (1988), and Hall (1993), intangible assets are important determinants of firms' stock market valuation, as they increase future cash flows of firms.

[7]Jarrell and Poulsen (1989) and Jensen and Ruback (1983) find large returns for stockholders of target firms. Jensen (1988) finds that the returns to stock holders of acquiring firms are positive, but relatively small.

[8]In the finance literature, Rhodes-Kropf et al. (2005) focus on the reverse correlation and examine the impact of market valuation on mergers. They find that firms' misvaluation is the reason behind merger activities.

are present, they help the merging firms to regain their combined pre-merger market share in the post-merger period. According to Packalen and Sen (2011), previous empirical studies only offer limited evidence on merger induced changes in market share, and they are generally limited to single industry analyses. This study also employs panel data based on financial indices to examine the impact of mergers on market concentration, stock market prices, and different profit measures.

The findings of this paper suggest that mergers increase stock market value, which imply a positive correlation between market structure and firm's market value. IV estimates of the effect of mergers on market value are comparable to non-instrumented estimates. The merger induced changes in market share are positive and statistically significant. More specifically, the long-run effects illustrate that manufacturing firms regain their market share in the post-merger period, and merger induced efficiencies are present. I also find evidence for an increase in stock market prices due to mergers. Furthermore, as the number of years that firms are observed in the post-merger period lengthens, the positive impact from mergers on stock market prices tend to become smaller on average.

Mergers also do not show any statistically significant change of concentration in the acquiring firms' industries. This implies that firms do not merge for the purpose of securing market power, and this finding is compatible with Andrade et al. (2001) who explain the purpose of mergers is not obtaining market power since 1940s due to changes in antitrust regulations. Mergers in the manufacturing sector also have inconclusive effect on profit. Furthermore, I find that the impact of mergers on market value is heterogeneous to firm size. Larger firms will experience higher market value if they decide to merge, probably because mergers involve combining assets which lead to an increase in their size, and possibly reduce their costs. In summary, my study offers some robust evidence and clarity on how firms benefit from mergers.

2 Empirical Framework

2.1 Mergers and Market Value

The empirical model that I employ to assess the impact of mergers on the market value of firms is based on Griliches (1981) and Hall et al. (2005). The general specification for a firm's market value function is

$$MarketValue_{it} = SV_{it} \left(TA_{it} + \gamma INA_{it}\right)^{\sigma}. \tag{1}$$

The variable $Market\ Value_{it}$ is the the market value of firm i in year t. Following Hall et al. (2005), the market value of a firm is calculated as the sum of the current market value of common and preferred stocks, long-term debt adjusted for inflation, and short-term debts of the firm net of assets. The variable SV_{it} is marginal shadow value of assets. The variables TA_{it} and INA_{it} are tangible and intangible assets, respectively. Their measurement is discussed shortly.

Using a logarithmic function, equation (1) becomes

$$logMarketValue_{it} = logSV_{it} + \sigma\ logTA_{it} + \sigma\ log\left(1 + \gamma\ \frac{INA_{it}}{TA_{it}}\right). \tag{2}$$

In the analysis of Hall et al. (2005), the variable $logSV_{it}$ includes time fixed effects (m_t) and the error term (ϵ_{it}). The term ϵ_{it} denotes the other factors that influence market value of firms. I assume that ϵ_{it} is additive, independently and identically distributed across firms and over time, and serially uncorrelated. The coefficient γ is the shadow price of the intangible asset to tangible asset ratio. The parameter σ is a scale factor in the value function.[9] Moving the variable TA_{it} to the left-hand side in equation (2) allows left-hand side of this equation

[9] According to Hall et al. (2005), the assumption of constant returns to scale with respect to assets usually holds in the cross-section. Thus, σ becomes one.

to be written as $log\left(\frac{Market\ Value_{it}}{TA_{it}}\right)$ or Tobin's q. Equation (2) then becomes

$$logq_{it} = log\left(1 + \gamma\ \frac{INA_{it}}{TA_{it}}\right) + m_t + \epsilon_{it}. \tag{3}$$

Following Hall et al. (2005), the variable TA_{it} is measured by the book value of firms based on their balance sheet. The book value of a firm is calculated as the sum of net plant and equipment, inventories, investments in unconsolidated subsidiaries, and intangibles and others. All components of TA_{it} are adjusted for inflation.[10] INA_{it} is estimated based on the approach of Hall et al. (2005), who measure the variable INA_{it} with $R\&D$ intensity ($R\&Dstock_{it}/TA_{it}$), patent intensity ($PATstock_{it}/R\&Dstock_{it}$), and citation intensity ($CITEstock_{it}/PATstock_{it}$). The variables $R\&Dstock_{it}$, $PATstock_{it}$, and $CITEstock_{it}$ measure the stock of $R\&D$, patents, and citations, respectively. These variables are constructed based on a declining balance formula with the depreciation rate of 15%.[11] Hall et al. (2005) justify their method for measuring INA_{it} of a firm by arguing that the firm's $R\&D$ expenditures show the intention of the firm to innovate. The $R\&D$ expenditures might become successful and result in an innovation. Patents of the firm catalogue the success of the innovative activity, and the importance of each patent is measured by the number of times it is cited in subsequent patents. Therefore, I employ $R\&D$, patent, and citation intensities to measure INA_{it}, and equation (3) becomes

$$\begin{aligned} logq_{it} \;\; = \;\; & log\left(1 + \gamma_1\ \left(\frac{R\&Dstock}{TA}\right)_{it} + \gamma_2\ \left(\frac{PATstock}{R\&Dstock}\right)_{it} + \gamma_3\ \left(\frac{CITEstock}{PATstock}\right)_{it}\right) \\ & + m_t + \epsilon_{it}. \end{aligned} \tag{4}$$

[10] Inflation adjustments are based on the CPI urban U.S. index for 1992 (Source: http://www.bls.gov).

[11] Following Hall et al. (2005), the employed declining balance formula is $K_t = (1-\delta)K_{t-1} + flow_t$. The variables K_t and $flow_t$ stand for knowledge stock and knowledge flow at time t, respectively. I define the initial stock of knowledge variables as the initial sample values of the knowledge variables similar to Noel and Schankerman (2006). I select the parameter δ or depreciation rate equal to 15%. Most researchers settled with this deprecation rate (Hall et al., 2000, 2005, and 2007). Hall and Mairesse (1995) show experiments with different deprecation rates, and they conclude that changing the rate from 15% does not make a difference. As a result, I select $\delta = 15\%$, and this selection assists in easy comparisons to previous studies.

There is a difference between the application and grant date of patents. Out of the patents applied close to the end date of the sample, only a small fraction is granted, and the rest are granted outside the reach of the sample. This issue indicates truncation in patent counts. Citation counts are also truncated. Truncations in citations happen since only citations that occur within the sample are observable. I correct for these truncations. As a result, the $PATstock_{it}$ and $CITEstock_{it}$ variables are built based upon patent and citation counts, which are corrected for the truncation problems. See Appendix A for a more detailed explanation of the correction procedures.

To estimate the impact of mergers on the market value of firms, I augment equation (4) with an indicator variable which is equal to one for post-merger years for merging firms ($DPostMerger_{it}$) following Ashenfelter et.al. (2009). To control for the effect of demand shocks, I include the firm level distributed sales ($logsale_{it}$ and $logsale_{it-1}$). I also add the variable $logemployee_{it}$ to control for the size of the firm. The variable $logemployee_{it}$ is measured by the log of the number of employees in a company. In years that an acquiring firm merges with another company, $logemployee_{it}$ is the sum of the employee number in the acquiring and target firms.[12] Therefore, equation (4) changes to

$$\begin{aligned} logq_{it} &= log\left(1+\gamma_1\left(\frac{R\&Dstock}{TA}\right)_{it}+\gamma_2\left(\frac{PATstock}{R\&Dstock}\right)_{it}+\gamma_3\left(\frac{CITEstock}{PATstock}\right)_{it}\right) \\ &\quad +\delta_1\, DPostMerger_{it}+\delta_2\, logsale_{it}+\delta_3\, logsale_{it-1}+\delta_4\, logemployee_{it} \\ &\quad +m_t+\epsilon_{it}. \end{aligned} \tag{5}$$

Equation (5) could be estimated with a non-linear least squares estimator, but it is easier to substitute the non-linear terms with series expansions and estimate the equation with a linear estimator, following Bloom et al. (2005) and Noel and Schankerman (2006).[13] This

[12]To control for the effects of market structure on market value, I also added the log of a Herfindahl index. I calculated this variable using firm-level sales based on 4-digit SIC codes. I did not include this variable in my specifications, as it did not play a role in deciding market value.

[13]I would not approximate $log(1+\theta\frac{INA_{it}}{TA_{it}})$ with $\theta(\frac{INA_{it}}{TA_{it}})$ because such an approximation is right if the ratio of intangible assets to tangible assets is small. However, this ratio is generally large for firms in the

approach makes the incorporation of firm fixed effects easier. Some firms might have a permanently higher market value than others due to omitted firm specific effects.[14] With the inclusion of the firm fixed effects, equation (5) becomes

$$\begin{aligned} logq_{it} &= \gamma_1 \, \Psi\left(log\left(\frac{R\&Dstock}{TA}\right)_{it}\right) + \gamma_2 \, \Omega\left(log\left(\frac{PATstock}{R\&Dstock}\right)_{it}\right) \\ &+\gamma_3 \, \Gamma\left(log\left(\frac{CITEstock}{PATstock}\right)_{it}\right) + \delta_1 \, DPostMerger_{it} + \delta_2 \, logsale_{it} \\ &+\delta_3 \, logsale_{it-1} + \delta_4 \, logemployee_{it} + m_t + \alpha_i + \epsilon_{it}, \end{aligned} \tag{6}$$

where the parameters Ψ, Ω, and Γ denote the polynomials of the measures of intangible assets. To avoid the omitted variable bias due to unobserved firm heterogeneities, I estimate equation (6) using a within estimator for panel data. Estimates of equation (6) imply that the fifth order polynomials of knowledge intensity variables are satisfactory. I do not consider the multiplicative terms of the measures of intangible assets in equation (6), because including them do not change the results.

2.2 The Instrumented Impact of Mergers on Market Value

It is plausible that a decision to merge is a response to increases in market value. If this is the case, then estimates based on equation (6) are biased and inconsistent. To isolate the exogenous impact of mergers ($DPostMerger_{it}$) on market value, I use three instruments and estimate equation (6) with an instrumental variable approach for panel data.[15]

One of my instruments is an indicator variable which takes a value equal to 1 if the acquiring firm in a merger has experienced another merger(s) in the past two to five years

manufacturing sector.

[14]For example, this could be the result of the stock of past innovations at the beginning of the sample, or a better ability of absorbing external technologies for reasons that are not explained by independent variables.

[15]A concern that might be raised here is that the endogenous variable ($DPostMerger_{it}$) is a binary variable. In this case the first stage IV estimation has to deal with a binary dependant variable. If I use the standard IV method, the standard errors are still correct and the discontinuity of the endogenous variable does not cause any inconsistency in the estimates following Heckman and Robb (1985), p.185.

($Merger2to5_{it}$). This instrument is relevant as firms with previous merger experiences have a larger size which might have lowered their costs, and increased their profit and market share. Thus, participation in a further merger could generate the same benefits. Additionally, acquiring firms with previous merger experiences might take part in the transition of another merger much easier due to their managerial improvements. I also report results using $Merger3to5_{it}$ and $MergerMoreThan5_{it}$ as instruments. These instruments are indicator variables which take a value equal to 1 if the acquiring firm in a merger pair has experienced another merger(s) in the past three to five years and more than five years ago, respectively.

2.3 Mergers, Market Share, Market Concentration, Stock Market Prices, and Profit

As one of the goals behind merger activities is increasing the market share, and merger induced changes are not examined that much in the recent empirical literature (Packalen and Sen, 2011), I estimate the impact of mergers on firm specific market share as

$$logMarketShare_{it} = \alpha_0 + \alpha_1 \, DPostMerger_{it} + m_t + \alpha_i + \epsilon_{it}, \tag{7}$$

where the variable $logMarketShare_{it}$ is the summation of the market share of acquiring firm i and target firm in year t when a merger happens. For all other firms, the variable $logMarketShare_{it}$ is the market share of firm i in year t. The market share of each firm is measured using firm-level sales based on 4-digit SIC codes. I do not use equation (6) to estimate the impact of mergers on market share as tangible and intangible assets are not important in market share. The specification in equation (7) is consistent with previous studies in the literature, such as Packalen and Sen (2011). Additionally, as a merger causes industry production to be reallocated among firms and changes the number of firms in the market, I examine the effect of mergers on concentration in acquiring firms' market based

on equation (7), where the dependent variable is the logarithm of the Herfindahl Index for market concentration ($logHHI_{it}$) in the market of firm i. This variable is measured using firm-level sales based on 4-digit SIC codes. To avoid the omitted variable bias due to unobserved firm heterogeneities, the impact of mergers on market share and market concentration are estimated using a within estimator for panel data.

Mergers might also have impact on stock market prices. I estimate this effect using

$$\begin{aligned} logPstock_{it} &= \beta_0 + \beta_1\, DPostMerger_{it} + \beta_2\, logemployee_{it} \\ &\quad +\beta_3\, logsale_{it} + \beta_4\, logsale_{it-1} + \beta_5\, logHHI_{it} \\ &\quad +m_t + \alpha_i + \epsilon_{it}, \end{aligned} \tag{8}$$

where the dependent variable is the annual average of monthly closing stock prices in US$. In the cases of mergers in the sample, this variable is the average of the annual average of monthly closing stock prices in US$ of the acquiring and target firms. The variable $logemployee_{it}$ controls for firm size, $logsale_{it}$ and $logsale_{it-1}$ control for demand shocks, and $logHHI_{it}$ is a control variable for the market structure.

To examine the profitability of mergers, I investigate the impact of mergers on several profit margin variables based on a model similar to equation (7). I do not use equation (6) as intangible assets are determinants of future expected earnings of firms not the realized profit margins. One of the profit margin variables is $logNPM_{it}$ which is the log of net profit margin or after tax profit margin. This variable is calculated from income before extraordinary items (I_{it}) divided by net sales ($Sale_{it}$). $logOPMAD_{it}$ is another profit margin variable, which is operating profit margin after depreciation and is calculated from operating income before depreciation (OI_{it}) minus depreciation and amortization (DA_{it}) divided by net sales ($Sale_{it}$). $logOPMBD_{it}$ is operating profit margin before depreciation which is measured from operating income before depreciation (OI_{it}) divided by net sales ($Sale_{it}$). Finally, the variable

$logPPM_{it}$ is the pretax Profit Margin and calculated from pretax income (PTI_{it}) divided by net sale ($Sale_{it}$). The impacts of mergers on prices and profit margins are estimated by a within estimator for panel data.

3 Data

My sample is based on four different data sources: the Compustat from Standard and Poors, the National Bureau of Economic Research (NBER), a company identifier file, and the Thompson Financial SDC Platinum. I employ the North American Annual Industrial data of the Compustat, consisting of 469,718 observations on 20,692 U.S. publicly traded firms from 1976 to 2006.[16] This data include information on firms' financial indicators. I use the information on 1,343,251 utility patents granted from 1963 to 2006 and their citations from the NBER to build firm specific intangible assets.[17] The citation data is only available for patents that are granted in 1976 or later.

The company identifier file facilitates linking the patent and citation files from the NBER to the Compustat data by firm names.[18] This link file is required because assignees apply for patents either under their own name or under their subsidiaries' names. The patent and citation information from the United States Patent and Trademark Office (USPTO), which are used for building the NBER data, do not specify a unique code for each patenting identity. However, Compustat has a unique code for each publicly traded firm. The link file contains the assignee number of each firm mentioned on patents in the NBER data, and its equivalent identifier in the Compustat data.

I also employ the merger data from the Thompson Financial SDC Platinum data base.

[16]The publicly traded firms are those traded on the New York, American, and regional stock exchanges, as well as over-the-counter in NASDAQ.

[17]The NBER patent and citation data files were originally built for the data from 1963 to 1999, and they are available in http://www.nber.org/patents. Hall et al. (2001) provide a detailed explanation of these files. Bronwyn H. Hall later updated these files from 1999 to 2006. I use the updated files, which are available at: http://elsa.berkeley.edu/∼bhhall/.

[18]The company identifier file is available at http://elsa.berkeley.edu/∼bhhall.

This data is available from 1980 to present. Considering the employed data sets from other data sources, explained above, I focus on 1980 to 2006 in the SDC merger data. These data have information on 6,072 completed mergers with 1,800 acquiring firms and 2,414 target firms.[19] In order to link the SDC merger data to the Compustat data, the acquiring and target firm names in the SDC are handmatched to the Compustat company names.

I use a sample of manufacturing firms (SIC 2000-3999) from the publicly traded U.S. firms in the Compustat data from 1976 to 2006. This sample in an unbalanced panel of 7,174 firms with 161,633 observations. Manufacturing firms are selected because this sector includes high technology firms, for whom intangible assets are more important. The sample of publicly traded firms is not an exact representative of all firms in the manufacturing sector. However, due to the data limitation, it is the best possible approximation of all firms in this sector. I also combine the patent and citation data files of the NBER together. After accounting for withdrawn patents and considering only the patents of publicly traded firms, the sample from the NBER data has 50,634 observations from 1976 to 2006.

I link the selected sample from the NBER data, explained above, to corresponding observations of publicly traded U.S. manufacturing firms in the sample from the Compustat data by using the company identifier file explained above. Dropping missing observations on market value ($Market\ Value_{it}$) and tangible assets (TA_{it}) of firms results in a sample that consists of 77,909 observations on 6,679 patenting and non-patenting firms from 1976 to 2006.[20] The patent and citation data are truncated as explained in section 2.1. I correct for these truncations, and the correction procedures are explained in Appendix A. After these corrections, I further limit the combined Compustat and NBER sample to 1976-2003 to avoid any potential problems arising from truncations. As a result, I focus only on when

[19] Completed mergers are the ones that are approved by antitrust authorities.

[20] I replace the missing observations of the variables that I use in the construction of $Market\ Value_{it}$ and TA_{it} with zero, and then I build the variables $Market\ Value_{it}$ and TA_{it} (The variables used in building $Market\ Value_{it}$ and TA_{it} are explained in section 2.1). In the next step, I drop the observations for which the value of variables $Market\ Value_{it}$ and TA_{it} are zero. In this method, I will lose less information due to missing observations.

the data is the least problematic.

In the next step, I select a sample of U.S. manufacturing target and acquiring firms from the SDC merger data. To make the selected sample of mergers from the SDC comparable to the combined Compustat and NBER sample, I limit the sample of mergers to 1980-2003. In this sample I have unique 1,566 acquiring firms and 2,075 unique target firms. I handmatched each SDC acquiring and target firm name to the Compustat company names in order to link the sample from the SDC merger data to the combined Compustat and NBER sample. I find 1,064 match in acquiring names and 1,528 match in target names to the company names in the combined Compustat and NBER sample.[21] Keeping in mind that some of the firms experience several mergers during the sample period, after adding the merger data to the combined Compustat and NBER sample, I have 1,965 pair of mergers.[22]

In some of these mergers, I cannot observe the acquiring firm in the pre and post-merger periods. There are two possible explanations for this matter. One is that some firms merge, and their name changes (The SDC merger data do not provide information on such changes). Second is that the merger happens right at year 2003, while the range of the sample under analysis is up to 2003. Therefore, I can not observe the merged company in the post-merger period. There are about 140 of these cases among the 1,965 pair of mergers in the data. Additionally, some of the mergers among the 1,965 pairs are the cases of repurchasing, approximately about 872 cases. I eliminate repurchases and the mergers which are not observed in the periods before and after the merger incident. This leaves me with 1,009 pair of merging firms with 8,043 observations, where some of the acquiring firms experience

[21] One reason for the lack of matching in some of the target and acquiring firm names to the Compustat names is that there are both publicly and privately owned firms in the SDC merger data, but the Compustat data only contain publicly traded firms. Additionally some of the SDC firms might not be in major exchanges similar to the Compustat firms.

[22] The number of firms experienced mergers in the combined Compustat and NBER sample is not equal to the number of handmatched names from the SDC to the combined Compustat and NBER sample. The reason is that there are companies in the SDC merger data that, for example, experienced mergers from 1995 to 2003. However, the same firm appears in the combined Compustat and NBER sample only for years 1976 to 1985.

several mergers in the sample. Among 1,009 merging firms, I have 508 unique acquiring firms.

After combining the selected samples from the Compustat, NBER, and SDC, the resulting sample is an unbalanced panel of 6,030 manufacturing firms with 60,731 observations from 1980 to 2003. About 1,009 of the firms in the sample acquire a target firm and experience a merger. Therefore, I can observe the acquiring firm in the pre and post-merger periods.[23] The result is a longitudinal firm-level data set on firm-level financial variables, and merger and patenting activities.

As a robustness check, I also construct the sample of analysis based on Bloomberg merger data rather than the SDC merger data. The Bloomberg merger data has information on 9,148 and 25,712 acquiring and target firms, respectively, from 1980 to 2010. These firms belong to all sectors and they are either private or publicly held. Similar to the SDC merger data, I focus on the manufacturing U.S. firms from 1980 to 2003. This leaves me with 3,049 acquiring firms and 2,085 target firms. Then, I handmatche the Bloomberg acquiring and target firm names to the Compustat company names. I find 1,798 match in acquiring firm names and 912 match in target firm names to the Compustat. After merging the matched names to the combined Compustat and NBER sample, explained above, I have 531 pair of mergers.[24] Similar to the SDC merger data, I eliminate the mergers that are not observed in at least one year before and after the merger incident (59 cases) as well as repurchases (19 cases), which leaves me with 451 pair of merging firms with 1,720 observations. Thus, the resulting sample from combining Compustat, NBER, and Bloomberg is a longitudinal firm-level data set that contains 6,029 publicly traded U.S. manufacturing firms with 61,640 observations from 1980 to 2003. About 451 of these firms acquire a target firm and are observed in the post and

[23] I consider the year of the merger incident in the post-merger period.

[24] The number of firms experienced mergers in the combined Compustat and NBER sample is not equal to the number of handmatched names from the Bloomberg merger data to the combined Compustat and NBER sample. The reason is that there are companies in the Bloomberg merger data that, for example, experienced mergers from 1995 to 2003. However, the same firm appears in the combined Compustat and NBER sample only for years 1976 to 1985.

pre-merger periods. I report estimates based on both samples with merger information from the SDC and Bloomberg. Table 1 in the Appendix shows a summary of these samples.

Table 2 in the appendix presents the descriptive statistics of all variables based on the SDC sample. The average firm in the sample is large and R&D intensive.[25] Figure 1 in the appendix, based on the SDC sample, shows an increasing trend in the number of mergers among publicly traded U.S. manufacturing firms in each year. The sharp decline in 2001 and afterwards coincides with the 9-11 attack and corporate scandals, such as Enron and the bursting of the dot.com bubble (Pepall et al. (2011), p.285).[26] Figure 2, based on the SDC sample, also displays the distribution of mergers based on the number of years they lasted after the merger incident in the sample. Out of 508 unique acquiring firms in the sample, 175 of them experience mergers which last for 2 years or less, 158 firms experience mergers which last between 3 to 4 years, mergers for 92 of them lasts between 5 to 6 years, and 134 of them experience mergers which last for more than 6 years in the sample.

Figure 3, based on the SDC sample, illustrates the average of the percentage change in Tobin's q for firm's who experience mergers which last for two years and non-merging firms. Apparently, mergers that last two years in the sample do not have a significant influence on the percentage change in Tobin's q of merging firms in comparison to non-merging firms. However, when I incorporate firm sales in measuring the percentage change in Tobin's q and find the weighted percentage change in Tobin's q, as Figure 4, based on the SDC sample, illustrates, firms who experience mergers that last for two years have generally a higher percentage change in Tobin's in comparison to non-merging firms.

[25]The average firm is large, because it has 7,000 employees. This firm is R&D intensive, since its R&D intensity is 2.65.

[26]Additionally, the sharp decline in 2001 and afterwards is associated with dropping mergers that occurred in 2003 and can not be observed in the post-merger period.

4 Results

4.1 Mergers and Market Value

Tables 3 and 4 contain estimates of mergers on market value based on equation (6) for 1980-2003 and 1990-2003, respectively. Columns (1) to (4) in both tables are based on the the SDC sample, and column (5) is based on the Bloomberg sample. Standard errors are all clustered at the firm level. The first and second columns in Tables 3 and 4 are the base specifications, which show the effect of mergers on market value in isolation from the effect of other regressors but for firm and time fixed effects. Column (3) adds R&D intensity and its fifth order polynomials, and column (4) includes all knowledge intensity variables and their fifth order polynomials to control for the impact of intangible assets. For the sake of brevity, I just report the results on polynomials of degree 2 of knowledge intensity variables in Tables 3 and 4.

Column (4) which includes all the regressors in equation (6), including fifth order polynomials, reports the estimated coefficient on $DPostMerger_{it}$ equal to 0.063 in Table 3. This result indicates that the difference in the mean of market value between merging and non-merging firms is increased following the merger incident on average (the base group is non-merging firms). One interpretation of this result might be that mergers, which lead to larger and less-competitive firms, increase expected future earnings of merging firms and therefore, increase their market value in comparison to non-merging firms. This provides evidence on the correlation between market structure and market value. The positive impact of mergers on market value is also present in the Bloomberg sample. Even in the smaller sample of 1990-2003 for both of the SDC and Bloomberg samples in Table 4, mergers increase firms' market value. In summary, my results offer strong evidence of higher shareholder values due to firm specific merger activities. This is informative given my use of a very large sample.

4.2 Instrumental Variables

In order to take into account the possibility of measurement errors in the impact of mergers on market value, Table 5 reports the First and second stage IV regressions using the instruments explained in section 2.2 based on the SDC sample. Column (1) employs an indicator variable which takes a value equal to 1 if the acquiring firm in a merging pair has experienced another merger(s) in the past two to five years ($Merger2to5_{it}$) as instrument, and column (2) uses $Merger3to5_{it}$ as instrument which is an indicator variable which takes a value equal to 1 if the acquiring firm in a merging pair has experienced another merger(s) in the past three to five years. Column (3) employs additional instrument, $MergerMoreThan5_{it}$, which is an indicator variable for acquiring firms in merging pairs who experienced other mergers in more than five years ago.

In all columns (1) to (3) of Table 5, the coefficient estimates of all instruments are positive and statistically significant at 1% level of significance. This conforms with the expectation that firms with previous merger experiences participate in another merger for enjoying the benefits of their previous mergers again. Additionally, the first stage F-statistics is large in all columns which mitigates concerns that second stage estimates might be unreliable. Therefore, I can reject the null hypothesis that the estimated coefficients of the instruments are equal to zero. I also conducted a test of overidentifying restrictions for column (3). The null hypothesis of the exogeneity of instruments could not be rejected. I employ the J-test of Hansen (1982). The amount of the test statistics is 0.043 and the P-value is 0.836. These results suggest that my employed instruments in column (3) can explain variations in decisions to merge, while remaining uncorrelated with error terms.

The instrumented impact of mergers on market value in the second stage IV estimates of Table 5 are not that different in magnitude from corresponding estimates in Table 3. In all columns, the impact of mergers on market value is positive and statistically significant.

4.3 Mergers, Market Share, and Market Concentration

As one of the goals behind any merger activity is increasing the market share, Table 6 reports the effect of mergers on market share based on equation (7). The findings in column (1) indicate that the difference in the mean of log of market share between merging and non-merging firms increases by 0.199 unit statistically significantly following a merger on average. Thus, this result provides evidence on the positive correlation between market structure and market share.

To examine whether the positive correlation between mergers and market share is sensitive to the number of years that a merged firm is observed in the post-merger period, I add three indicator variables to equation (7) instead of the variable $DPostMerger_{it}$. The variable $D2Merger_{it}$ takes a value equal to one if the merger is observed two years or less in the post-merger period and zero otherwise. $D34Merger_{it}$ and $D56Merger_{it}$ are indicator variables for mergers observed three or four years and five or six years in the post-merger period, respectively. The base group includes mergers which are observed six years or more after the merger incident. As columns (2) to (4) of Table 6 illustrate, the positive and statistically significant impact of mergers on market share persists as the number of years that a merger is observed in the sample changes. More specifically, the estimated long-run effects of mergers on market share or the coefficients on the variables $D34Merger_{it}$ and $D56Merger_{it}$ are positive and statistically significant. They imply that after merger incident, firms move toward regaining their pre-merger market share, and merger induced efficiencies are present. This finding is supported by the theoretical study of Farrell and Shapiro (1990). Interestingly, this empirical result is also robust to using the sample based on the Bloomberg data in column (5) or the smaller sub sample of 1990 to 2003.

As a merger causes industry production to be reallocated among firms and changes the number of firms in the market, Table 6 in columns (6) and (7) also reports the impact of mergers on market concentration in acquiring firms' market based on equation (7), where

the dependent variable is the logarithm of the Herfindahl Index for market concentration ($logHHI_{it}$). Contrary to my expectation, column (6) does not show a statistically significant effect from mergers on market concentration. This finding holds even in the different sample from the Bloomberg data in column (7) of Table 6 or in the smaller sample from 1990 to 2003. My results might imply that the merger activities in the manufacturing sector on average are less likely to be an effort to secure a market power. Andrade et al. (2001) clearly state that antitrust regulations have made mergers for the purpose of obtaining market power hard to achieve since the 1940s. Additionally, the lack of correlation between mergers and market concentration in my large sample of manufacturing firms is compatible with the previous literature, such as Pautler (2003) and White (2002).

4.4 Mergers, Stock Market Prices, Profit Margins, and Firm Size

Table 7 examines the relation between mergers and stock market prices in the pre and post-merger periods based on equation (8). As columns (1) and (2) of Table 7 show, no matter I take into account the differences in the number of years that mergers are observed in the post-merger period, or if I focus on the smaller sample of 1990-2003 rather than 1980-2003, the impact of mergers on stock market prices are positive and statistically significant as expected. This finding is robust to employing the sample based on the Bloomberg data which has smaller number of mergers in comparison to the SDC data. As a result, Table 7 provides evidence on stock market price increase of mergers in the manufacturing sector on average. The other observation in this table is that as the number of years that the firm is observed in the post-merger period lengthens, the positive impact from mergers on stock market prices tend to become smaller.

Table 8 examines the effect of mergers on different profit margin variables which are explained in section 2.3.[27] The results display that mergers only have a positive and statistically

[27] All the dependent variables in columns (1) to (8) of Table 8 are scaled up by 100.

significant impact on variables operating profit margin after depreciation ($logOPMAD_{it}$) and operating profit margin before depreciation ($logOPMBD_{it}$). This result is robust to using the sample based on the Bloomberg data. The findings of Table 8 implies inconclusive results from the impact mergers on profit margins.

Finally, Table 9 analyses the possible heterogeneity in the impact of mergers on market value as a result of firm size. To analyse the impact of this heterogeneity, I add the variable $DPostMerger_{it} \times logemployee_{it}$ to equation (6). The results in Table 9 show that the estimated coefficient of the variable $DPostMerger_{it} \times logemployee_{it}$ is positive and statistically significant, while $DPostMerger_{it}$ generally preserves its positive impact on market value but not its statistical significance. This finding is robust to the sample from the Bloomberg data or to the smaller sample from 1990-2003, but not its statistical significance. This result implies that larger firms will experience higher market value if they decide to merge, probably because the merger activity involves combining assets which leads to an increase in their size, and possibly reduce their costs. As a result, mergers increase their future expected earnings and market value.

5 Conclusion

Some of the most mentioned benefits of mergers are higher market share and shareholder value, as well as improved efficiencies. The theoretical literature has investigate the benefits of mergers for firm outcomes extensively. The ambiguous effects of mergers found in economic theory are carried to empirical research on mergers. Most of the previous empirical studies on large samples across many industries are only available for mergers that occurred prior to 1980 and are not based on panel data (Pautler, 2003). This implies that the findings of these empirical studies on merger effects might be under the influence of potentially confounding effects from unobserved heterogeneities. The more recent empirical literature on mergers are mostly focused on price induced changes of mergers in a single industry (Ashenfelter et al.

2009). Thus, literature only provides little clear evidence that mergers have systematically resulted in benefits for firms and losses for consumers.

This study investigates the effects of mergers on firm specific market value, market share, market concentration, stock market prices, and profit margins. These contributions to the literature are facilitated through constructing a unique panel of more than 6,000 publicly traded U.S. manufacturing firms from 1980 to 2003. This sample incorporates merger information from the SDC Platinum data source and contains financial indices for both merging and non-merging firms and for both before and after merger periods. The data allow me to perform a multi-industry analysis to evaluate the effects of more than 1,000 mergers that occurred over the sample period on firm outcomes. The interesting feature of this data is the information on patents and patent citations which assist in taking into account the impact of intangible assets in evaluating merger induced changes in share holder values. This study with more than 20 years of observations in the panel also facilitates investigating the long-run effects of mergers. Furthermore, this paper builds another panel data sample of publicly traded U.S. manufacturing firms that contains merger information based on the Bloomberg data source and reports the empirical results both based on the SDC sample and the Bloomberg sample.

My results based on the SDC and Bloomberg samples show that mergers increase market value of firms, as the larger and less competitive merged firms are expected to have higher future earnings, which increase market value. This further provides evidence on the positive correlation between market structure and market value. The positive impact of mergers on market value is persistent, when I instrument the merger variable with having previous merger experiences for acquiring firms in merging pair of firms.

My empirical findings indicate that mergers do not result in an increase in market concentration. Therefore, this might imply that merger activities in the manufacturing sector are not for the purpose of securing a market power. I find a positive impact from mergers on

market share and stock market prices. The positive impact on market share, specifically, the long-run effects, illustrate that manufacturing firms are regaining their pre-merger market share in the post-merger period, and merger induced efficiencies are present. This is supported by Farrell and Shapiro (1990). Furthermore, as the number of years that the firm is observed in the post-merger period lengthens, the positive impact from mergers on manufacturing stock prices tend to become smaller on average. Mergers in the manufacturing sector also have inconclusive effect on profit margins. Finally, I find evidence of heterogeneous impact of mergers on market value due to firm size. Larger firms will experience higher market value if they decide to merge, probably because mergers involve combining assets which leads to an increase in their size, and possibly reduce their costs. As a result, mergers increase large firms' future expected earnings and market value.

In summary, my study offers some robust evidence and clarity on how firms benefit from mergers. This study suggests the need for more empirical research of other benefits of mergers for firms, such as the impact of mergers on R&D advancements and attainment of intangible assets of firms.

References

Andrade, Gregor, Mark Mitchell, and Erik Stafford, "New Evidence and Perspectives on Mergers," *Journal of Economic Perspectives*, 2001, *15* (2), 103–120.

Arrow, Kenneth, "Economic Welfare and Allocation of Resources to Invention," 1962. In *The Rate and Direction of Inventive Activity,* ed. Richard Nelson. Princeton, New Jersey: Princeton University Press.

Ashenfelter, Orley, Daniel Hosken, and Matthew Weinberg, "Generating Evidence to Guide Merger Enforcement," 2009. CEPS Working Paper No. 183.

——, ——, and ——, "The Price Effects of a Large Merger of Manufacturers: A Case Study of Maytag-Whirlpool," 2011. National Bureau of Economic Research Working Paper No. 17476.

Bloom, Nick, Mark Schankerman, and John Van Reenen, "Identifying Technology Spillovers and Product Market Rivalry," *CEPR Discussion Paper 3916*, 2005.

Borenstein, Severin, "Airline Mergers, Airport Dominance, and Market Power," *American Economic Review*, 1990, *80* (2), 400–404.

Chouinard, Hayley and Jeffrey Perloff, "Gasoline Price Differences: Taxes, Pollution Regulations, Mergers, Market Power, and Market Conditions," *The B.E. Journal of Economic Analysis and Policy*, 2007, *7* (1), Article 8.

Coloma, German, "The Effect of Repsol-YPF Merger on the Argentine Gasoline Market," *Reveiw of Industrial Organization.*

Dafny, Leemore, "Estimation and Identification of Merger Effects: An Application ot Hospital Mergers," *Journal of Law and Economics.*

Daughety, Andrew, "Beneficial Concentration," *American Economic Review*, 1990, *80* (5), 1231–1237.

Entezarkheir, Mahdiyeh, "Essays on Innovation, Patents, and Econometrics." PhD dissertation, University of Waterloo 2010.

Farrell, Joe and Carl Shapiro, "Horizontal Mergers: An Equilibrium Analysis," *American Economic Review*, 1990, *80* (1), 107–126.

Griliches, Zvi, "Market Value, R&D, and Patents," *Economic Letters*, 1981, *7* (2), 183–187.

Hall, Bronwyn, "R&D Investment and the Evolution of the US Manufacturing Sector: Econometric Studies at the Firm Level," 1988. Dsertation, Stanford University.

____ , "Stock Market Valuation of R&D Investmentduring the 1980s," *American Economic Review*, 1993, *83* (2), 259–264.

____ **, Adam Jaffe, and Manuel Trajtenberg**, "Market Value and Patent Citations: A First Look," 2000. National Bureau of Economic Research Working Paper No. 7741.

____ **,** ____ **, and** ____ , "The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools," 2001. National Bureau of Economic Research Working Paper No. 8498.

____ **,** ____ **, and** ____ , "Market Value and Patent Citations," *RAND Journal of Economics*, 2005, *36* (1), 16–38.

____ **and Jacques Mairesse**, "Exploring the Relationship Between R&D and Productivity in French Manufacturing Firms," *Journal of Econometrics*, 1995, *65* (1), 263–293.

____ **, Grid Thoma, and Salvatore Torrisi**, "The Market Value of Patents and R&D: Evidence From European Firms," 2007. National Bureau of Economic Research Working Paper No. 13426.

Hansen, Lars, "Large Sample Properties of Generalized Method of Momemnts Estimators," *Econometrica*, 1982, *50* (4), 1029–1054.

Heckman, James and Richard Robb, "Alternative Methods for Evaluating the Impact of Interventions," 1985. In *Longitudinal Analysis of Labor Market Data ed. James Heckman and Burton Singer. Cambridge; NewYork: Cambridge University Press.*,.

Hirschey, Mark, "Market Structure and Market Value," *Journal of Business*, 1985, *58* (1), 89–98.

Jarrell, Gregg and Annette Poulsen, "The Returns to Acquiring Firms in Tender Offers: Evidence From Three Decades," *Financial Management*, 1989, *18* (3), 12–19.

Jensen, Michael, "Takeovers: Their Causes and Consequences," *Journal of Economic Perspective*, 1988, *2* (1), 21–48.

____ **and Richard Ruback**, "The Market for Corporate Control: The Scientific Evidence," *Journal of Financial Economics*, 1983, *11* (1), 5–50.

Lichtenberg, Frank and Donald Siegel, "Takeovers and Corporate Overhead," 1992. In *Corporate Takeovers and Productivity,* ed. Frank Lichtenberg. Cambridge, Massachusetts: MIT Press.

Lindenberg, Eric and Stephen Ross, "Tobin's q Ratio and Industrial Organization," *Journal of Business*, 1981, *54* (1), 1–32.

Maksimovic, Vojislav and Gordon Phillips, "The Market for Corporate Assets: Who Engages in Mergers and Assets Sales and are There Efficiency Gains?," *Journal of Finance*, 2001, *56* (1), 2019–65.

Malmendier, Ulrike, Enrico Moretti, and Florian Peters, "Winning by Losing: Evidence on the Long-Run Effects of Mergers," 2012. National Bureau of Economic Research Working Paper No. 18024.

McAfee, Preston and Michael Williams, "Horizontal Mergers and Antitrust Policy," *Journal of Industrial Economics*, 1992, *40* (2), 181–187.

Mueller, Dennis, *The Determinants and Effects of Mergers : an International Comparison*, Cambridge, Massachussets: Oelgeschlager, Gunn Hain ; Knigstein/Ts.: Verlag A. Hain, 1980.

____ , "Mergers and Market Share," *Review of Economics and Statistics*, 1985, *67* (2), 259–267.

Noel, Michael and Mark Schankerman, "Strategic Patenting and Software Innovation," 2006. http://sticerd.lse.ac.uk/dps/ei/EI43.pdf.

Packalen, Mikko and Anindya Sen, "Static and Dynamic Merger Effects: A Market Share Based Empirical Analysis," 2011. http://economics.uwaterloo.ca/ packalen/StaticAndDynamicMergerEffects.pdf.

Peball, Lynne, Dan Richards, and George Norman, *Contemporary Industrial Organization: A Quantitative Approach*, Hoboken, NewJersey: John Wiley & Sons,., 2011.

Philips, Gordon and Alexei Zhdanove, "R&D and the Incentives from Merger and Acquisition Activity," 2012. National Bureau of Economic Research Working Paper No. 18346.

Ravenscraft, David and G Pascoe, "Can the Stock Market Predict Merger Success?," 1989. mimeo, University of North Carolina Centre for Economics Studies, Bureau of the Census.

____ **and Scherer**, "The Profitability of Mergers," *International Journal of Industrial Organization.*

Rhodes-Kropf, Matthew and S Viswanathan, "Market Valuation and Merger Waves," *The Journal of Finance.*

____ **, David Robinson, and S Viswanathan**, "Valuation waves and merger activity: The empirical evidence," *Journal of Financial Economics.*

Salant, Stephen, Sheldon Switzer, and Robert Reynolds, "Losses from Horizontal Merger: The Effects of an Exogenous Change in Industry Structure on Cournot-Nash Equilibrium," *Quarterly Journal of Economics.*

Schumpeter, Joseph, *Capitalism, Socialism and Democracy*, New York, New York: Harper & Brothers, 1942.

Soneshine, Ralph, "The Stock Market's Valuation of R&D and Market Concentration in Horizontal Mergers," *Review of Industrial Organization.*

Stahl, Jessica, "Mergers and Sequential Innovation; Evidence from Patent Citations," 2010. http://www.federalreserve.gov/pubs/feds/2010/201012/201012pap.pdf.

White, Lawrence, "Trends in Aggregate Concentration in the United States," *Journal of Economic Perspectives*, 2002, *16* (4), 137–160.

Winston, Clifford, Vikram Mahesri, and Scott Denis, "Long-Run Effects of Mergers: The Case of U.S. Western Railroads," *Journal of Law and Economics*, 2009, *54* (2), 275–304.

Wright, Joshua, "Antitrust, Multi-dimentional Competition and Innovation: Do we have an Antitrust Relevant Theory of Competition Now?," 2009. George Mason Law and Economics Research Paper No. 09-44.

Figures and Tables

Figure 1: Number of Mergers over Years.

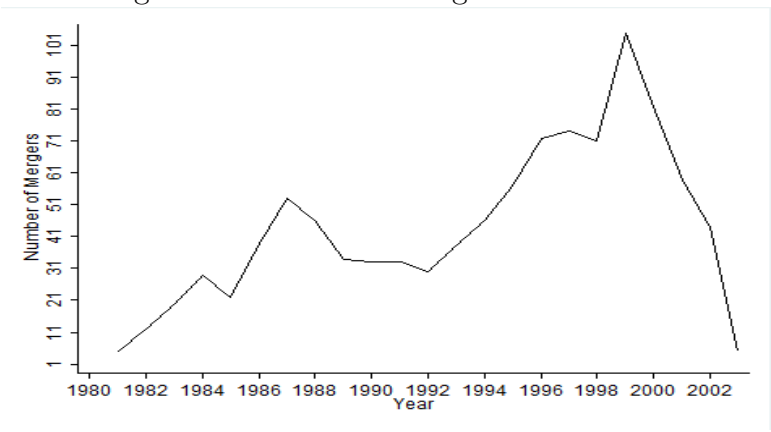

Figure 2: Distribution of Mergers by Years since Merger Incident.

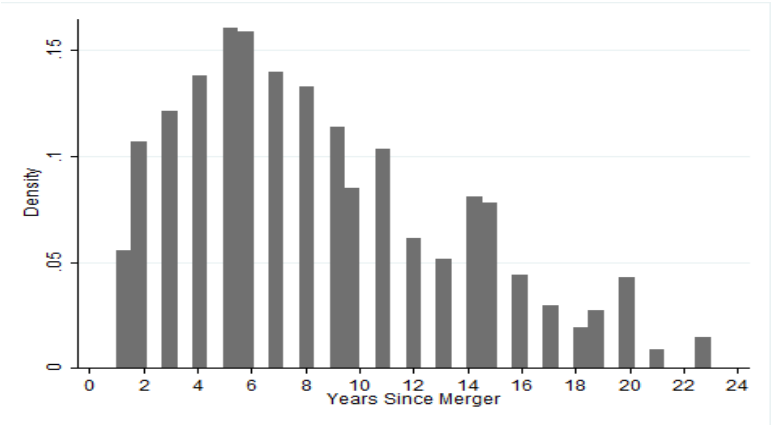

Figure 3: Average of %△q for Firms Merged in last 2 years and Non-Merging Firms.

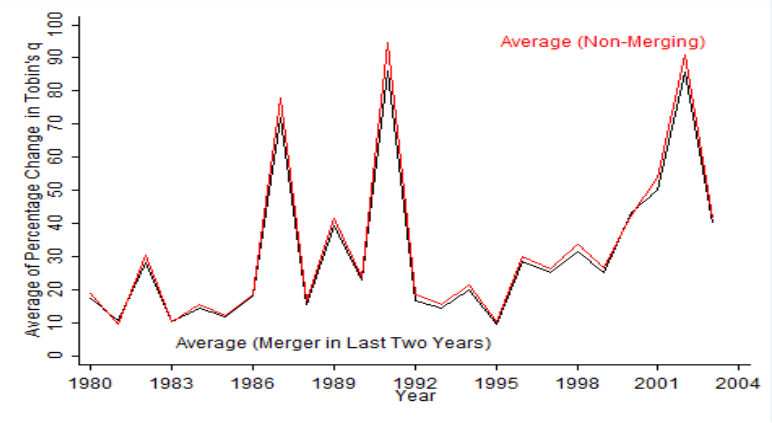

Figure 4: Weighted Average of %△q for Firms Merged in last 2 years and Non-Merging Firms.

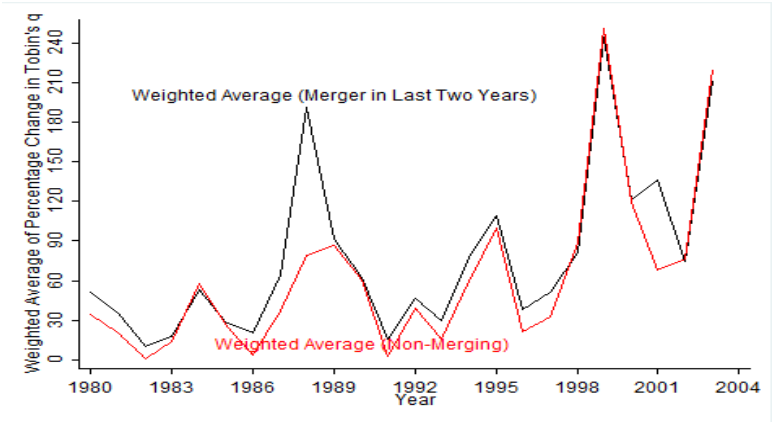

Table 1: A Summary of Samples Based on SDC and Bloomberg Data

Sample Based on SDC	**Sample Based on Bloomberg**
60731 Observations	61640 Observations
6030 Publicly Traded U.S. Manufacturing Firms	6029 Publicly Traded U.S. Manufacturing Firms
1980-2003	1980-2003
1009 Merger Pairs with 8043 Observations	451 Merger Pairs with 1720 Observations

Table 2: Descriptive Statistics Based on the SDC Sample

Variable	Description	Obs	Mean	Median	Std.Error	Min	Max
$Market\ Value_{it}$	Market Value	60731	699	32	3370	0.002	135045
TA_{it}	Book Value	60731	929	39	4446	0.001	134448
q_{it}	(Market Value /Book Value)	60731	4	0.79	80	0.001	10322
$DPostMerger_{it}$	Indicator for Pot-Merger Period	60731	0.13	0	0.34	0	1
$D2Merger_{it}$	Indicator for Mergers Observed <2 Years Post-Merger	60731	0.006	0	0.076	0	1
$D34Merger_{it}$	Indicator for Mergers Observed between 3 to 4 Years Post-Merger	60731	0.003	0	0.056	0	1
$D56Merger_{it}$	Indicator for Mergers Observed between 5 to 6 Years Post-Merger	60731	0.002	0	0.041	0	1
$D6Merger_{it}$	Indicator for Mergers Observed >6 Years Post-Merger	60731	0.002	0	0.047	0	1
$R\&Dstock_{it}$	Stock of R&D	60731	173	3.57	1100	0	37430
$PATstock_{it}$	Stock of Patents	60731	65	0	545	0	29355
$CITEstock_{it}$	Stock of Citations	60731	787	0	5666	0	172357
$(R\&Dstock/TA)_{it}$	R&D Intensity	60731	2.65	0.140	61.64	0	7201
$(PATstock/R\&Dstock)_{it}$	Patent Intensity	60731	0.48	0	7.87	0	1363
$(CITEstock/PATstock)_{it}$	Citation Intensity	60731	5.32	0	13.79	0	930
$Sale_{it}$	Firm-Level Net Sales (MM$)	60566	1413	76	7096	0	232571
$employee_{it}$	Joint Employee of Acquirer and Target (M)	56246	7	1	27	0	813
HHI_{it}	Market Concentration	60731	0.29	0.24	0.19	0	1
$Market\ Share_{it}$	Joint Market Share of Acquirer and Target	60566	0.08	0.011	0.17	0	1.38

Table 2 is Continued

$Merger2to5_{it}$	Indicator for Acquiring Firms Who also Merged in the Past 2 to 5 Years	60731	0.04	0	0.18	0	1
$Merger3to5_{it}$	Indicator for Acquiring Firms Who also Merged in the Past 3 to 5 Years	60731	0.02	0	0.16	0	1
$MergerMoreThan5_{it}$	Indicator for Acquiring Firms Who also Merged in More than 5 Years ago	60731	0.03	0	0.17	0	1
$Pstock_{it}$	Stock Prices	49849	35	8.17	760	0.002	68068
OI_{it}	Operating Income Before Depreciation (MM$)	60326	203	7	1081	-5156	35019
DA_{it}	Depreciation and Amortization (MM$)	60356	72	3	438	0	15922
I_{it}	Income Before Extraordinary Items (MM$)	60550	62	2	523	-56122	22071
PTI_{it}	Pre-Tax Income (MM$)	60545	107	2	764	-56494	32660
NPM_{it}	Net Profit Margin $(I/Sale)_{it}\times 100$	59284	-318	2.96	7221	-868400	36800
$OPMAD_{it}$	Operating Profit Margin After Depreciation $((OI-DA)/Sale)_{it}\times 100$	59075	-301	6	7014	-8886900	12000
$OPMBD_{it}$	Operating Profit Margin Before Depreciation $(OI/Sale)_{it}\times 100$	59077	-279	10	6686	-855700	10694.12
PPM_{it}	Pre-Tax Profit Margin $(PTI/Sale)_{it}\times 100$	59280	-318	5	7240	-868400	36800

Table 3: Mergers and Market Value (1980-2003)

Dependent Variable $logq_{it}$[28]	(1) SDC	(2) SDC	(3) SDC	(4) SDC	(5) Bloomberg
$Dpostmerger_{it}$	0.142***	-0.046**	0.061**	0.063**	0.099***
	(0.018)	(0.020)	(0.022)	(0.022)	(0.028)
$logSale_{it}$			0.003	0.005	-0.000
			(0.012)	(0.012)	(0.013)
$logSale_{it-1}$			-0.003*	-0.003*	-0.001
			(0.002)	(0.002)	(0.001)
$logemployee_{it}$				-0.118***	-0.131***
				(0.017)	(0.016)
$log(\frac{R\&Dstock}{TA})_{it}$			0.320***	0.325***	0.296***
			(0.015)	(0.014)	(0.014)
$[log(\frac{R\&Dstock}{TA})_{it}]^2$			0.065***	0.065***	0.068***
			(0.004)	(0.004)	(0.004)
$log(\frac{PATstock}{R\&Dstock})_{it}$				0.036**	0.024**
				(0.011)	(0.010)
$[log(\frac{PATstock}{R\&Dstock})_{it}]^2$				-0.005	-0.004
				(0.005)	(0.004)
$log(\frac{CITEstock}{PATstock})_{it}$				-0.001	0.014
				(0.037)	(0.031)
$[log(\frac{CITEstock}{PATstock})_{it}]^2$				-0.029	-0.023
				(0.020)	(0.018)
$D(R\&D_{it}=0)$			0.118	0.122*	-0.312***
			(0.073)	(0.041)	
$D(Patent_{it}=0)$				-0.032	-0.002
				(0.040)	(0.032)
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes
Observation	60731	60731	38729	38729	56026
$WithinR^2$	0.003	0.028	0.265	0.267	0.216

[28]The signs ***, **, and * mean significance at 1%, 5%, and 10%, respectively. The numbers in the parentheses are the cluster-robust standard error (clustered at the firm-level).

Table 4: Mergers and Market Value (1990-2003)

Dependent Variable	(1)	(2)	(3)	(4)	(5)
$logq_{it}$[29]	SDC	SDC	SDC	SDC	Bloomberg
$Dpostmerger_{it}$	-0.009	-0.058*	0.056*	0.060**	0.084**
	(0.028)	(0.031)	(0.030)	(0.030)	(0.030)
$logSale_{it}$			0.0155	0.018	0.002
			(0.014)	(0.014)	(0.014)
$logSale_{it-1}$			-0.002	-0.003	0.001
			(0.002)	(0.002)	(0.002)
$logemployee_{it}$			-0.106***	-0.098***	-0.125***
			(0.022)	(0.022)	(0.020)
$log(\frac{R\&Dstock}{TA})_{it}$			0.366***	0.373***	0.329***
			(0.018)	(0.018)	(0.017)
$[log(\frac{R\&Dstock}{TA})_{it}]^2$			0.060***	0.060***	0.064***
			(0.004)	(0.004)	(0.004)
$log(\frac{PATstock}{R\&Dstock})_{it}$				0.047 ***	0.035**
				(0.014)	(0.013)
$[log(\frac{PATstock}{R\&Dstock})_{it}]^2$				-0.002	-0.000
				(0.006)	(0.006)
$log(\frac{CITEstock}{PATstock})_{it}$				0.022	0.023
				(0.038)	(0.032)
$[log(\frac{CITEstock}{PATstock})_{it}]^2$				-0.048**	-0.033*
				(0.021)	(0.018)
$D(R\&D_{it}=0)$			0.127	0.136	-0.344***
			(0.107)	(0.106)	(0.055)
$D(Patent_{it}=0)$				-0.044	-0.003
				(0.041)	(0.033)
Firm FE	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes
Observation	38323	38323	24964	24964	34773
$WithinR^2$	0.000	0.004	0.283	0.286	0.229

[29]The signs ***, **, and * mean significance at 1%, 5%, and 10%, respectively. The numbers in the parentheses are the cluster-robust standard error (clustered at the firm-level).

Table 5: Panel IV Estimates of Mergers on Market Value Based on SDC (1980-2003)[30]

First Stage IV			
Dependent Variable $DPostMerger_{it}$	(1)	(2)	(3)
F	962	625	279
P-value	[0.000]	[0.000]	[0.000]
$Merger2to5_{it}$	0.389***		
	(0.013)		
$Merger3to5_{it}$		0.308***	0.317***
		(0.012)	(0.014)
$MergerMoreThan5_{it}$			0.221***
			(0.015)
Second Stage IV			
Dependent Variable $logq_{it}$			
$DPostMerger_{it}$	0.148**	0.133**	0.141*
	(0.048)	(0.061)	(0.073)
Control Variables in Equation (5)	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observation	38376	38376	38376
R^2	0.266	0.267	0.268
Overidentifying Restrictions J-test and P-value			0.043 [0.836]

[30]The signs ***, **, and * mean significance at 1%, 5%, and 10%, respectively. The numbers in the parentheses are the cluster-robust standard error (clustered at the firm-level).

Table 6: Mergers, Market Share, Market Concentration[31]

Dependent Variable	$log\ Market\ Share_{it}$					$log\ HHI_{it}$	
	(1) SDC	(2) SDC	(3) SDC	(4) SDC	(5) Bloomberg	(6) SDC	(7) Bloomberg
1980-2003							
$DPostMerger_{it}$	0.199***						
	(0.035)						
$D2Merger_{it}$		0.429***	0.443***	0.448***	0.248**	0.016	-0.027
		(0.092)	(0.092)	(0.092)	(0.083)	(0.021)	(0.038)
$D34Merger_{it}$			0.364***	0.367***	0.287***	-0.030	-0.020
			(0.059)	(0.059)	(0.072)	(0.026)	(0.029)
$D56Merger_{it}$				0.342***	0.167*	0.005	-0.035
				(0.064)	(0.097)	(0.024)	(0.036)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	59291	59291	59291	59291	60186	60731	61630
$WithinR^2$	0.015	0.014	0.014	0.015	0.010	0.038	0.037
1990-2003							
$DPostMerger_{it}$	0.239***						
	(0.045)						
$D2Merger_{it}$		0.348**	0.362**	0.366**	0.143**	0.018	-0.008
		(0.122)	(0.122)	(0.122)	(0.063)	(0.025)	(0.034)
$D34Merger_{it}$			0.241***	0.242***	0.233***	-0.024	-0.014
			(0.048)	(0.048)	(0.071)	(0.025)	(0.025)
$D56Merger_{it}$				0.221***	0.081	0.002	-0.048
				(0.053)	(0.085)	(0.021)	(0.030)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	37202	37202	37202	37202	37755	38323	38879
$WithinR^2$	0.017	0.016	0.016	0.016	0.011	0.047	0.047

[31]The signs ***, **, and * mean significance at 1%, 5%, and 10%, respectively. The numbers in the parentheses are the cluster-robust standard error (clustered at the firm-level).

Table 7: Mergers and Stock Market Prices[32]

Dependent Variable	(1)	(2)	(3)	(4)
$log\ Pstock_{it}$	SDC	SDC	Bloomberg	Bloomberg
1980-2003				
$DPostMerger_{it}$	0.276***		0.490***	
	(0.038)		(0.058)	
$D2Merger_{it}$		0.284***		0.458***
		(0.060)		(0.094)
$D34Merger_{it}$		0.268***		0.316***
		(0.069)		(0.064)
$D56Merger_{it}$		0.250***		0.350***
		(0.053)		(0.031)
Observation	47626	47626	48508	48508
$WithinR^2$	0.285	0.281	0.288	0.282
1990-2003				
$DPostMerger_{it}$	0.164***		0.306***	
	(0.048)		(0.053)	
$D2Merger_{it}$		0.139**		0.201**
		(0.053)		(0.065)
$D34Merger_{it}$		0.209***		0.163**
		(0.055)		(0.056)
$D56Merger_{it}$		0.160**		0.156**
		(0.051)		(0.063)
Observation	29869	29869	30418	30418
$WithinR^2$	0.230	0.229	0.231	0.227
Firm Size,Demand Shock, and Market Structure	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

[32]The signs ***, **, and * mean significance at 1%, 5%, and 10%, respectively. The numbers in the parentheses are the cluster-robust standard error (clustered at the firm-level).

Table 8: Mergers and Profit Margins (1980-2003)

Dependent Variable	$logNPM_{it}$		$logOPMAD_{it}$		$logOPMBD_{it}$		$logPPM_{it}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SDC								
$DPostMerger_{it}$	-0.013		0.060**		0.070***		-0.006	
	(0.027)		(0.024)		(0.020)		(0.027)	
$D2Merger_{it}$		0.059		0.134***		0.099***		0.072
		(0.056)		(0.037)		(0.030)		(0.054)
$D34Merger_{it}$		-0.058		0.083		0.105**		0.014
		(0.087)		(0.054)		(0.036)		(0.068)
$D56Merger_{it}$		0.188*		0.177***		0.155***		0.215**
		(0.098)		(0.039)		(0.029)		(0.093)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	39772	39772	42551	42551	45833	45833	39884	39884
$WithinR^2$	0.015	0.016	0.020	0.020	0.011	0.011	0.023	0.024
Bloomberg								
$DPostMerger_{it}$	0.044		0.182***		0.117***		0.063	
	(0.042)		(0.034)		(0.028)		(0.042)	
$D2Merger_{it}$		0.082		0.211***		0.159***		0.090
		(0.084)		(0.056)		(0.036)		(0.078)
$D34Merger_{it}$		-0.066		0.139**		0.090**		0.002
		(0.097)		(0.048)		(0.044)		(0.084)
$D56Merger_{it}$		0.120*		0.170**		0.130**		0.124
		(0.076)		(0.062)		(0.044)		(0.083)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	40585	40585	43400	43400	46704	46704	40698	40698
$WithinR^2$	0.015	0.015	0.021	0.020	0.011	0.011	0.023	0.023

Table 9: Mergers, Firm Size, and Market Value (1980-2003)[33]

Dependent Variable $logq_{it}$	(1) SDC	(2) Bloomberg
1980-2003		
$DPostMerger_{it}$	-0.004	0.031
	(0.027)	(0.056)
$DPostMerger_{it} \times$	0.053***	0.022
$logemployee_{it}$	(0.011)	(0.019)
Control Variables in Equation (5)	Yes	Yes
Firm FE	Yes	Yes
Time FE	Yes	Yes
Observation	38729	56026
$WithinR^2$	0.264	0.233
1990-2003		
$DPostMerger_{it}$	0.032	0.064
	(0.033)	(0.059)
$DPostMerger_{it} \times$	0.059***	0.011
$logemployee_{it}$	(0.016)	(0.020)
Control Variables in Equation (5)	Yes	Yes
Firm FE	Yes	Yes
Time FE	Yes	Yes
Observation	24964	34773
$WithinR^2$	0.289	0.227

[33]The signs ***, **, and * mean significance at 1%, 5%, and 10%, respectively. The numbers in the parentheses are the cluster-robust standard error (clustered at the firm-level).

Appendices

A Correcting Truncation in Patent and Citation Counts

To correct for truncation in patent counts, I follow the approach of Hall et al. (2000), which defines weight factors to correct for truncation in patent counts. Their weight factors are calculated according to

$$\begin{aligned} patent_t^* &= \frac{patent_t}{\sum_{k=0}^{2003-t} weight_k} \\ 2000 &\leq t \leq 2003, \end{aligned} \tag{A.1}$$

where $patent_t$ is the number of patents granted at time t to all firms and $weight_k$ is built based on the average of citations in each lag for the patents of firms.[34] Hall et al. (2000) multiply patent counts in ending years of the sample with the inverse of the weight factors ($1/patent_t^*$) and correct for the truncation. I only correct patent counts for 2000 to 2003 because from 2004 to 2006 (end of my sample) the results are under the influence of "edge effect"(Hall et al., 2000). This means the 2006 data will not be usable and 2005 data will have large variance. Figure A.1 displays a comparison of original and corrected patent counts for truncation.

To correct for truncations in citations, I have employed the method of Hall et al. (2000). I calculate the distribution of the fraction of citations received by each patent at a time between the grant year of the citing patents and the grant year of the cited patent. Using this distribution, I predict the number of citations received for each patent outside the range of the sample, maximum to 40 years after the grant date of the patent. Figure A.2 displays a comparison of original and corrected citation counts. I use the truncation corrected patent and citation counts in my analysis.

[34] Lags are defined as the difference between the ending years of the sample and year 2003. Therefore, lags are 2003-2000=3, 2003-2001=2, 2003-2002=1, and 2003-2003=0.

Figure A.1: Patents per $R\&D$ with Corrected and Not Corrected Patent Counts.

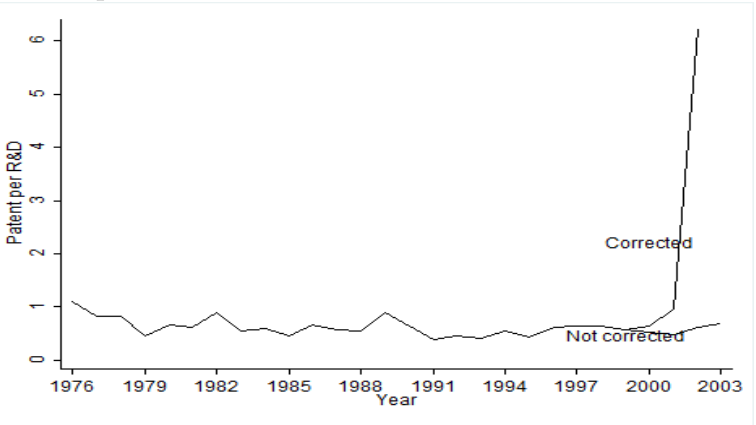

Figure A.2: Citations per $R\&D$ with Corrected and Not Corrected Citation Counts.