

Mergers and Acquisitions: An Investigation of
Changes in Firm Value

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Spring 2017

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Abstract

This study analyzes large mergers of publicly traded firms occurring between 2000 and 2005 in order to identify the effect that merging has on economic value. The analysis begins by replicating the standard methodology employed in outcome studies to identify the change in value resulting from merging. To address a current gap in the literature, the analysis goes further in identifying and assigning magnitudes to several of the synergies associated with merging. The results show a significant negative effect from merging on both the revenue and profit margin of the merged firm, implying that, on average, mergers destroy value. Further analysis showed that merging has an ambiguous effect on operating synergies; the fact that this is one of the reasons most cited by firm management for merging may help to explain the value deterioration. Finally, the analysis of the effect of merging on financial synergy showed a significantly lower effective tax rate resulting from the merger; however, since this lowered tax rate is a transfer of wealth, it is difficult to argue that such a financial synergy creates economic value.

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1 Introduction

The contemporary literature on merger analysis is expansive, but there is still intense debate over whether mergers create value. Much of this disagreement stems from a divide between industrial organization economists and finance economists; the former favoring outcome studies that analyze firm balance sheets, and the latter favoring event studies that analyze equity prices. Despite this major divide in methodology, literature from both sides remains largely undecided on the central issue of identifying the effect of merging on firm value. Many have argued that this lack of consensus stems from a combination of differences in methodology, sample firm characteristics, and sample time period across different merger studies. Despite the ambiguity of research on the effects of merging, the conventional wisdom that mergers create value prevails amongst firm management.

Though there has been extensive research done on the effects of merging on firm value, little has been done to identify and assign magnitudes to the sources of these value changes; this research begins to address this gap in the literature by investigating the effects of some of the synergies most commonly associated with merging. Identifying the sources and magnitudes of different synergies that occur during a merger will allow research in this field to move beyond simply identifying value changes associated with merging, and allow for a more in-depth analysis of why the value changes we observe occur.

Section 2 begins with a discussion of why firms merge and an explanation of the synergies they hope to enjoy as a result of merging. This section also includes a comparison of the merits and shortcomings of the two main methodologies in merger

analysis, and a discussion of trends in the literature showing what is most likely to make a merger successful. Section 3 includes information on sample construction, data issues and remedies, and a description of the dataset. Section 4 presents the baseline specification and identification strategy used in the analysis. Section 5 presents the results of the analysis and a discussion of their relevance and implications for future research.

2 Literature Review

2.1 Why Firms Merge

The analysis of the impacts of mergers and acquisitions begins with the fundamental question: why do firms merge? Firms choose to undergo mergers because they have in general been shown to create economic value (Jensen and Ruback, 1983). Mergers occur due to undervaluation: when a firm is undervalued by financial markets, relative to its true value, the firm will be targeted for acquisition by those who identify this anomaly. These firms are targeted for acquisition because their undervaluation makes it possible for another firm to gain more from acquiring the undervalued firm than they spend acquiring it. Though the reasons for merging seem very well grounded in economic logic, this is not always the case; often, the decision by a firm to bid to on a target stems from managerial hubris (Roll, 1986). This hubris effect is important to note, as it can lead managers to bid on other firms when it may not be beneficial for their firm; this type of managerial activity has been shown to occur, as managers who own more stock in their own firm are less likely to bid on target

firms (Larcker, 1983).

Another important consideration is which firms decide to merge. On average, firms that make acquisitions operate significantly more efficiently than their industry peers before the merger takes place (Heron and Lie, 2002). Furthermore, most acquisitions feature an acquiring firm that is very large (Tichy, 2001). Firms are also more likely to undergo a merger if it is financed with stock equity (Savor and Lu, 2009). This holds true because when a firm pays with stock equity, assuming that the target firm is undervalued by financial markets, they effectively purchase real capital and assets at a discounted rate.

2.2 Merging Synergies: The Theoretical Reasons for Merging

The gains from mergers can be divided into three main categories: operating synergies, financial synergies, and collusive synergies. Operating synergies are the gains from a merger that stem from economies of scale, which allow the merged firm to operate more efficiently than the two separate firms before. In general, operating synergies are the result of some combination of increased growth and decreased costs; however, this synergy can have many unexpected catalysts. These catalysts can take many different forms, from the removal of incompetent target management, to merged firms enjoying lower interest rates than before, thereby effectively lowering capital expenditures (Panetta et. al., 2009; Andrade et. al., 2001). Financial synergies are the gains from a merger relating to the increased financial efficiency of the merged firm, generally taking the form of tax savings or increased debt capac-

ity. One major financial synergy that merged firms enjoy comes from the fact that profits generate a tax liability, though losses do not generate a reciprocal tax credit; merged firms can mitigate this asymmetry to some extent, by pooling together their gains and losses across different segments of the firm (Cole and Vu, 2006). When the respective firms in a merger both do business in the same industry, the acquiring firm also enjoys a collusive synergy, as the merger increases the firm's market power. Effectively removing the target firm from its competition, the acquiring firm gains weight within its industry. Such increased market power can allow the merged firm to act in an anticompetitive manner, making gains at the expense of customers and suppliers (Devos et. al., 2009).

A review of the channels through which merged firms are theorized to create value highlights an important lesson: not all merger gains were created equal. Operating synergies highlight increased efficiency of the firm, and how this creates value; however, financial and collusive synergies may only change the distribution of wealth, rather than add to the stock of wealth as a whole. In the case of financial synergies, some of the gains the firm enjoys are also merely a change in the distribution of wealth – from the government to the firm. The same is true when increased market power allows the firm to act noncompetitively, as the gains accrued by the firm come from a redistribution of wealth from consumers and suppliers to the firm. Consequently, mergers motivated by reductions in taxes or competition may still benefit the acquiring firm, though the net economic gains become difficult to identify. Unsurprisingly, operating synergies relating to the strategic choice of assets in acquisition have been the most common catalyst of increased efficiency from mergers (Healy et. al., 1992).

2.3 Types of Mergers: Selecting the Target and Identifying the Gains from Merging

The different types of mergers and the expected source of the gains from merging can be divided into three main categories: horizontal mergers, vertical mergers, and diversifying mergers. A horizontal merger is one that occurs between firms that operate in the same market. The majority of the gains from such mergers stem from collusive synergies (Chatterjee, 1986). A vertical merger is one that occurs between firms that operate at separate stages of the production process for a specific good. In a vertical merger the majority of the gains stem from operational synergies (Devos et. al., 2009). A diversifying merger is one that occurs as an effort by the acquirer to expand the products it sells, or otherwise diversify its investments. The majority of the gains from diversifying mergers are derived from financial synergies (Fluck and Lynch 1999). Diversifying mergers also make some gains from operating synergies, relating to decreased capital costs associated with the merged firm being able to borrow money at a lower interest rate (Cole and Vu, 2006).

2.4 Approaches to Merger Analysis: Event Studies vs. Outcome Studies

The analysis of mergers by economists is largely divided into two fields: finance and industrial organization. Finance economists favor event studies, which analyze the immediate stock market reactions to merger announcements, whereas industrial organization economists prefer outcome studies, which analyze balance sheet data over longer periods of time. Gunter Tichy (2001) made a significant contribution

to the literature in this area by uniting empirical literature from both finance and industrial organization to derive several stylized facts about mergers. Though this provides an insightful conglomeration of many different studies, one should read his paper with a healthy amount of skepticism, as it may not be appropriate to use such a wide cross-section of different merger samples to test a specific theory, and the stylized facts presented are inevitably crude (Lyons, 2001).

Finance economists prefer to analyze mergers through event studies because they view mergers as a market process for allocating extra resources to the most effective use. Event studies employ a market model of stock returns to predict security prices in the absence of a merger, and then compare these predictions to the actual security prices surrounding the merger. The sum of the difference between the predicted security prices and their true prices over the period surrounding the merger (generally from several days before announcement to the close of the deal) are known as the cumulative average abnormal returns (Cummins and Weiss, 2004). Such event studies depend on the assumption of rapidly adjusting, perfect capital markets, and more specifically, on the assumption of immediate adjustment of stock prices to information about an impending merger. This assumption seems paradoxical to say the least, especially considering that the basis for nearly all mergers depends on identifying a target firm that has, in fact, been undervalued by financial markets. Furthermore, even if one can safely assume that informational asymmetries do not preclude an efficient capital market, many event studies are fraught with methodological issues. The most consequential of these issues is attempting to define what the expected returns in the long run for acquiring firms should be (Andrade et. al.,

2001). This inability to accurately define the long run expected returns effectively prevents economists from identifying the abnormal returns resulting from a merger, as it is impossible to find the abnormal returns without accurately predicting the counterfactual expected returns had the merger not occurred.

Industrial organization economists are more skeptical about the allocative efficiency of financial markets, and favor the employment of outcome studies for merger analysis under the assertion that if mergers truly do create value, such value creation would show up in the firm's balance sheets. One of the main advantages of outcome studies is that, unlike event studies, outcome studies generally span much larger time periods, effectively allowing the time necessary for the gains or losses from the merger to be fully realized. Analysis of a large sample of outcome studies has shown that there is little variation in results across different identification strategies; rather, much of the variation in results across outcome studies has stemmed from differences in the composition the merger sample with respect to the firm's characteristics, motives for merging, time period, and other unobservable factors (Tichy, 2001). Much like event studies, outcome studies have also been susceptible to methodological issues; however, it has become somewhat standard to address these issues by applying a time series regression analysis that employs both time and individual firm fixed effects (Solomon and Hill, 2016).

Whether outcome studies or event studies more accurately estimate the value changes from mergers is still hotly debated in academia; however, outcome studies seem to have fewer methodological issues and questionable assumptions. The longer time period of outcome studies allows for the returns from a merger, whether pos-

itive or negative, to be fully realized. On the contrary, financial markets have a limited time horizon, tending to lead to overly optimistic evaluations at the merger announcement (Tichy, 2001). Outcome studies also present the advantage of analyzing the balance sheets of the firm that would necessarily show any value creation that occurs, whereas there is some question as to how well security prices substantiate value creation.

2.5 The Merging Process: Who Comes out on Top

There are several trends across different type of mergers that serve as indicators of where much of the value creation is likely to accrue. In nearly all mergers, the shareholders of the target firm tend to accrue more of the gains than the shareholders of the acquiring firm (Fuller et. al., 2002). The main factor that leads target shareholders to fare better relative to acquiring shareholders is that, regardless of whether other firms bid on the target, there mere potential for another firm to bid to acquire the target often allows the target to extract most of the surplus from the transaction (Andrade et. al., 2001). In fact, target shareholders often enjoy quite substantial cumulative average abnormal returns, within the range of 12 to 15 percent (Cummins and Weiss, 2004). Though the literature is fairly clear that target firms gain from mergers, the results pertaining to the acquiring firm have been less clear. Studies that exhibit the best outcomes for acquiring firms only show that the acquiring firm does not lose value from the merger, whereas less optimistic estimates exhibit profit deterioration resulting from the merger (Jensen and Ruback, 1983). One possible explanation for this lack of value creation by the acquiring firm is managerial hubris;

when mergers are motivated by managerial hubris, such acquisitions generally fail to increase the combined value of the target and acquiring firm due to a decrease in value of the acquiring firm large enough to offset the gain in value by the target firm (Roll, 1986). Another major determinant of where the value that is created accrues is the payment method chosen by the acquiring firm. Across different types of mergers, those in which the acquirer finances the purchase with cash, as opposed to stock equity, fare much better (Linn and Switzer, 2001).

3 Data

3.1 Sample Construction

The data used was gathered from the Bloomberg Terminal's Merger and Acquisition database and the Bloomberg Terminal's historical firm financial data (Bloomberg, 2017). From this database, the sample was constructed of only completed deals including firms who had regularly reported financial data. The sample was constructed from mergers that were valued at greater than \$250 million with completion dates ranging from 1/1/2000 to 1/1/2005; due to differences in the amount of time between the announcement and completion of the merger, the observation dates ranges from 1993 to 2009. A total of 4642 mergers fit the above criteria, which were subsequently randomized using a random number generator to select the sample for analysis. After selecting a random sample, firm financial data was imported for each financial quarter from the five years preceding and following the date of the mergers. As would be expected, data for all target firms following the date of the merger is missing, as

the following the merger firm is delisted and ceases to exist.

3.2 Matching Firms for Control

The sample initially constructed only includes firms that are merging. If the firms that merged differ from those that did not in observable or unobservable ways, then the results would be biased; this issue and how it is addressed will be discussed further in section 4. In order to address this potential issue, matched firms were included in the sample to serve as a counterfactual to the merging firms. The matched firms to be used as a counterfactual were identified using The Bloomberg Terminal's peer group assignments, which match firms on size, region, industry, and other relevant characteristics (Bloomberg, 2017). These matched firms, that did not undergo a merger, will serve as the counterfactual to the merging sample in the analysis. Data was compiled on these firms throughout the entire sample period in order to allow all of these matched firms to serve as a counterfactual for all merging firms in the sample, regardless of merger date.

3.3 Variables of Interest

Data on merging firms was gathered across the ten years surrounding the merger announcement date on a number of relevant firm financials. The data on the acquiring and target firm's revenue is measured in millions. The data from the acquiring and target firm's profit margin is measured as the comparison of how much of the revenue incurred was retained in income, calculated as: $(NetIncome/Revenue) * 100$. The data from the acquiring and target firm's capital expenditure is mea-

sured as the amount the firm spent on purchases of tangible fixed assets, in millions. The data from the acquiring and target firm's effective tax rate is a measure of total tax paid as a percentage of the firm's accounting income, calculated as: $(TaxExpenses/PretaxIncome) * 100$. For revenue, profit margin, capital expenditure, and effective tax rate, new variables were generated as the sum of the target and acquiring firms in observations preceding the merger, and only the acquiring firm's financials in the period following the merger. This was done in order to allow analysis of whether the merged firm differs significantly from the two firms before the merger. Four additional variables were generated by taking the natural log of revenue, profit margin, capital expenditure, and effective tax rate; these will be useful in mitigating the effects of outliers in the analysis. A dummy variable $Merged_i$ was generated, which takes a value of zero in all observations preceding the merger date, and a value of one in all observations following the merger date. For matched firms that did not undergo a merger, the dummy variable $Merged_i$ always takes a value of zero.

3.4 Data Issues and Remedies: Database Quality and Outliers

The data gathered from the Bloomberg Terminal had several issues that had to be addressed before analysis. The most obvious issue with the initial dataset was observations with impossible values, such as negative revenue or negative capital expenditure. There were less than 10 such observations within the dataset, no more than two of which were concentrated within the same firm; these anomalous obser-

vations were deleted, and subsequently imputed with the average of the observation preceding and following the error. A handful of observations were dropped altogether before analysis due to seriously inadequate data, such as mergers that included a firm that reported absolutely none of its financials within the sample time period.

One of the mergers in the sample is an extreme outlier within the dataset: the acquiring firm Konica Minolta Inc., identified in the data as Merger ID #26. This outlier does not stem from any issues with the database or the firm's reporting of its financials; rather, this firm truly is as massive as it appears to be, with quarterly revenue exceeding \$250 billion (Konica Minolta Inc., 2017). Compared to the average quarterly revenue within the sample of roughly \$7.8 billion, this observation is much larger and therefore cause for concern that it may have a disproportionate effect on the results; however, since the data is accurate it has been left, unadulterated, in the dataset. The concerns over this outlier having an excessive impact on the results will be addressed later through regressions employing a natural log functional form and firm fixed effects. Figure 1 and Figure 2 exhibit this outlier, and the effect that taking the natural log of the variable has on the disproportionate effects coming from the outlier firm; it is important to note that the time axis on this graph measures time in terms of the difference from the observation date to the merger date, so as to place all firms on a common timeline relative to their differing merger dates.

3.5 Dataset Description

A summarization of descriptive statistics on the relevant variables of merging firms can be found in Table 1: Summary Statistics. This table shows the descriptive statis-

tics for each variable of interest from the acquiring and target firms and the combined variables of interest which take the value of the sum of both firms for observations preceding the merger, and take the value of the acquiring firm in observations following the merger. This table also summarizes the natural logs of the variables of interest, which were taken in order to reduce the disproportionate impact of outliers. Table 2: Summary Statistics of Control Firms exhibits the same summary statistics, though for the group of matched firms that will be used as a counterfactual for the merging firms.

Figure 5 exhibits average revenue of merging firms across the sample period by the time difference between a given observation date and the merger date. Here the revenue is divided into three categories: the acquiring firm before the merger, the target firm before the merger, and the merged firm following the merger. Similarly, Figure 6 shows average profit margin of merging firms across the sample period with observations divided into the aforementioned categories. Following the base analysis of the effect merging has on firm value, further investigation will be done to determine the sources of changes in firm value, using the firm's capital expenditure and effective tax rate. Figures 7 and 8 show the average capital expenditure and effective tax rate of merging firms, again divided into the three aforementioned categories. Figures 9 through 12 present a similar visualization, though presenting the natural logs of the variables of interest of merging firms throughout the sample period.

The mergers in this sample were limited to those with a deal value of greater than \$250 million. This was done in order to address concerns of heterogeneity of merger size, as larger firms have been shown to respond differently to mergers when

compared to smaller firms (Tichy, 2001). The distribution of the value of the mergers in the dataset is shown in Figure 3: Merger Value. The majority of the mergers in the sample were valued at less than \$20 billion. The distribution is right skewed, with the majority of the values being fairly close to the \$250 million cutoff.

As previously mentioned, the payment type of a merger can offer insights into how well the merger will fare relative to other payment types. Figure 4: Payment Type, shows the distribution of payment types in the dataset, between cash payment, stock payment, or some combination thereof. There is a relatively even distribution between these three payment types, with most firms choosing to finance with stock, and the fewest firms choosing to finance with cash. There was one merger within the sample with an undisclosed payment method.

4 Identification Strategy

4.1 Identifying the Effect of Merging on Firm Value

Identifying the change in value from mergers necessitates an easily observable variable that shows changes in value creation. It is common throughout the literature to use a firm's revenue to analyze changes in value from mergers, as any gains or losses that accrue from the merger would have to eventually show up in the firm's cash flow (Andrade et. al., 2001). The following regression model will be used to identify the effect of merging on firm revenue:

$$\widehat{Revenue}_i = \beta_0 + \beta_1 Merged_i + \gamma_{ti} + \alpha_{fi}$$

In this regression $\widehat{Revenue}_i$ is the predicted quarterly revenue of the firm, measured in millions. $Merged_i$ is a dummy variable for whether the observation is before or after the merger. γ_{ti} is a yearly time fixed effect. α_{fi} is an individual firm fixed effect.

Revenue has been proven to be a good indicator of changes in firm value; however, it would be shortsighted to assume that analyzing revenue alone can definitively show the changes in value resulting from a merger. For example, following a merger firm revenue could rise due to an increased customer base; however, this would not necessitate value creation, as if the increase in revenue is coupled with an increase in costs that is of greater magnitude, we may incorrectly conclude that the merger created value when, in fact, it did not. Employing an additional regression identifying the effect of merging on a firm's profit margin allows for a comparison of the results, the congruency of which would help in confirming the conclusion. The following regression model will be used to identify the effect of merging on firm profit margin:

$$\widehat{ProfitMargin}_i = \beta_0 + \beta_1 Merged_i + \gamma_{ti} + \alpha_{fi}$$

In this regression, $\widehat{ProfitMargin}_i$ is the predicted quarterly profit margin of each firm, measured as $(NetIncome/NetRevenue) * 100$. $Merged_i$ is a dummy variable for whether the observation is before or after the merger. γ_{ti} is a yearly time fixed effect. α_{fi} is an individual firm fixed effect.

4.2 Identifying Changes in Firm Synergies from Merging: The Sources of Value Change

As the literature points out, there has been significant research on the effects of mergers on firm value; however, there has been little work done to link the type of synergy to the amount of value creation (Chatterjee, 1986). Identifying the channels through which mergers affect firm value will help to fill in gaps in contemporary merger literature; furthermore, being able to assign magnitudes to different synergies will allow firms in the future to be better able to identify potential mergers that would maximize value creation. It is important to note here that such a decomposition of the synergies associated with merging would not be possible with stock data, which is a large part of the reason that this analysis employs an outcome study, rather than an event study.

One of the major synergies theorized to create value as the result of a merger is operating synergy, which increases value by exploiting capital synergies to increase the efficiency of the merged firm relative to the two firms before the merger. If such increased efficiency does result from a merger, we would expect to see evidence of this in the merged firm's financials; particularly, if a firm is enjoying increased capital efficiency, we would expect the returns to be realized through decreased capital expenditure. The following regression model will be used to identify the effect of merging on a firm's capital expenditure:

$$\widehat{CapitalExpenditure}_i = \beta_0 + \beta_1 Merged_i + \gamma_{ti} + \alpha_{fi}$$

In this regression, $\widehat{CapitalExpenditure}_i$ is the predicted quarterly capital expenditure of each firm, measured as the amount of money spent on tangible fixed assets in

millions. $Merged_i$ is a dummy variable for whether the observation is before or after the merger. γ_{ti} is a yearly time fixed effect. α_{fi} is an individual firm fixed effect.

Another important synergy theorized to create value as the result of a merger is financial synergy, which creates value for the firm largely through tax savings. There is some question as to whether this truly causes economic value creation, or merely redistributes wealth from the government to the firm; nonetheless, financial synergies are still cited by many acquiring firms as their main reason for pursuing a given target. Financial synergies can be easily observed through the effective tax rate that a firm pays. The following regression model will be used to identify the effect of merging on a firm's effective tax rate:

$$\widehat{EffectiveTaxRate}_i = \beta_0 + \beta_1 Merged_i + \gamma_{ti} + \alpha_{fi}$$

In this regression, $\widehat{EffectiveTaxRate}_i$ is the predicted quarterly effective tax rate of each firm, measured as the total tax paid by a firm as a percentage of the firm's accounting income. $Merged_i$ is a dummy variable for whether the observation is before or after the merger. γ_{ti} is a yearly time fixed effect. α_{fi} is an individual firm fixed effect.

4.3 Controlling for Time-Variant Factors

On average, a firm is expected to grow and expand over time as their size increases; resultantly, when studying mergers it is important to control for this growth so as to not attribute an increase in value from time trends to a merger. The revenue of firms in the dataset increases over time, and in order to find the causal effect from merging

time trends must be accounted for. Without such a control the changes in firm value that result from time trends would be mistakenly attributed to the merger, causing an estimate of the impact of merging that would overstate any positive results from the merger. There are numerous factors, both observable and unobservable, that change over time and impact all observations in the sample, such as government regulations and international agreements.

In this model time-variant factors are controlled for with the use of a time fixed effect regression. Matched firms that are similar to the merging firms on key characteristics, such as size, region and industry, were added to the sample to serve as a counterfactual to the merging firms. The addition of these firms to the sample allows for a more accurate time fixed effect that is determined by other, non-merged, firms, rather than the only the merging firms, which may be fundamentally different from non-merging firms. Applying a time fixed effect to the regression model effectively controls for all time-variant variation within the sample.

4.4 Controlling for Time-Invariant Factors

There are many variable elements within firms that impact the performance of the firm overall. For example, one of the main determinants of firm success is the decisions made by its board of directors; since these directors make their decisions in response to firm-specific circumstances, changes in the composition of the board of directors can create an issue of reverse causality, as decisions may be made partially in response to low firm value, rather than the cause of it.

This endogeneity issue is commonly addressed in outcome studies through the

application of a time-series analysis that employs firm fixed effects (Hausman and Taylor, 1981). Employing a firm fixed effect controls for all firm-level factors, both observable and unobservable, that do not change over time. By applying this firm fixed effect in conjunction with a time fixed effect, all time-variant and time-invariant endogeneity are effectively wiped from the model, allowing for an accurate estimate of the causal effect of merging on firm value.

4.5 Addressing Outliers in Analysis

As noted in the section on data description, this dataset included one firm that was a large outlier. Addressing this in analysis is essential so as to ensure that this one outlier does not drive the majority of the results. In order to combat this issue, regressions will also be run on the natural log of the dependent variables of interest. Figures 1 and 2 exhibit how regressing on the natural log of the dependent variables addresses this issue by mitigating the ability of the outlier firm to drive the results.

5 Results

5.1 The Effect of Merging on Firm Revenue: The Myth of Value Creation

Table 3 presents the estimates of the effect of merging on firm revenue; in order to address outliers, the model regressing on the natural log of revenue will be the focus of the majority of the analysis. When employing both an individual firm fixed effect and a time fixed effect, merging produces a highly statistically significant

point estimate of -0.177, predicting that a merger is associated with a decrease in firm revenue of roughly 17.7 percent. When run with revenue as a scale, rather than a natural log, the regressions results predict an increase in firm revenue of roughly \$646.9 billion; at first glance this may seem contradictory; however, it is likely that these scale results are being driven largely by the outlier from in the sample, Konica Minolta Inc. When this outlier is properly controlled for using a regression with a natural log functional form, the results show a significant decrease in revenue.

Under the assumption that any value creation resulting from a merger would eventually be realized in the firm's cash flows, the results indicate that mergers may not create value for firms as they have long been assumed to do. Furthermore, mergers appear to destroy value, as the revenue of the merged firm following the merger is significantly lower than the sum of the revenue of the target and acquiring firm preceding the merger. Without increasing the revenue of a firm it is difficult, though not impossible, for the firm to accrue some value from a merger.

5.2 The Effect of Merging on Firm Profit Margin: A Check for Congruency

The baseline specification showed that following a merger, a merged firm is predicted to have a revenue that is significantly less than the sum of the revenue of the target and acquiring firm preceding the merger. These results lend themselves to the conclusion that mergers do not create value; however, it is possible that a merged firm may see value accrual through increased profit margins despite a lower revenue. This would be possible if increased efficiency, or some other synergy resulting from

the merger, outweighs the negative effect on revenue. If this were to be the case, mergers could create value without increasing firm revenue. Thus, an investigation of the effect that merging has on a firm's profit margin is necessary to ensure that the results are congruent with the effect of merging on revenue.

Table 4 presents the estimates of the effect of merging on firm profit margin. Employing both an individual firm fixed effect and a time fixed effect produces a highly statistically significant point estimate of -0.719, predicting that a merger is associated with a 71.9 percent decrease in firm profit margin. When run with profit margin as a scale, rather than a natural log, the regression results produce a point estimate of 10.40, predicting that a merger is associated with an increase of 10.4 in firm profit margin. This estimate, which does not control for outliers, produces a point estimate that is highly statistically insignificant; this is likely caused by the failure to properly control for outliers. These results are not only congruent with the previous finding that mergers are predicted to decrease revenue, they also imply value destruction of a much larger magnitude.

5.3 The Sources of Value Change from Mergers: Operating Synergies

Though there is a quite extensive literature on the effects mergers have on firm value, there is a significant lack of research on the causes of the observed changes in firm value. The different theoretical synergies from merging address the ways a merger could create value; however, in practice it has been more difficult to measure and identify these synergies empirically. Identifying the synergies involved in changes in

firm value resulting from a merger will allow for a more comprehensive analysis of why mergers have the effect on value that they do, rather than merely identifying the value change.

One of the motivations for merging most frequently cited by firms are operating synergies, which are thought to increase the productivity of a merged firm over that of the target and acquiring firm preceding the merger. If such synergy occurs, following a merger we would expect to see the synergy realized in the form of decreased capital expenditure by the merged firm. This holds true because if the merged firm truly operates more productively we would expect the firm to spend less on capital at any given level of production.

Table 5 presents the estimates of the effect of merging on firm capital expenditure. Employing both an individual firm fixed effect and a time fixed effect produces a significant point estimate of -0.140, predicting that a merger is associated with a 14 percent decrease in firm capital expenditure. When run with firm capital expenditure as a scale, rather than a natural log, the results predict a statistically significant increase in firm capital expenditure of roughly \$94.98 million, though this estimate is also highly statistically insignificant. These contradictory point estimates present a lack of clarity on the effect that merging has on firm capital expenditure.

These contradictory results may indicate that there is another confounding variable, such as the motivation for the merger, that creates bias on the estimates of the effect of merging on firm capital expenditure. One possible explanation is that decreased capital expenditure most commonly results from vertical mergers, as these contradictory results would make sense if only a certain subclass of mergers enjoy

significant operating synergies. This contradiction may also help to explain the previous results on firm revenue and profit margin; operating synergies are generally the main motivation cited by managers for merging, and if only a subclass of mergers realize this synergy following a merger, it follows logically that value change, on average, would be negative.

5.4 The Sources of Value Change from Mergers: Financial Synergies

Another major motivation for merging often cited by firms is financial synergy. One of the main financial synergies cited by firms is a decreased effective tax rate. Table 6 presents the estimates of the effect of merging on the effective tax rate paid by a firm. Employing both an individual firm fixed effect and a time fixed effect produces a highly statistically significant point estimate of -0.643, predicting that a merger is associated with a 64.3 percent decrease in the effective tax rate paid by the firm. When run with effective tax rate as a scale, rather than a natural log, the regression results are comparable, predicting that a merger is associated with a 20.18 percentage point decrease in the effective tax rate paid by the firm. It is important to note here that though taking the natural log of the effective tax rate helps mitigate the impact of outliers, it also lowers the sample size by roughly fifty quarterly observations; this occurs because firms with an effective tax rate of 0 will be undefined in the natural logarithm function. Though this drop in sample size is important to pay attention to, it is unlikely to be cause for concern here as it appears that the results from both functional forms are congruent with one another.

These results are congruent with much of the conventional theory about mergers. A decreased tax rate will undeniably help firms accrue value and increase profit margins; however, one should not misconstrue value creation for the firm with the creation of economic value. The increased value that a firm enjoys following a merger from a decreased effective tax rate should be viewed as a transfer of wealth, rather than value creation. Value creation would imply that the merged firm was allocating its resources more efficiently than the target and acquiring firm were separately before the merger. The benefits the firm does enjoy from a decreased effective tax rate do not increase allocative efficiency and therefore do not create economic value; rather, this is merely a transfer of wealth from the government to the firm.

5.5 The Results and their Implications

The results predict that a merged firm will have a revenue that is roughly 17.7 percent lower than that of the target and acquiring firm preceding the merger. These results are congruent with findings from aggregated analysis of merger research, which has shown that half of mergers reduce the value of the firm, with another quarter only increasing firm value at the cost of consumers (Tichy, 2001). Such a decrease in revenue resulting from a merger implies that, on average, merging does not create economic value for the merged firm. The analysis goes a step further in analyzing the effect of merging on firm profit margin, as a juxtaposition of these results to analyze their congruence allows for a more robust investigation. The results predict that a merged firm will have a profit margin that is roughly 71.9 percent lower than that of the target and acquiring firm preceding the merger. These results are consistent

with analysis by Ravenscraft and Scherer, (1989) who used a line of business analysis that showed a loss in profitability following a merger. The analysis on the effect that merging has on firm profit margin is not only consistent with the previous results on firm revenue, the magnitude of the predicted decrease in profit margin implies even greater value destruction. With such a decrease in revenue, and an even greater decrease in profit margin, both sets of results imply that mergers at best have little impact on firm value, though likely destroy economic value.

It appears that mergers may not create economic value; in fact, it seems they destroy economic value. Despite the fact that, on average, merging did not create value for the firms in the sample, they chose to merge regardless. Assuming that a profit maximizing firm would only undergo a merger with the goal of creating economic value, we may be able to explain some of the value destruction by decomposing some of the synergies theorized to create value during mergers. The scale and natural log functional form analyses of the effect of merging on operating synergies, specifically firm capital expenditure, produced statistically significant contradictory point estimates. As previously noted, one possible explanation for this contradiction is that only a certain subclass of mergers, likely vertical mergers, enjoy the operating synergies theorized to be enjoyed during most mergers. If operating synergies, frequently cited by firms as a major motivation for merging, do not increase economic value for all merging firms as they have been thought to, such a difference between expectations and outcome can help explain some of the value destruction exhibited in the baseline specification.

Another major synergy that firms hope to capitalize on when merging is financial

synergy, namely the reduction in the effective tax rate paid by the larger merged firm following the merger. The results predict that a firm's effective tax rate will decrease by nearly sixty-five percent compared to pre-merger levels. Such an effect on tax rate explains why this is one of the reasons that most entices firms to merger; however, the economic value creation here is not clear. The lowered tax rate, and any value accrued by the firm as a result, only represent a transfer of wealth from the government to the firm, while not truly creating any economic value. This is not to say that the firm does not benefit from this lower effective tax rate, though in terms of economic value creation financial synergies have little, if any, effect.

The results show a destruction of firm value following a merger, and the decomposition of synergies highlights several reasons for this; however, miscalculations of the expected synergies from merging are not the only causes of such value destruction. One of the main unmeasurable causes of such value destruction stems from managerial hubris (Roll, 1986). This explanation follows the idea that managers may choose to bid on a target firm due to a hubris effect, rather than the expected returns from the acquisition. Though it is difficult to prove empirically, the effect of managerial hubris in conjunction with the conventional idea that mergers should create value likely plays a role in the value destruction resulting from mergers.

These results showing deterioration of firm value following a merger may seem surprising; however, given that the stock market is a highly efficient capital market, this should not be surprising at all. Aggregated analysis of research on stock markets has shown that they tend to serve as extremely efficient capital markets (Fama, 1970). Fully efficient capital markets imply that market prices fully reflect all avail-

able information about the firms. Since capital markets have been shown to be highly efficient, it should be unsurprising that mergers, which hope to create value by purchasing a target firm that is undervalued by capital markets, show dismal results, as a highly efficient capital market would rarely allow for such undervaluation.

Another explanation for the value deterioration shown to result from mergers is that synergy may be a two-way street. Shaver advanced the idea that while much attention is given to the synergies surrounding a merger that are theorized to create value, there are also contagion and capacity synergies that destroy value during a merger (2006). It is theorized that when two independent firms are merged, channels between the two firms are opened that management hopes will facilitate positive synergy; however, these same channels can also be used to facilitate a contagion effect that will make the firm less efficient. The capacity effect theorizes that when a firm merges, it may see value deterioration that stems from the inability of managers and employees to handle the increased workload of the merged firm. These effects suggest that synergy is currently being viewed by academia as a one-way street that creates value, when in reality opening these channels also facilitate synergies that deteriorate firm value.

Contradicting the conventional wisdom that mergers create value, these results show that merging has a detrimental impact on firm value. As addressed, the effects of managerial hubris, shortcomings of operating synergies relative to expectations in some classes of mergers, and channels for negative synergies all help to explain why firms merge in the face of increasing evidence that mergers have an ambiguous, or even deteriorative, effect on firm value. Assertions that mergers create value are

further weakened by the fact that the only value creation firms have been shown here to enjoy stem from financial synergies; these synergies, though beneficial for the firm, do not create any economic value as they merely represent a transfer of wealth. This shows that not only are mergers predicted to decrease value on average, but the only positive effects shown for the firm do not create economic value. Relating back to the literature, it is important to note here that the results showing value deterioration came from a sample of firms that have characteristics associated with the most positive returns from merging, such as very large firm size and deal value. This furthers the argument that mergers do not create, and in fact destroy, value, as even the firms in this sample, which have characteristics that have been shown to make value accrual during a merger more likely, were unable to realize any value creation.

6 Conclusion

The main takeaway from this analysis is that mergers, on average, destroy economic value. This directly contradicts the conventional wisdom that mergers create value; however, it does follow the trend in merger analysis that has seen the positive predicted effects of merging grow smaller and ultimately disappear as identification strategies have improved. Once the value deterioration resulting from mergers was identified, further analysis was done to decompose and assign magnitudes to some of the synergies related to merging. This analysis found that operational synergies, which firms generally hope will create most of the value from merging, showed a

contradictory effect from merging. Though the reason for this is not entirely clear, the ambiguity of the results can help to explain some of the value destruction. Financial synergies were shown to accrue value for the firm; however, the fact that this is a transfer of wealth rather than value creation calls into question whether such a synergy is actually beneficial for the economy. Other explanations, which currently lack an expansive literature, for the exhibited value deterioration include managerial hubris and negative synergy effects, though empirical analysis of these may prove troublesome as they are often difficult to measure.

It is critical here to acknowledge that there is still much disagreement across empirical analysis on the effects that merging has on economic value. These disagreements partially stem from the debate over whether outcome studies or event studies are more suitable for merger analysis, and it may take some time to definitively prove the superiority of either. Another aspect that may feed such disagreement is the aggregate nature of most merger studies, which tend to aggregate and analyze a number of mergers with differing motives, payment methods, sizes, and consequently different outcomes. Contemporary literature on merger analysis, including this study, aims to take a sample of mergers and use it to identify the effect of merging; however, further research is needed in decomposing successful mergers in order to better understand how and why they create value. Much like how the analysis here highlights the difference between managerial expectations and outcomes, such research would help identify why firms on average do not create value when merging by analyzing the essential components of, and motivations for, a successful merger.

7 Tables and Figures

7.1 Tables

Table 1: Summary Statistics of Merging Firms

	Obs	Mean	Variance	Std. Dev.	Min	Max
Acquirer Revenue	1855	7050.184	6.91e+08	26283.49	2	299879
Target Revenue	839	2754.039	5.28e+08	22977.01	0	272530
Acquirer Profit Margin	1835	2.359741	16771.94	129.5065	-4840.344	760.7477
Target Profit Margin	828	-38.99591	485354.8	696.6741	-19046.87	253.6355
Acquirer Capital Expenditure	1660	487.764	2041033	1428.647	0	18822
Target Capital Expenditure	764	130.5295	836670.2	914.6968	0	13431
AcquirerTaxRate	1504	36.60513	3964.321	62.96285	0	1961.878
TargetTaxRate	611	33.12366	571.4584	23.9052	0	366.6667
Revenue	1565	7853.366	8.10e+08	28464.42	6.52	299879
ln(Revenue)	1565	7.603864	2.637884	1.624157	1.874874	12.61113
Profit Margin	1549	-19.7344	283816.1	532.744	-19175	769.4075
ln(Profit Margin)	1244	2.438111	1.269789	1.126849	-5.991465	6.645621
Capital Expenditure	1405	532.3601	2351415	1533.432	0	18822
ln(Capital Expenditure)	1392	4.98642	2.621473	1.619096	0	9.842782
Effective Tax Rate	1142	47.31104	5223.226	72.27189	0	1961.878
ln(Effective Tax Rate)	1095	3.66814	.4336263	.6585031	-.3074767	7.581657

Table 2: Summary Statistics of Control Firms

(1)					
	Obs	Mean	Std. Dev.	Min	Max
Revenue	1587	3469.238	6601.012	.697	65424
Profit Margin	1587	3.028984	81.53131	-1585.94	191.8988
Capital Expenditure	1267	237.0759	464.4445	0	4487
Effective Tax Rate	1365	103.0731	2426.726	0	89172.57
ln(Revenue)	1587	6.682314	1.952493	-.3609699	11.08864
ln(Profit Margin)	1419	2.152286	1.097088	-4.173388	5.256968
ln(Capital Expenditure)	1209	4.23917	1.899511	-4.199705	8.408939
ln(Effective Tax Rate)	1287	3.363118	.6360315	-1.290621	11.39833

Table 3: The Effect of Merging on Firm Revenue

	(1)	(2)	(3)	(4)	(5)	(6)
	Revenue	Revenue	Revenue	ln(Revenue)	ln(Revenue)	ln(Revenue)
Merged	6892.9*** (784.0)	6333.9*** (878.2)	646.9* (280.2)	1.074*** (0.0685)	0.839*** (0.0751)	-0.177*** (0.0353)
Constant	3467.9*** (440.7)	783.1 (2823.0)	-616.5 (926.4)	6.801*** (0.0385)	5.332*** (0.242)	5.915*** (0.117)
Year FE	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes
Y-Mean	5646.0	5646.0	5646.0	7.140	7.140	7.140
R-Squared	0.0240	0.0390	0.966	0.0725	0.123	0.932
Obs	3152	3152	3152	3152	3152	3152

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: The Effect of Merging on Firm Profit Margin

	(1)	(2)	(3)	(4)	(5)	(6)
	Profit Margin	Profit Margin	Profit Margin	ln(Profit Margin)	ln(Profit Margin)	ln(Profit Margin)
Merged	5.707 (14.62)	-13.75 (16.44)	10.40 (26.33)	-0.143** (0.0473)	-0.0892 (0.0525)	-0.719*** (0.0584)
Constant	-9.991 (8.156)	-33.48 (50.98)	-37.19 (85.48)	2.328*** (0.0259)	1.893*** (0.161)	3.686*** (0.178)
Year FE	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes
Y-Mean	-8.215	-8.215	-8.215	2.286	2.286	2.286
R-Squared	0.0000486	0.0102	0.103	0.00340	0.0195	0.612
Obs	3136	3136	3136	2663	2663	2663

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: The Effect of Merging on Firm Capital Expenditure

	(1)	(2)	(3)	(4)	(5)	(6)
	Capital Expenditure	Capital Expenditure	Capital Expenditure	ln(Capital Expenditure)	ln(Capital Expenditure)	ln(Capital Expenditure)
Merged	417.8*** (47.30)	395.2*** (52.84)	94.98** (30.09)	0.854*** (0.0726)	0.752*** (0.0806)	-0.140** (0.0510)
Constant	254.4*** (27.18)	13.23 (330.2)	647.2*** (141.6)	4.353*** (0.0420)	5.067** (1.735)	6.741*** (0.689)
Year FE	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes
Y-Mean	392.3	392.3	392.3	4.639	4.639	4.639
R-Squared	0.0284	0.0441	0.887	0.0505	0.0703	0.865
Obs	2672	2672	2672	2601	2601	2601

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: The Effect of Merging on Firm Effective Tax Rate

	(1)	(2)	(3)	(4)	(5)	(6)
	Effective	Effective	Effective	ln(Effective	ln(Effective	ln(Effective
	Tax Rate	Tax Rate	Tax Rate	Tax Rate)	Tax Rate)	Tax Rate)
Merged	-56.40	-71.92	-20.18	-0.107***	-0.0150	-0.642***
	(77.73)	(86.63)	(155.0)	(0.0293)	(0.0315)	(0.0446)
Constant	94.86*	38.09	-172.6	3.536***	3.590***	4.245***
	(42.91)	(280.0)	(475.2)	(0.0163)	(0.0999)	(0.134)
Year FE	No	Yes	Yes	No	Yes	Yes
Firm FE	No	No	Yes	No	No	Yes
Y-Mean	77.67	77.67	77.67	3.503	3.503	3.503
R-Squared	0.000210	0.00521	0.0219	0.00553	0.0786	0.438
Obs	2507	2507	2507	2382	2382	2382

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

7.2 Figures

Figure 1: Revenue Throughout the Sample Period (Merging Firms)

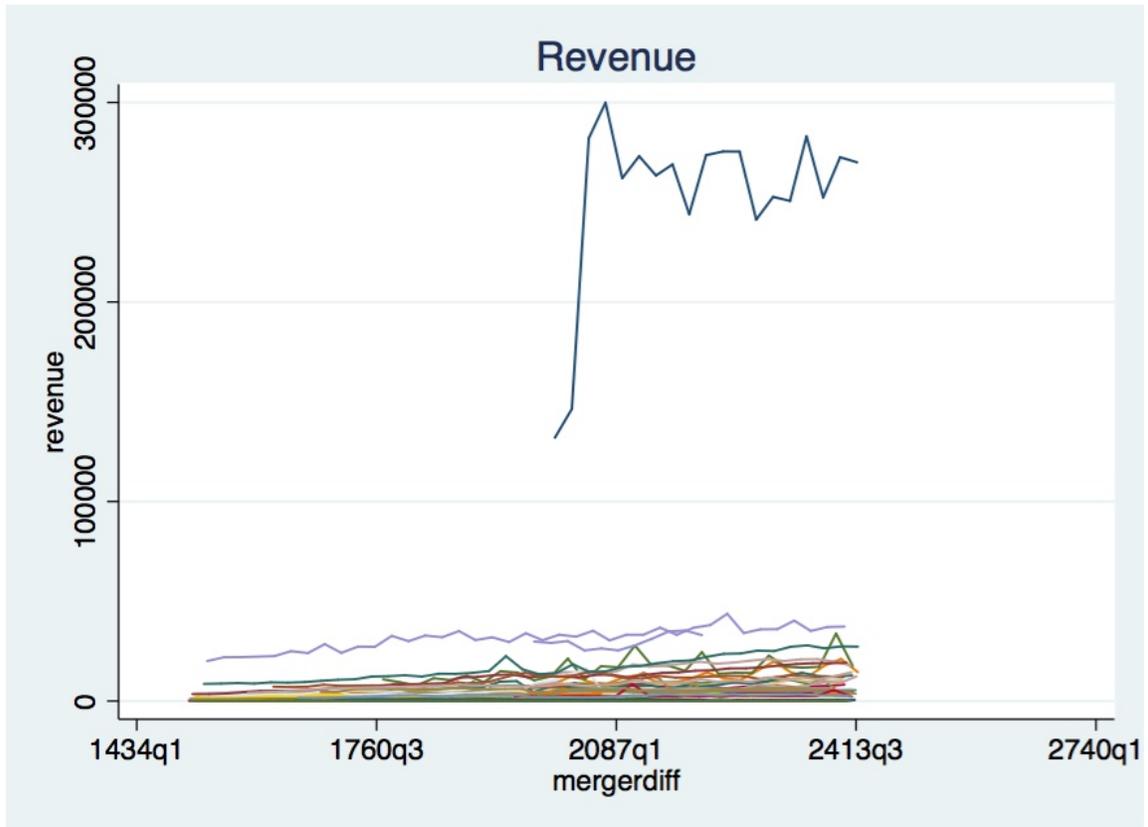


Figure 2: $\ln(\text{Revenue})$ Throughout the Sample Period (Merging Firms)

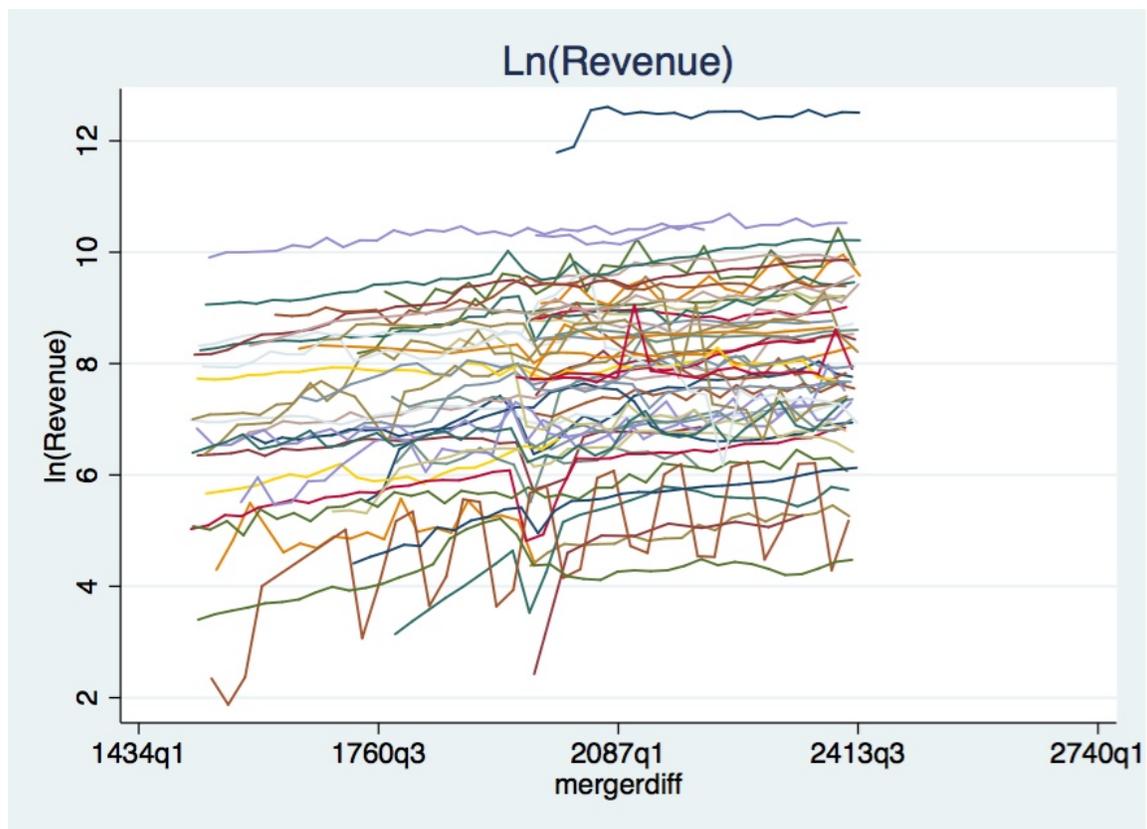


Figure 3: Merger Value

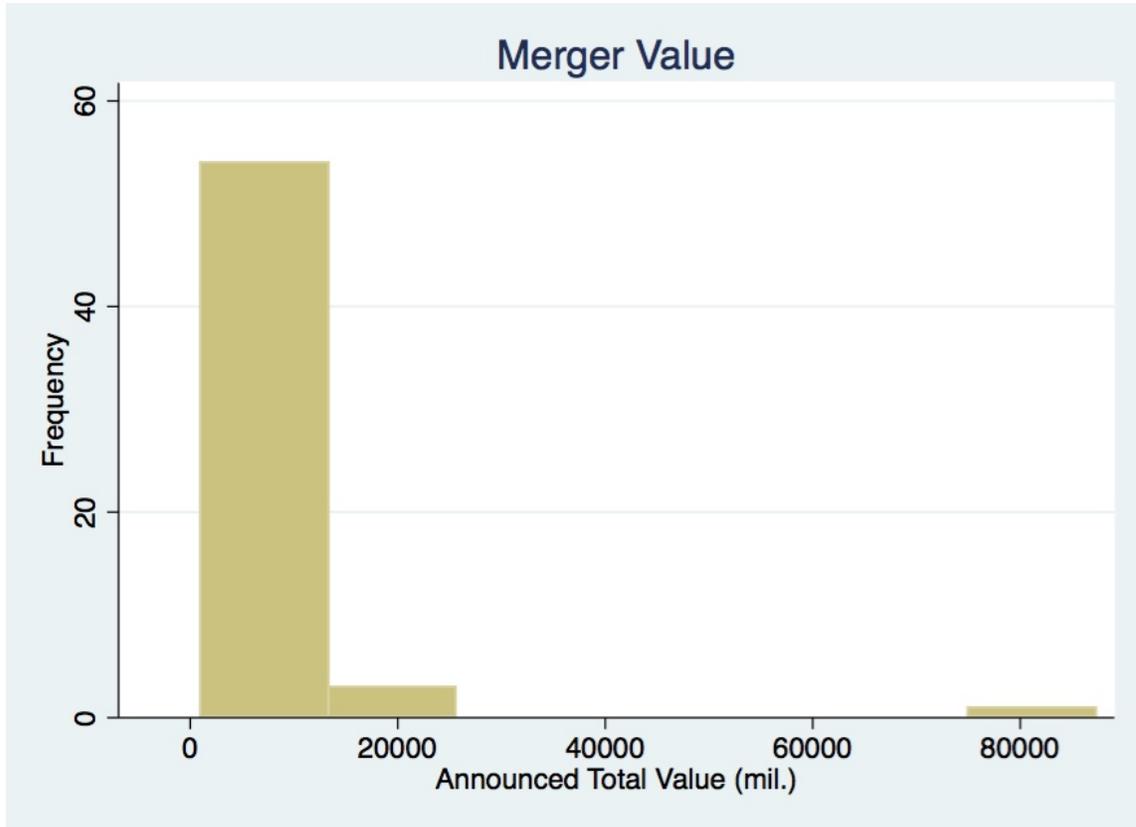


Figure 4: Payment Type

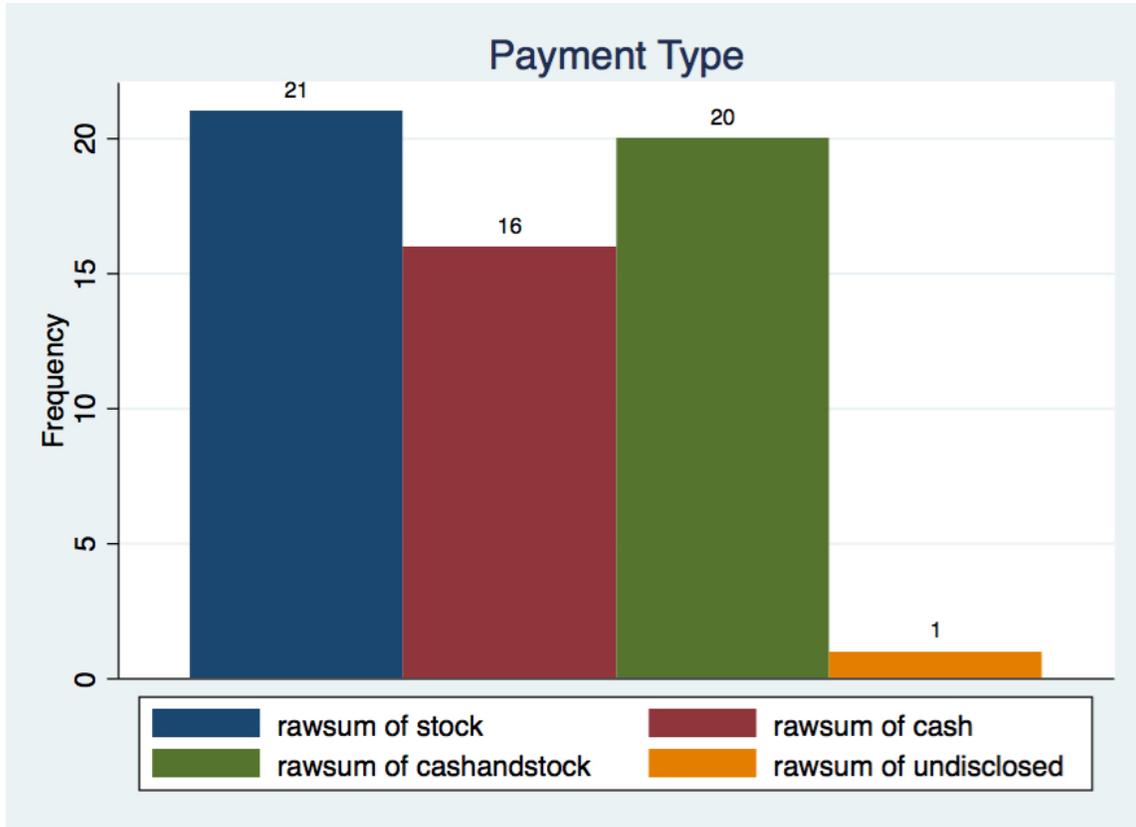


Figure 5: Average Revenue (Merging Firms)

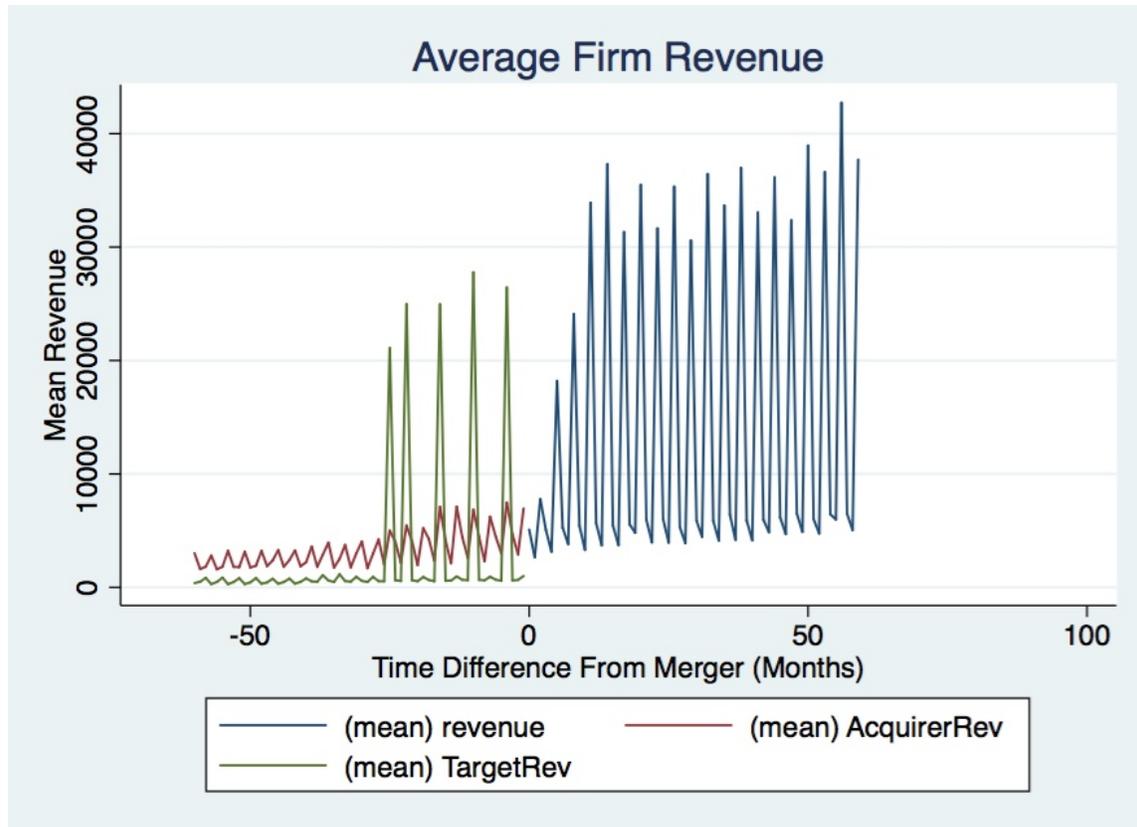


Figure 6: Average Profit Margin (Merging Firms)

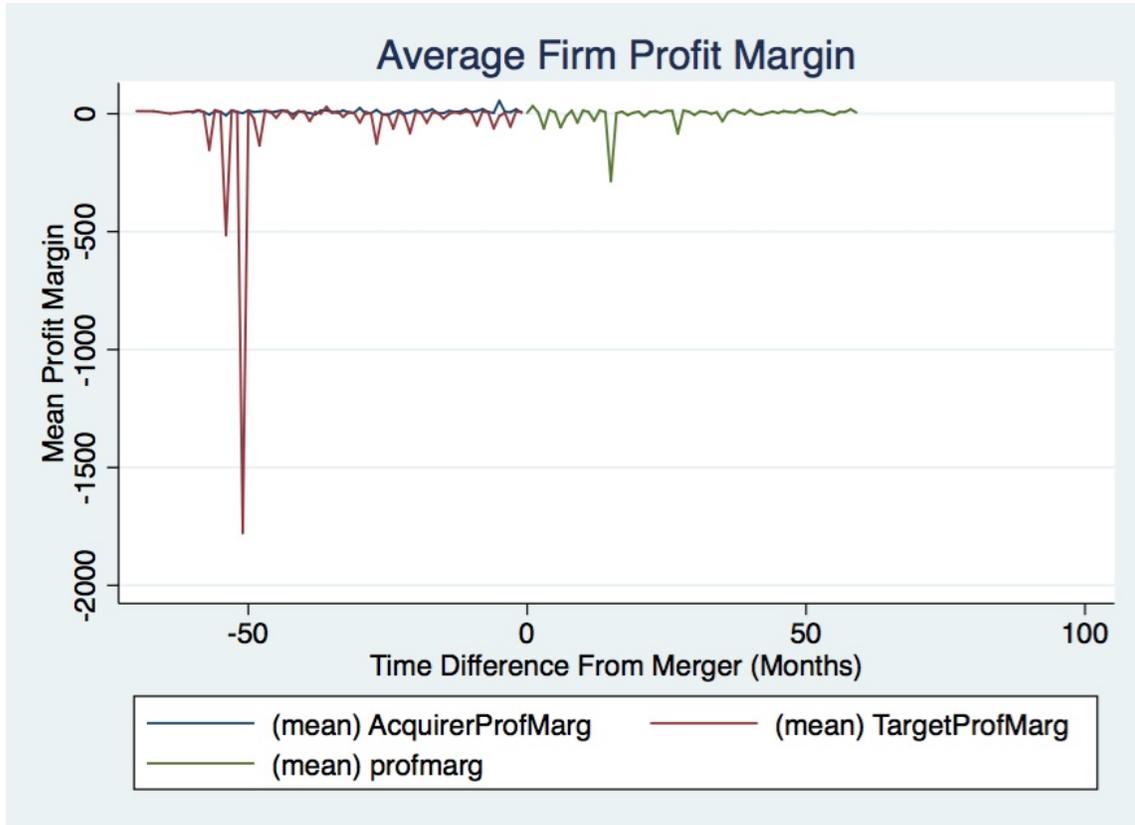


Figure 7: Average Capital Expenditure (Merging Firms)

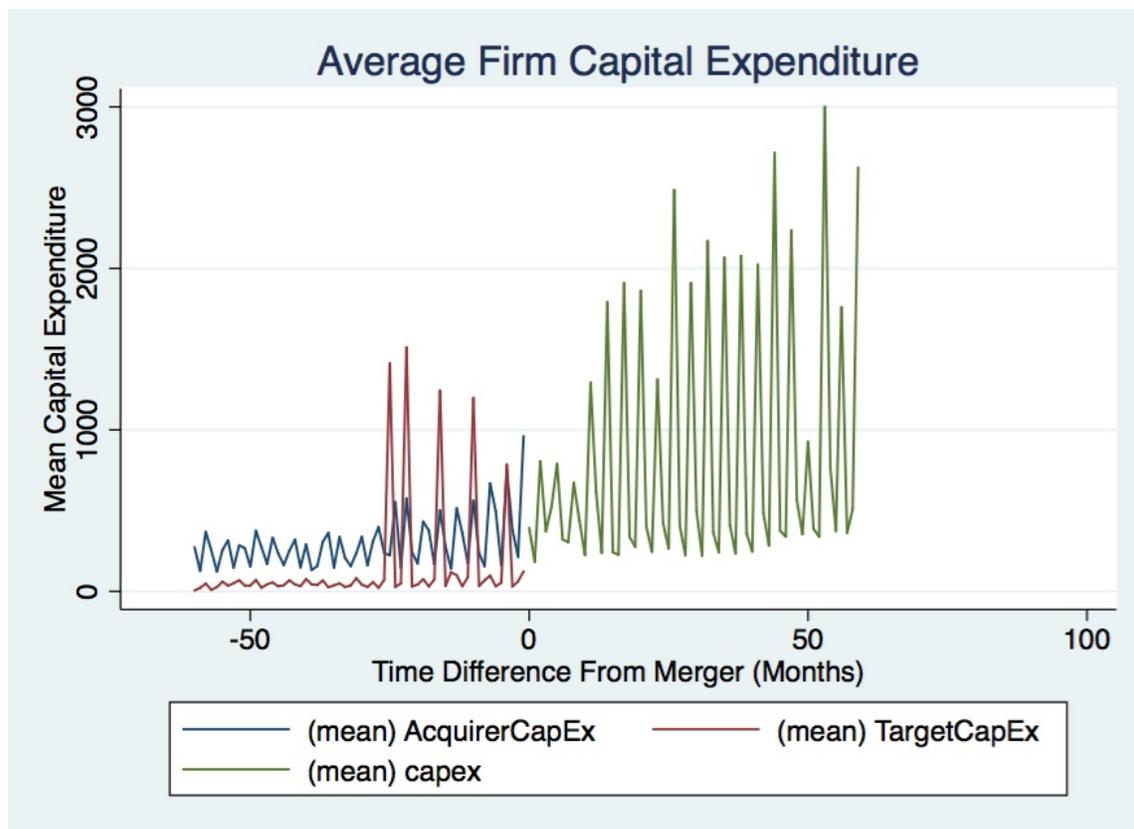


Figure 8: Average Effective Tax Rate (Merging Firms)

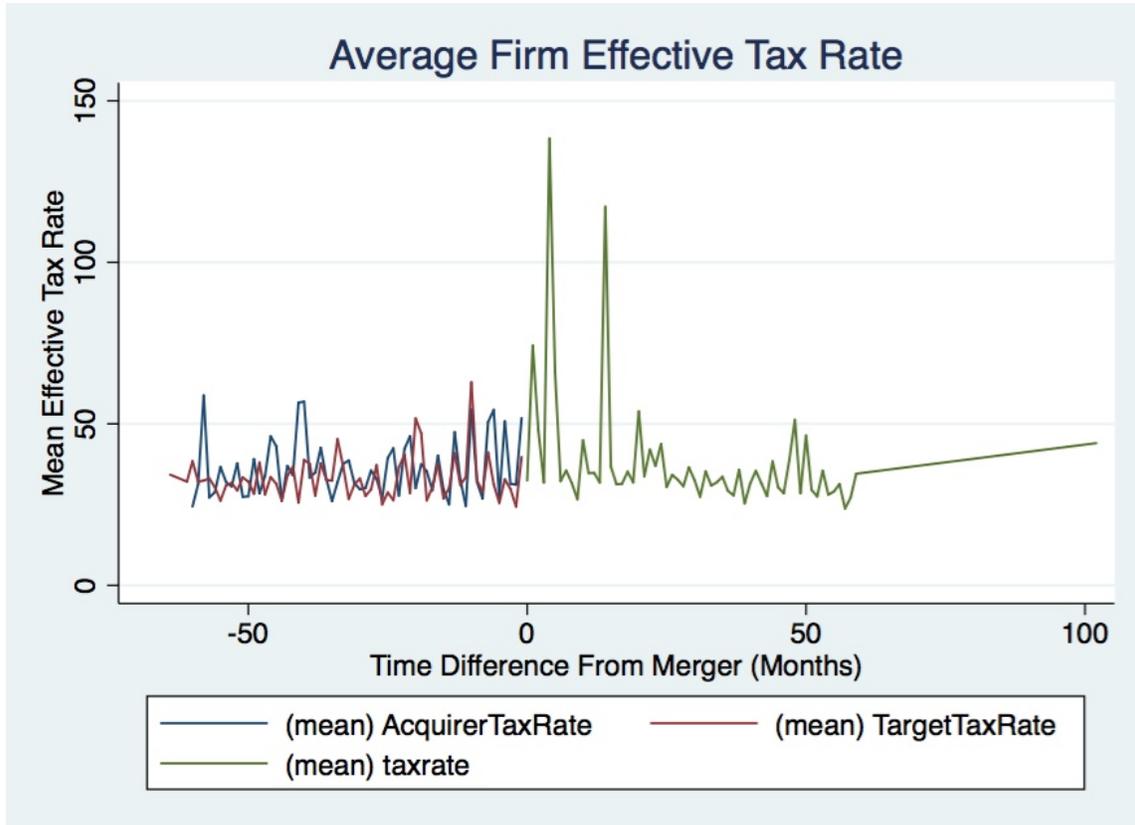


Figure 9: Average Natural Log of Firm Revenue (Merging Firms)

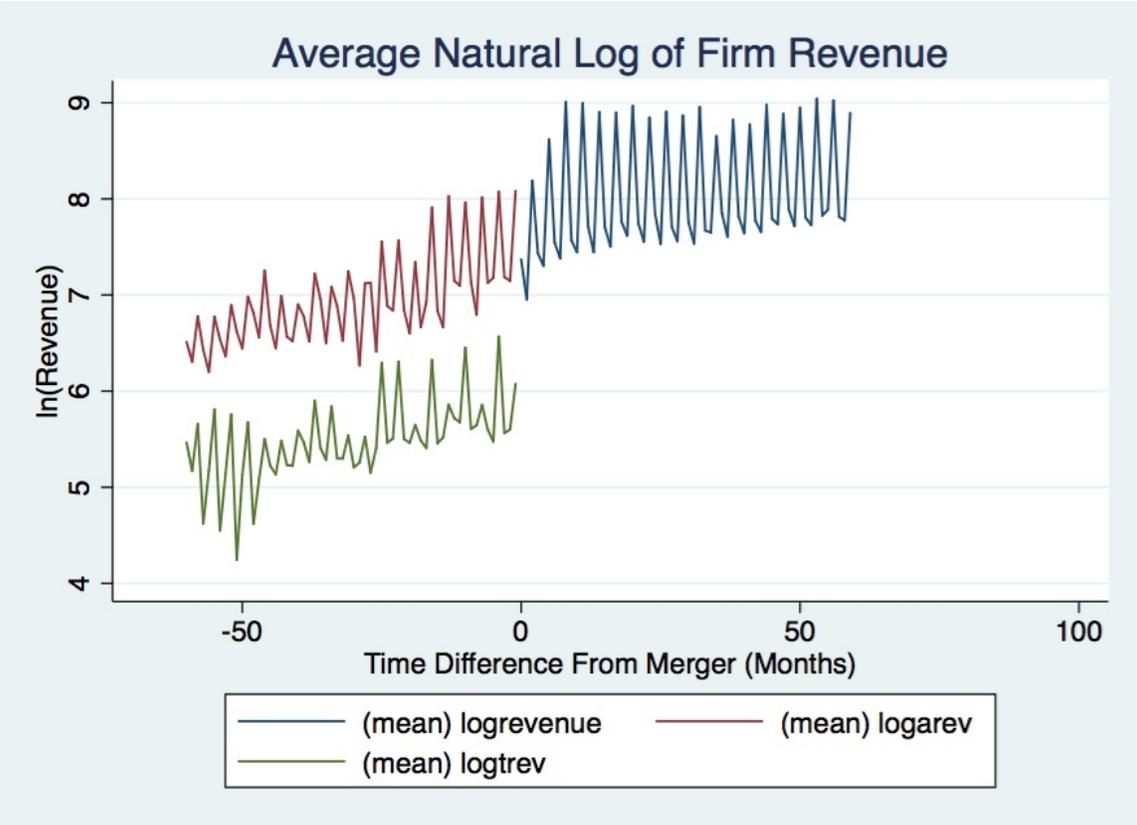


Figure 10: Average Natural Log of Firm Profit Margin (Merging Firms)

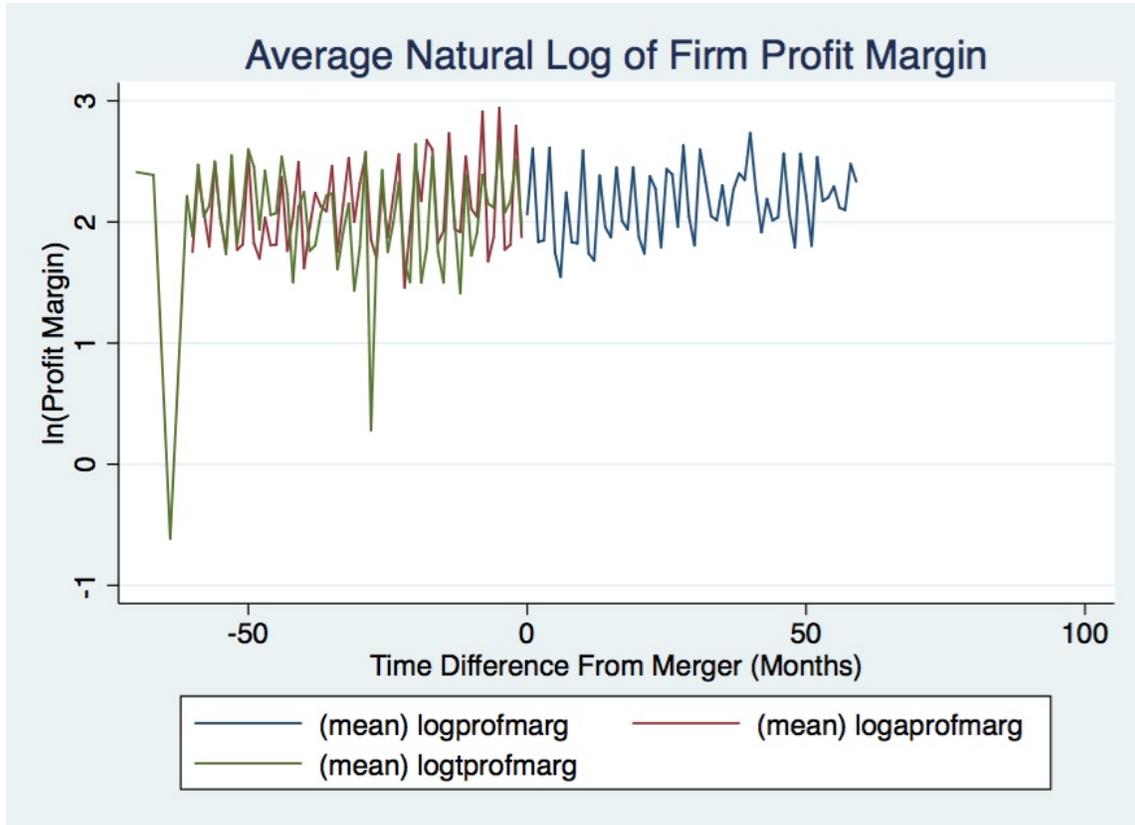


Figure 11: Average Natural Log of Firm Capital Expenditure (Merging Firms)

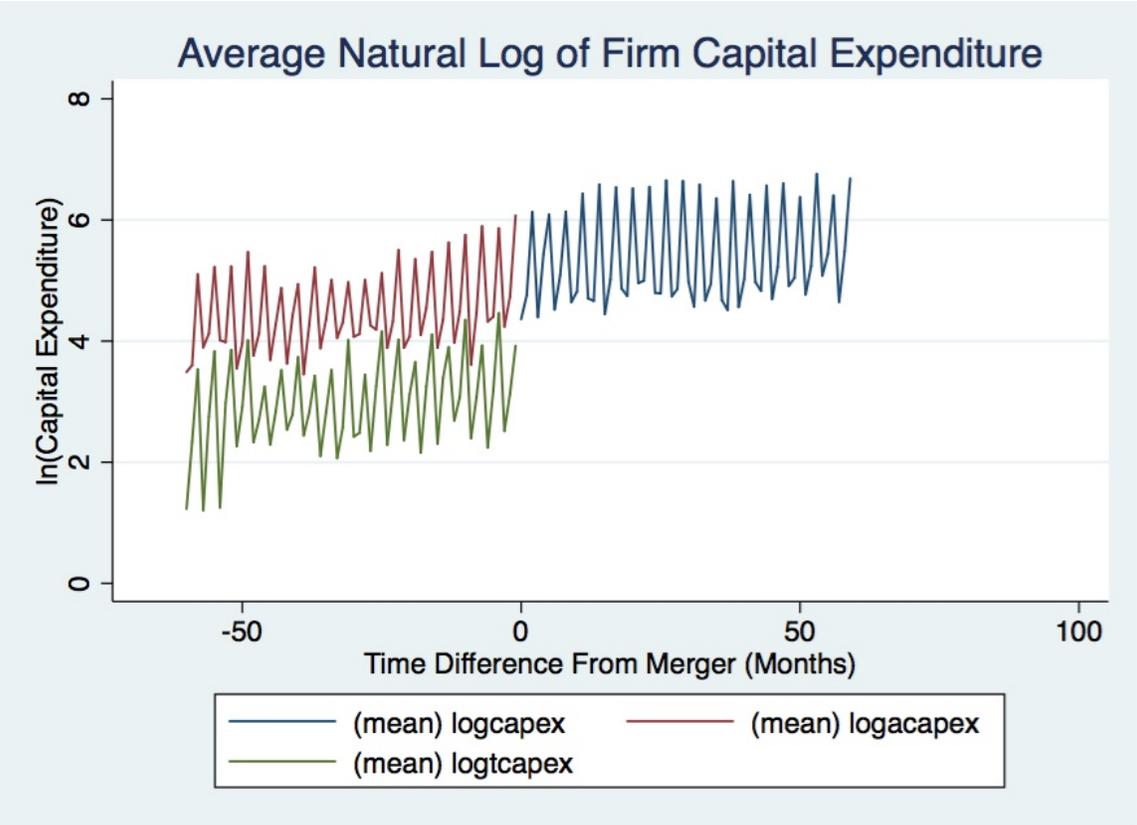
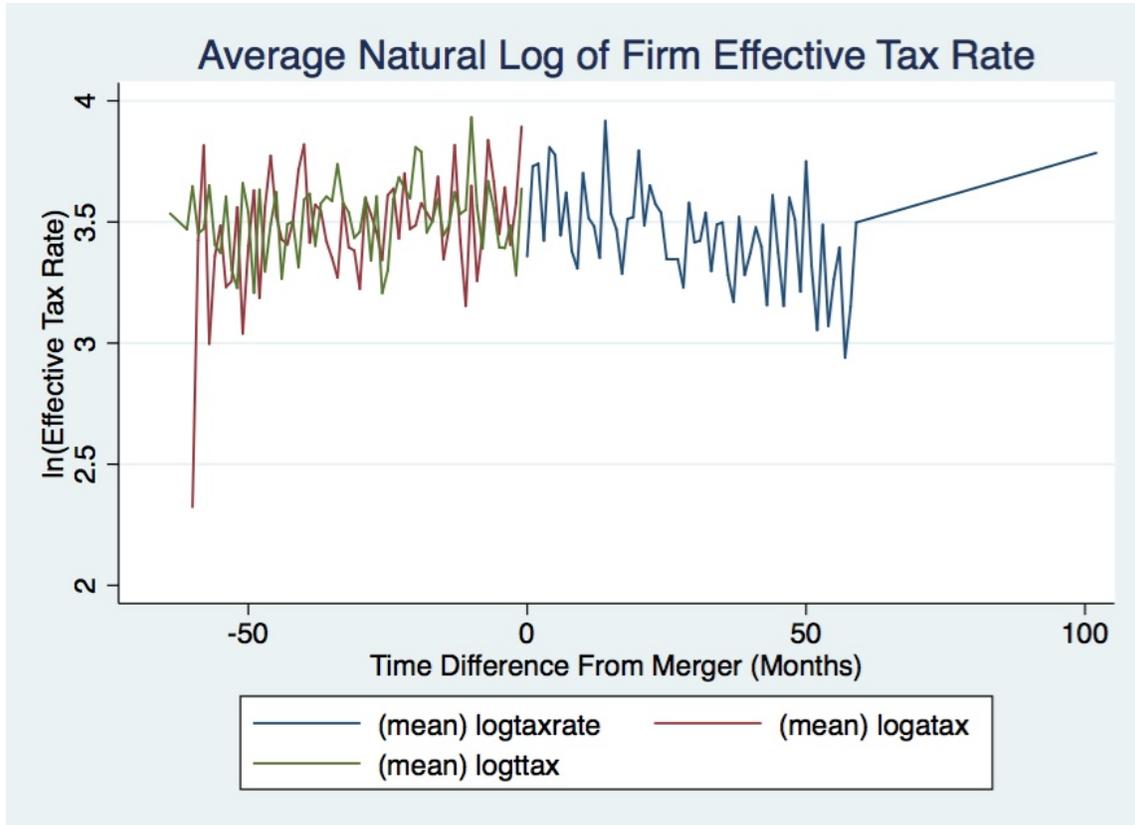


Figure 12: Average Natural Log of Firm Effective Tax Rate (Merging Firms)



8 References

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