Mergers and Acquisitions and the Valuation of Firms

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Abstract

We use EV/EBITDA as a measure of firm value and the financial fundamental ratios price to sales ratio, debt to equity ratio, market to book ratio and financial leverage as controls to measure the effect of mergers and acquisitions (M&A) on firm value. We use a large panel of 65,000 M&A deals globally from the Communications, Technology, Energy and Utilities sectors between the years of 2000 to 2010. First, we find significant contemporaneous effects of the financial fundamental ratios on firm value. Second, we find evidence of negative long-term M&A effects and positive instantaneous M&A impact on firm value because EV moves faster relative to a slow moving EBITDA. Finally, we find that the effect of M&A on firm value in the financial crisis of 2008 is much distinct from the same effect during the recession of 2001.

Keywords: Mergers and acquisitions (M&A), firm value, EV/EBITDA, treatment effect, DID estimation, propensity score matching
JEL Classification Codes: G34, C31, C33

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Comments Welcome

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1. Introduction

Mergers and acquisitions (M&A) is a general term used to refer to the consolidation of companies. It is part of corporate strategy, corporate finance and management dealing with the buying, selling, dividing, spinning and combining of different companies and similar entities that can help an enterprise grow rapidly in its sector or location of origin, or a new field or new location, without creating a subsidiary, other new entity or using a joint venture. A merger is a combination of two companies to form a new one, while an acquisition is the purchase of one company by another in which no new company is formed. Either structure can result in the economic and financial consolidation of two entities.

Historically, we can identify roughly six waves of M&A activities. The first wave of horizontal mergers in 1897-1904; the second wave of vertical mergers in 1916-1929; the third wave of diversified conglomerate mergers in 1965-1969; the fourth wave of congeneric mergers, hostile takeovers and corporate raiding in 1981-1989; the fifth wave of cross-border mergers in 1992-2000; and the sixth wave of shareholder activism, private equity and leveraged buyout (LBO) in 2003-2008.

M&A activity may also be construed as a type of restructuring in some entity reorganization with the aim of providing growth and value. Consolidation of an industry or sector occurs when widespread M&A activities concentrate the resources of many small companies into a few larger ones. For example, a large wave of M&A deals occurred in the automotive industry in the U.S. between 1910 and 1940, and a turbulent time for the airlines M&A was between 1970's and 1980's. Most importantly, the great revolution of information and telecommunications between 1985 and 2000 pushed global M&A activities in the technology and communication sectors to hit a highest level in the 21st century. In the beginning of 2014, Comcast Corporation and Time Warner Cable engaged in a friendly merger thus creating a world-wide technology and media company. The agreement is stock-for-stock transaction in which Comcast would acquire 100 percent of Time Warner Cable’s 284.9 million shares outstanding for shares of CMCSA amounting to approximately $45.2 billion in equity value in February of 2014. Also, Facebook announced in February 2014 that it had reached a definitive agreement to acquire WhatsApp, a rapidly growing cross-platform mobile messaging company, for a total of approximately $19 billion, including $4 billion in cash, approximately $12 billion
worth of Facebook shares and additional $3 billion in restricted stock units to be granted to WhatsApp’s founders and employees that will vest over four years subsequent to closing. So far during 2014, the worldwide mergers and acquisitions transaction value in the technology sector soared to $65.2 billion, up 90% from the same period last year which was US$34.4 billion and the highest year-to-date level since 2000. The top-value global M&A deals in all sectors are listed in Table 1.

Ultimately, our literature review shows that there is no agreement on either the motives or the effects of M&A on firm performance. Our aim is to measure the effect of M&A activities on firm value. We choose an enterprise value multiple as the metric for firm value since it takes debt into account, which the acquirer will have to assume, and eliminates the potential influence of inflation and tax policy. Thus, we can compare the results on firm value across countries and across time periods.

In particular, we investigate whether or not M&A have an impact on firm value; which factors have a significant effect, and how they influence firm value instantaneously and in the long-run. Moreover, an enterprise multiple may vary depending on the industry type. We examine the Communications, Technology, Energy and Utilities sectors, in order to understand the differences in technology-intensive and resource-intensive firms. We use a large sample consisting of global M&A deals for the period between the year of 2000 and 2010, using fixed-effects, dynamic panel regression and treatment effect models including propensity score matching with differences-in-differences. Table 2 presents a classification of the sectors and subsectors examined in this paper.

The paper is organized as follows. First, we present an introduction followed by a literature review. Section 3 then outlines the definition and descriptive statistics of the variables in sample dataset. Section 4 provides the empirical models and estimations including contemporary impact on firm value from financial fundamental ratios by panel regressions, the instantaneous, long-term effect and difference-in-differences estimations of M&A activities on firm values. Section 5 summarizes the major findings and gives recommendations for future research work.
2. Literature review

The magnitude of M&A phenomena has raised questions related to why M&A occur and how M&A affect the outcome of corporations in terms of financial performance, research and development, productivity and market share. Since the late 1990s, the literature focused on the theory of mergers and acquisitions, providing insights into the success or failure of M&A activities. The issues ranged from theories of the firm conceptualized into the motives for merger, their empirical investigation, performance measurement of merged firms using share price data and accounting data, empirical examination of financial characteristics of acquirer and target firms and the determinants of aggregate merger activity. Despite the large literature, there is no agreement about either the motives or the effects of M&A (Chapman 2003, Chen and Findlay 2003, DeYoung et al. 2009, Kwoka 2002, Menapara and Pithadia 2012, Schulz 2007).

A key main motivation for M&A is to provide growth of the company or positive shareholder value. The general motivations come from financial performance, technology innovation and market trend. The acquiring firm seeks improved financial performance (Erel et al. 2012). A more traditional view is that M&A take place to lower the costs of the company relative to the same revenue stream and increase profit margins, thus maximizing stockholder wealth (Bradley et al. 1988, Manne 1965). The acquisitions serve as a means to seize the efficiency gain potentially stemming from economies of scale and scope, managerial and financial synergies, and superior management. Also, a company is more competitive as it increases its market share. The acquirer firm can obtain a group of target markets for actual and potential products to be sold in those markets; meanwhile it absorbs a major competitor and thus increases its market power by capturing increased market share to set prices (Abellán 2004). Moreover, many M&A activities provide an opportunity for corporations and their shareholders to receive some tax benefits, in a small minority of cases these benefits are larger in comparison to the value of the acquired company, suggesting tax provided motivation. But, even in cases where there are significant tax benefits, there is no strong evidence that they were the driving factors in the takeovers (Auerbach and Reishus 1987). On average and across the most commonly studied variables, acquiring firms' financial performance does not positively change as a function of their acquisition activity (King et al. 2004). M&A activities appear to occur in different extents across different sectors. In technology-intensive firms (i.e. Communications and
Technology sectors), M&A appears to be strongly associated with R&D intensity and innovation. Due to fast growing technological change, an acquirer can take advances of a target’s product capability, patents and brand recognition by their customers (Sevilir and Tian 2012). The transfer of technologies and capabilities results in faster growth of acquirers (Ranft and Lord 2002). More recent literature also suggests that corporate managers conduct M&A to expand the power of their companies so as to facilitate their empire-building (Ravenscraft and Scherer 1987).

In the resource-intensive firms (i.e. Energy sector and Utilities sector) the focus is on geographical expansion, resource transfer and diversification. A non-financial merger motivator has long been believed to be geographic diversification. It is an attempt to expand market share, decrease risk, and in the long run increase profits (Frohlich and Kavan 2000). Many others (Baker et al. 1988, Conyon and Gregg 1994, Firth 1991) find that executive rewards increase with firm size in the wake of acquisitions. Also, resource and nonperforming assets are unevenly distributed across firms (Barney 1991) and the interaction of target and acquiring firm resources can create value through either overcoming asymmetry or by combining scarce resources (King et al. 2008).

Besides the motivations from the company’s perspective, the boom in M&A is also a general phenomenon generated by new global conditions, such as trends linked to the transformation of markets, e.g. the flourishing of regulatory shifts; and technology, e.g. the emergence of new business and market opportunities, the rise of technological interrelatedness, and the establishment of new communications and cross-border restructuring (Cassiman and Colombo 2006).

In terms of M&A effects, they have been used as instruments for firm growth for many years. Engaging in M&A represents an important commitment for any company as it affects every facet of its organization. Studies of this approach for emerging markets like China and India were undertaken in Menapara and Pithadia (2012), and cross-border M&A deals were examined in Chapman (2003), Chen and Findlay (2003) and Jongwanich et al. (2013). In order to best measure pre- and post- M&A effects, we can examine synergy realization, absolute performance, and relative performance. Analytical methods include, but are not limited to, mean and standard deviation, ratio analysis, paired sample t-test, which involves the use of accounting
measures like size, growth, profitability, risk and leverage to analyze the performance characteristics of the acquirer and target (merging and merged) firms in the pre- and post-takeovers periods (Vanitha and Selvam 2007); and difference-in-difference estimation to single out the causal effect of M&A (Hall 1990, Szücs 2013).

The economic advantages of M&A have been examined at length. Caves (1989) and Röller et al. (2000) provided support for the thesis that firms achieve or strengthen market power and obtain efficiency gains by being able to exploit economies of scale and scope. Kumar and Singh (1994)’s case study concluded that rehabilitation of a sick company by merging with a healthy company is one of the most effective way for their rehabilitation. Sanker and Rao (1998) analyzed the implications of takeovers from the financial point of view with the help of certain parameters like liquidity, leverage and profitability. They observed that a sick company is taken over by a good manager and makes serious attempts to turnaround successfully. Pawaskar (2001) compared the pre- and post-merger operating performance of the corporations involved in merger between 1992 and 1995 to identify their financial characteristics; this study identified the profile of the profits and showed that the merging firms were at the lower end in terms of growth, tax and liquidity of the industry, while the merged firms performed better than the respective industry in terms of profitability. Saple (2000) also found that the target firms were better than industry averages while the acquiring firm had lower than industry average profitability.

Agrawal and Jaffe (2000) brought out “The Post-merger Performance Puzzle.” They examined the literature on long-run abnormal returns following mergers, and also examined explanations for any findings of underperformance following mergers; they concluded that the evidence does not support the conjecture that underperformance is specifically due to a slow adjustment to merger news, and rejected the earnings-per-share myopia hypothesis, i.e. the hypothesis that the market initially overvalues acquirers if the acquisition increases EPS, ultimately leading to long-run under-performance. The success of merger and acquisitions depends on proper integration of employees, organization culture, IT, products, operations and service of both the companies. Proper integration in mergers plays a critical role in determining how effectively merged organizations are able to integrate business processes and people, and deliver products and services to both internal and external customers of the organization.
Nevertheless, despite the many advantages M&A could offer, the statistical evidence supporting the hypothesis that profitability and efficiency increase following M&A is at best weak (Berkovitch and Narayanan 1993, Jensen and Ruback 1983, Lichtenberg 1992, Mueller 1980, Ravenscraft and Scherer 1987). The problem with most existing studies is that they disregard the issue on how value is created through M&A and hence fail to identify the conditions that should hold for M&A to positively contribute to firm’s performances (Caves 1989).

Some notable and seminal empirical studies show a negative impact of M&A on the financial and economic performance of companies. Vanitha and Selvam (2007) analyzed the pre- and post-merger financial performance of manufacturing sector during 2000-2002; they found that the overall financial performance of merged companies in respect of 13 variables were not significantly different from the expectations. Mantravadi and Reddy (2007, 2008) conducted research to study the impact of M&A on the operating performance of the acquiring corporation in different periods in India, by examining some pre- and post-merger financial ratios with chosen sample firms and mergers between 1991-2003. Their results suggest that there are minor variations in terms of impact on operating performance following merger in different intervals of time in India. Kumar (2009) also examined the post-merger operating performance of a sample of 30 acquiring companies involved in merger activities during 1999-2002 in India; the study attempted to identify synergies, if any, resulting from mergers and found that post-merger profitability, asset turnover and solvency of the acquiring companies, on average, showed no improvement when compared with pre-merger values. Other studies link M&A and R&D (Hall 1990). Hitt et al. (1991) and (1996) find that M&A seem to shift the innovative strategy more towards external sourcing. Szücs (2013) used different matching techniques to construct separate control groups for acquirers and targets to single out the causal effect of mergers on R&D growth and intensity. They found that M&A have a direct significant negative impact on internal R&D inputs, as well as ex-post R&D output compared to competitors.

Despite the goal of performance improvement, results from mergers and acquisition are sometimes disappointing compared with what is predicted or expected. Numerous empirical studies show high failure rates of M&A deals. They develop a comprehensive research framework that bridge different perspectives and promote understanding of factors underlying
M&A performance in business research and scholarship (Straub 2007). As Barnes said, “Although some regions present access to new consumer populations and additional growth opportunities exist in other fast-growing emerging markets, investors are playing it safe by staying on the sidelines to avoid the risks associated with expanding their organizations’ global footprint.” These studies should help managers in the decision making and M&A process.

In this paper, we measure the effect of M&A activities on firm value using an enterprise value multiple as the metric for firm value. We examine whether or not mergers and acquisitions have an impact on firm value; which factors have a significant effect, and how they influence firm value instantaneously and in the long-run. Moreover, an enterprise multiple may vary depending on the industry type. We examine the Communications, Technology, Energy and Utilities sectors, in order to understand the differences in technology-intensive and resource-intensive firms. We use a large sample consisting of global M&A deals for the period between the year of 2000 and 2010, using fixed-effects, dynamic panel regression and treatment effect models including propensity score matching with differences-in-differences.

3. Data and Descriptive Statistics

The sample of firm-level financial data was collected from the Bloomberg database. We looked for the firms worldwide with M&A completed activities during the year of 2000 to 2010, and the deals were both domestic and cross-border. For each deal, we focused on the acquirer firm’s financial fundamental data for a time period of seven years: three-years before the M&A, one-year when M&A takes place and three-years after the M&A takes place thus yielding a balanced panel dataset.

We include five financial fundamental ratios as measurement and controls in the models: enterprise multiple, price to sales ratio, debt to equity ratio, market to book ratio and financial leverage. Enterprise value (EV) is an economic measure reflecting the market value of a whole business. Enterprise value is calculated as market capitalization plus debt (both long-term and short-term), minority interest and preferred shares, minus total cash and cash equivalents. It is

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1 The definitions and interpretations of these variables and a complete list of terms describing M&A activity are available in an Appendix upon request.
more comprehensive than market capitalization, which only includes common equity. Enterprise value differs significantly from simple market capitalization in several ways, and many consider it to be a more accurate representation of a firm's value. One may think of enterprise value as the theoretical takeover price. In the event of a buyout, an acquirer would have to take on the target’s debt, but would pocket its cash. The value of a firm's debt would need to be paid by the buyer when taking over a company, thus EV provides a much more accurate takeover valuation because it includes debt in its value calculation.

Earnings before interest, taxes, depreciation and amortization (EBITDA) is an indicator of a company’s financial performance. It is computed by revenue minus expenses (excluding interest, taxes, depreciation and amortization). EBITDA is essentially net income with interest, taxes, depreciation and amortization added back to it, and can be used to analyze and compare profitability between companies and industries because it eliminates the effects of financing and accounting decisions. Many companies, especially in the technology sector, now commonly quote it. EBITDA gives a good metric to evaluate a business’ current operational profitability, but not cash flow. It also leaves out the cash required to fund working capital and the replacement of old equipment, which can be significant. Although EBITDA is not a financial metric recognized in generally accepted accounting principles, it is widely used when assessing the performance of companies. It is intended to allow a comparison of profitability between different companies, by canceling the effects of interest payments from different forms of financing (by ignoring interest payments), political jurisdictions (by ignoring tax), collections of assets (by ignoring depreciation of assets), and different takeover histories (by ignoring amortization).

A negative EBITDA indicates that a business has fundamental problems with profitability. A positive EBITDA, on the other hand, does not necessarily mean that the business generates cash. This is because EBITDA ignores changes in working capital (usually needed when growing a business), capital expenditures (needed to replace assets that have broken down), taxes, and interest.

Enterprise multiple (EV/EBITDA) is a ratio used to determine the value of a company. It is calculated as enterprise value divided by its earnings. It’s useful for transnational comparisons because it ignores the distorting effects of individual countries' taxation policies. Enterprise
multiples can vary depending on the industry. It’s important to compare the multiple to other companies or to the industry in general. Expect higher enterprise multiples in high growth industries (like biotech) and lower multiples in industries with slow growth (like railways). The EV/EBITDA multiple is a better metric than market capitalization for takeovers. It looks at a firm as a potential acquirer would, and used to find attractive takeover candidates. Compared to other multiples like the P/E, this ratio may be preferred because it is normalized for differences between companies: using EBITDA normalizes for differences in capital structure, taxation and fixed asset accounting; meanwhile, using enterprise value also normalizes for differences in a company's capital structure. A company with a low enterprise multiple might be undervalued, and thus can be viewed as a good takeover candidate.

Broadly speaking, a company's assets are financed by either debt or equity. The weighted average cost of capital (WACC) is the rate that a company is expected to pay on average to all its security holders to finance its assets. The inverse of enterprise multiple, EBITDA/EV, is also a financial ratio that measures a company's return on investment. The company directors can compare their return with how much interest they have to pay for every dollar it finances, then determine the economic feasibility of expansionary opportunities and mergers.

Price to sales ratio (P/S) is a valuation ratio that compares a company’s stock price to its revenues. It is an indicator of the value placed on each dollar of a company’s sales or revenues. This ratio can be calculated either by dividing the company’s market capitalization by its total sales over a 12-month period, or on a per-share basis by dividing the stock price by sales per share for a 12-month period. Like all ratios, the price-to-sales ratio varies greatly from sector to sector, so it is most relevant when used to compare companies within the same sector. A low ratio may indicate possible undervaluation, while a ratio that is significantly above the average may suggest overvaluation.

The smaller this ratio is (i.e. less than 1.0), signals a better investment opportunity since the investor is paying less for each unit of sales. But investors should exercise caution when using price to sales ratios since the numerator, the price of equity, takes a firm's leverage into account, whereas the denominator, sales, does not. Comparing P/S ratios carries the implicit assumption that all firms in the comparison have an identical capital structure. This is always a problematic assumption, and even more so when the assumption is made between industries,
since industries often have vastly different typical capital structures (for example, a technology vs. a utilities company). This is the reason why P/S ratios across industries vary widely.

Debt to equity ratio (D/E) is a measure of a company's financial leverage calculated by dividing its total liabilities by stockholders' equity. It also depends on the industry in which the company operates. For example, capital-intensive industries tend to have a D/E ratio above 2, while technology-intensive companies have a D/E ratio of under 0.5. Debt to equity ratio indicates what proportion of shareholders’ equity and debt a company is using to finance its assets. A high D/E ratio generally means that a company has been aggressive in financing its growth with debt, i.e. the company could potentially generate more earnings than it would have without this outside financing. But this can result in volatile earnings as a result of the additional interest expense. If this were to increase earnings by a greater amount than the debt cost (interest), then the shareholders benefit as more earnings are being spread among the same amount of shareholders. However, the cost of this debt financing may outweigh the return that the company generates on the debt through investment and business activities and become too much for the company to handle. This can lead to bankruptcy, which would leave shareholders with nothing.

Market-to-book ratio (M/B) is a financial ratio used to find the value of a company by comparing the current market value of a firm to its book value. Market value is determined in the stock market through its market capitalization. Book value is calculated by looking at the firm's historical cost, or accounting value. The ratio can be calculated in two ways, either divide the company's market capitalization by its total book value, or use the book value per-share to divide the company's current share price, but the result should be the same in each way. As with most ratios, it varies a fair amount by industry. Industries that require more infrastructure capital (e.g. Utilities firms) will usually trade at P/B ratios much lower than, for example, technology firms.

This ratio attempts to identify overvalued or undervalued securities by taking the market value and dividing it by book value. In basic terms, if the ratio is above 1 then the stock is overvalued; if it is less than 1, the stock is undervalued. A higher M/B ratio implies that investors expect management to create more value from a given set of assets, all else equal. M/B ratios do not, however, directly provide any information on the ability of the firm to generate profits or cash for shareholders.
Financial leverage is the degree to which a company uses fixed-income securities such as debt and preferred equity. The more debt financing a company uses, the higher its financial leverage. A high degree of financial leverage means high interest payments, which negatively affect the company's bottom-line earnings per share. Businesses leverage their operations by using fixed cost inputs when revenues are expected to be variable. An increase in revenue will result in a larger increase in operating income. Financial leverage can be calculated by the ratio of total assets to shareholders’ equity, or equivalent to a ratio of return on equity to return on assets. In corporate finance, operating leverage is an attempt to estimate the percentage change in operating income for a one-percent change in revenue, and financial leverage tries to estimate the percentage change in net income for a one-percent change in operating income; the product of the two is called total leverage and estimates the percentage change in net income for a one-percent change in revenue.

While leverage magnifies profits when the returns from the asset more than offset the costs of borrowing, losses are magnified when the opposite is true. A corporation that borrows too much money might face bankruptcy or default during a business downturn, while a less-levered corporation might survive. So while adding leverage to a given asset always adds risk, it is not the case that a levered company or investment is always riskier than an unlevered one. In fact, many highly levered hedge funds have less return volatility than unlevered bond funds and public utilities with lots of debt are usually less risky stocks than unlevered technology companies. The financial crisis of 2007–2009, like many previous financial crises, was blamed in part on excessive leverage.

3.1 Descriptive statistics

We collect data of firms worldwide from four sectors, e.g. Communication, Technology, Energy and Utilities, who have M&A activities during the year of 2000 to 2010. In Table 3, the total volume of M&A activities per year within these four sectors varied between 4,000 and 9,000 for the first 10 years of 21st century. The cyclical nature of the market and the economy suggests that every strong economic growth bull market in history has been followed by a sluggish low growth bear market. As shown in Figure 1, the trend of the number of M&A deals follows the macroeconomic cycle in general, the largest amount of deals was observed in the year 2000, followed by a fast decline during the trough years of 2001 to 2003. As financial markets turn
better, the number of deals climb from approximately 2004 and kept increasing to another peak in 2007. After the subprime crisis of 2008, the number of deals falls through 2010.

Comparing the four sectors, more M&A deals emerge in the Communications sector followed by the Technology sector and the trend follows the macroeconomic cycle closely. In the resource-intensive industries of Energy and Utilities, we observe less M&A activity, and it does not cycle closely with the market. This is because Communications and other service sectors are most involved in the major change of liberalization in international capital movements and investments. Regulatory reforms in these sectors are playing an important role in the dramatic increase in M&A. Also, the pace of technological change has generated new business and markets. Due to the time and cost constraints, companies may experience difficulties in developing in-house R&D, so they may opt for M&A as a means of acquiring technological and human resources in order to remain internationally competitive. The drastic decline in communications and transportation costs has also been identified as a major factor behind the latest M&A wave.

Our sample includes 65,521 firms with 458,647 observations in total. We analyze the firm’s enterprise multiple EV/EBITDA for a period of seven years and the effect of M&A activities on firm value. To reduce the weight of outliers, we censor the dependent variable, EV/EBITDA, at the 1st and 99th percentiles by setting extreme values to the 1st and 99th percentile values, respectively. The M&A deals which have only one year of data available were also eliminated from the panel. As a result, the unbalanced panel dataset consists of 31,284 M&A deals with 165,660 observations: 67,608 from Communication sector, 46,419 from Technology sector, 30,088 from Energy sector and 21,545 from Utilities sector; the time dimension is evenly distributed in seven years, as listed in Table 4a and 4b.

Besides the EV/EBITDA multiple, several firm financial fundamental ratios are included as control variables, e.g. price to sale ratio (P/S), debt to equity ratio (D/E), market to book ratio (M/B) and financial leverage (FL). The descriptive statistics of raw and trimmed data are summarized in Table 5a and 5b. First, we note that the enterprise value multiple is in the range of 1 to 150 with mean of 18.22 and standard deviation 18.49 and Figure 2 presents the distribution of EV/EBITDA, and by sector. The average P/S ratio is 4.13, the average D/E ratio is 114.51, the average M/B ratio is 3.43 and average FL is 2.69. We also note in Table 6 that the unconditional
correlation between EV/EBITDA and short- and long-term debt is significant at the 5% level, thus we take total debt into account after normalization (zscore). We also present pair-wise correlations between the five control variables; they are not correlated at 1% significant level, except for financial leverage and market to book ratio.

4. Econometric Models and Empirical Results

We present the several econometric models and estimation in the following.

4.1 Panel Fixed Effects and Dynamic Panel Models

First, we estimate two econometric models: panel fixed effects and Arellano and Bond dynamic panel methodology. The panel fixed effects model is given by

$$\frac{EV}{EBITDA_{it}} = \alpha_0 + \beta_1 \frac{P}{S_{it}} + \beta_2 \frac{D}{E_{it}} + \beta_3 \frac{M}{B_{it}} + \beta_4 FL_{it} + \beta_5 ZD_{it} + \delta_i + \epsilon_{it}. \quad (1)$$

We also use the Arellano and Bond dynamic panel estimations since we have a small number of years and a large number of firms, and the dynamic panel model is given by

$$\frac{EV}{EBITDA_{it}} = \alpha_0 + \beta_0 \frac{EV}{EBITDA_{it-1}} + \beta_1 \frac{P}{S_{it}} + \beta_2 \frac{D}{E_{it}} + \beta_3 \frac{M}{B_{it}} + \beta_4 FL_{it} + \beta_5 ZD_{it} + \delta_i + \epsilon_{it}. \quad (2)$$

In the models above, $i$ indexes the firm and $t$ indexes the relative year to the mergers and acquisitions activity. The main hypotheses refer to the signs and magnitudes of the coefficients $\beta_1$ to $\beta_5$. The models are first applied to all observations in the panel dataset, and specifications refer to overall effects on firm valuation. Second, we estimate those regressions for each sector separately and also on every year to capture the effect in specific industry and time periods.

The results of fixed-effect panel regressions are list in Table 7. Column 1 refers to the relationship between firm’s enterprise multiple ($EV/EBITDA$) and its financial fundamental ratios ($P/S$, $D/E$, $M/B$, $FL$ and $ZD$). This regression includes firms in all four sectors. The first main result is that the price to sales ratio and market to book ratio have significant positive effects on enterprise multiple, while debt to equity ratio and financial leverage are statistically insignificant to firm value. An increase of one unit in price to sales ratio and market to book ratio brings up the enterprise multiple on average by 1% and 4%, respectively; because market capitalization is
positive related to EV. Columns 2 to 5 present the regression results for each one of those four sectors, Communication, Technology, Energy and Utilities, to capture the industry type effects. The main results of columns 1 continue to hold. Now, the financial leverage has a significant positive effect on firm value of Communication and Technology companies, while this effect is negative on Energy firms. Also, total debt to equity ratio affects firm values only in Energy and Utilities sectors. An increase of one unit in debt to equity ratio lower the enterprise multiple by 1‰-1%, since short- and long-term debt is negative related to EV.

The dynamic effects come next. Besides all the contemporary financial fundamental ratios list above, we believe that the firms’ current value should be also highly related to their performance in the previous years. We estimate the Arellano and Bond dynamic panel regression including one-lag of EV/EBITDA in the model. As shown in Table 8, the coefficient on EV/EBITDA_{t-1} is highly significant; and it indicates negative autocorrelation. The magnitude is large, about -23% in this dynamic model, indicating potential for overreaction and under-reaction of EV/EBITDA over time. This dynamic effect is well identified in all sectors examined. In column 1 of Table 8, the effects of the independent variables are similar to the fixed-effect model shown in Table 7, which indicates a robust impact of financial ratios on firm value. However, in columns 2 to 5, we find some changes in the result of dynamic panel model for each sector. In the Communications and Technology sectors, the contemporary effect of financial leverage in the dynamic model is not significant as well as the price to sale ratio in the Communications sector. The effect of the market to book ratio is still highly significant, but with lower magnitudes.

Overall, in Table 8 we find consistent and robust evidence that current firm values are much sensitive to the lagged values. The market to book ratio is a robust factor across all sectors, while others are not significant in all cases.

Next, we perform the Arellano and Bond dynamic panel regression for each year. Table 9 presents the regression results in each year of 2000 to 2010. The results show the general case with lagged enterprise multiple and all five controls as before. In the year of 2000 and 2004-2007,

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2 The Wooldridge test for autocorrelation in the panel confirms a first order autocorrelation in enterprise multiple for overall data: Wooldridge test for autocorrelation in panel data; H0: no first order autocorrelation; F(1, 26963) = 1533.254; Prob > F = 0.0000.
we experienced business peaks in the market, during which the total number of M&A activities increased rapidly. From the regression results in Table 9, almost all the financial fundamental ratios (excluding financial leverage) command significant effects on firm value in the year of 2000 and 2004~2007. For example, an increase of one unit in market to book ratio can bring up the enterprise multiple by 39% in the year of 2004, say from 1.00 to 1.39.

As often occurs in a peak-and-trough cycle, growth that takes place in a boom is rarely maintained and backed up by actual company profits. In the year of 2001 to 2003, 2008 and 2009, the dynamic panel model doesn’t identify such significant effect of the control variables on firm values. The price to sale, debt to equity and market to book ratios are only significant at 5% level occasionally at the year of 2001, 2002, 2009 and 2010; while none of them are significant in 2003 and 2008 at all.

From a perspective of year by year, the contemporaneous effect of price to sales, debt to equity and market to book ratios on EV/EBITDA are more likely to be significant in peak years in the 2000s and quantitative larger in magnitude than financial leverage. During trough years, firms operate less efficiently and may even go bankrupt; under pressure of recession, firm value is not highly sensitive to its own financial fundamentals, thus we can hardly estimate the enterprise multiple only by financial ratios. On the other hand, the firm’s current value is always much more sensitive to the lagged value ranging from -11% to -33%; this result is consistent for firms in all company sectors and persistent across years.

4.2. Treatment Effects

We estimate several treatment effects econometric models below. First, we estimate regressions with time dummy variables. We control for time effects on firm values in the period of seven years using a set of time dummy variables:

$$\frac{EV}{EBITDA_{it}} = \alpha + \beta_1 \frac{P}{S_{it}} + \beta_2 \frac{D}{E_{it}} + \beta_3 \frac{M}{B_{it}} + \beta_4 FL_{it} + \beta_5 ZD_{it} + \delta_i + \sum_{t=-3}^{3} dt_{lt} + \epsilon_{lt} \tag{3}$$

where \( i \) indexes the observation and \( dt_{lt} \) is the time dummy defined by relative year (\( dt \)): 
The regression results with time dummy variables are shown in Table 10. We note that the extent of the effect on firm value is different for each year. First, the dummy $dt_0$ is omitted; second, the coefficients of $dt_{-3}$, $dt_{-2}$ and $dt_{-1}$ are positive in most cases; third, the coefficients of $dt_1$, $dt_2$ and $dt_3$ are negative in all cases. This result indicates that the firm value at a specific year highly depends on the period relative to the merger and acquisition activity. We set the value at the year of M&A ($dt=0$) as benchmark; a positive coefficient for $dt_{-3}$, $dt_{-2}$ and $dt_{-1}$ indicates a higher firm value at the year before M&A; a negative coefficient for $dt_1$, $dt_2$ and $dt_3$ indicates a lower firm value at the year after M&A. The regression results for Communication and Technology sectors are consistent with the overall data; but the results for Energy and Utilities sectors are different since we observe negative and insignificant coefficients before the M&A activity. Figure 3 describes the trend of firm value in each of the four sectors over relative years ($dt$). The difference of firm value between pre- and post- M&A can be easily observed, and the year of M&A is the changing point.

Next, we estimate a long-term effect of M&A with time dummies. Each observation contains a valuation outcome of a firm either before or after mergers and acquisitions activity. Hence, M&A can be considered as a treatment to some firms and for those firms that do not receive the M&A treatment can be seen as blank controls. We separate all the observations into two groups: one is the treated group with dummy “treat=1” for all the data after M&A ($dt = 0, 1, 2$ and $3$); the other is the untreated group with dummy “treat=0” for the data before M&A ($dt = -3, -2$ and -1). Table 11 presents the treatment effect results by the regression adjustment method.
First we note that the potential outcome mean is 17.36 for the treated group and 19.05 for the untreated group, thus the average treatment effect is -1.69. The potential outcome mean of EV/EBITDA for firms after M&A is lower than that before the M&A deal, and this difference is statistically significant. Moreover, from the regressions, the P/S, D/E and M/B ratios are highly significant in both groups, a lower magnitude in the treated one; while ZD is significant after M&A but not before, because an acquirer would have to take on the target’s entire debt which is a huge impact on their accounting after M&A.

The results above indicate that EV/EBITDA varies from sector to sector. Higher firm values are expected in high growth industries (like Technology) and lower multiples in industries with slow growth (like Utilities). It's important to compare EV/EBITDA multiple within the same industry in general. Thus, the average treatment effect of M&A on the separate sectors should be also different. Table 12 summarizes the average treatment effect of M&A in each sector separately. Those results are estimated by three different econometric methods: regression adjustment, propensity score matching and nearest neighborhood matching. The ATEs are always significant in Communication and Technology sectors, but insignificant in Energy and Utilities sectors. As shown in Figure 4, the M&A activities in different sectors affect firm values to different extents.

We proceed estimating the instantaneous effect of M&A from the treatment perspective. Besides the discrepancy of firm values pre- and post- mergers and acquisitions activities, another pattern emerges from Figure 4. There is an increase in the middle point on each line of EV/EBITDA. The value gets stimulated at the time when M&A takes place. We design another model to test this hypothesis. Again we separate all the observations into two groups but with different assignments: one is the treated group with dummy “M&A=1” just for the data at the year of M&A (dt = 0); the other is the untreated group with dummy “M&A=0” for all the rest of data at the years with no M&A happening (dt = -3, -2, -1 and 1, 2, 3).

Table 13 presents the treatment effect results using the regression adjustment method. First, we note that the potential outcome mean is 19.06 for treated group and 17.86 for untreated group, thus the average treatment effect is +1.2. The potential outcome mean of EV/EBITDA for firms being experiencing M&A is higher than those having no M&A activity during that year, and this difference is significant. More importantly, this instantaneous effect of M&A activity on
EV/EBITDA is significant on all firms no matter which sector it belongs to. We also note that the greatest increase of 1.6 in the enterprise multiple appears at Communication sector, followed by an increase of 0.8 from Technology and Energy sectors, and a lowest increase 0.6 from the Utilities sector. Therefore, a firm generally has higher EV/EBITDA ratio when M&A takes place.

Finally, we apply the difference-in-difference (DID) method to analyze the data in partitions of two consecutive years. Taking the years of 2000 and 2001 as an example, the experiment is designed as shown in Table 14a. In Table 14b we note that for 2000-2001, the sample includes 10,192 observations, in which 5,849 of them are from the control group (no M&A activity in both year of 2000 and 2001) and other 4,343 are from the treated group (no M&A in year 2000 but M&A in year of 2001).

First, we estimate the DID without covariates. We estimate the regression of firm’s EV/EBITDA with time dummy Year2001, state dummy M&A2001, and composite dummy DiD2001 = Year2001 * M&A2001. This OLS regression analysis is equivalent to estimation with only binary period and treatment variables. The results may be subject to biases, because simple difference estimation proceeds under the assumption that the treatment and control groups are the same in every respect apart from the treatment. However, we cannot guarantee that, in the absence of treatment, the unobserved differences between treatment and control groups are the same over time. Thus, we can specify some pre-treatment covariates of the model as optional controls; and these variables are used to estimate the propensity score. We use the covariates P/S, D/E, M/B, FL and ZD. Table 15a shows the results for 2000-2001 in both cases. In the case of no covariates, the coefficient of DiD2001 is -1.99 with p-value 0.016. This result indicates that the firm’s EV/EBITDA value after M&A is lower than those without M&A activities, and this effect is statistically significant. The DID estimate with covariates (P/S, D/E, M/B, FL and ZD) is -2.037, close to the results above, and also statistically significant. Hence, mergers and acquisitions activities in the year of 2001 lower the firm’s EV/EBITDA.

Tables 15b-15i repeat the analysis above for all pairs of subsequent years up to 2008-2009. The results for M&A in 2002, 2005, 2006 and 2007 shows negative effects on the firm EV/EBITDA for both cases with and without covariates, but the estimates are not statistically significant. In the other years of 2003, 2004 and 2009 the effect of M&A on value is positive but not statistically significant. The key result is the 2007-2008 pair in Table 15h. It shows a highly
statistically significant positive effect of M&A on firms EV/EBITDA of the order of magnitude of 2.409 without covariates and 1.726 with covariates. The importance of this result is that 2008 is the year of the U.S. financial crisis thus providing evidence that in a year of extreme financial stress, M&A provided a source of counter balance in the sense of positive effects on firms EV/EBITDA.

4.3 Discussion

First, from the two treatment experiments above, we find that the long-term effect of M&A activity on firms’ EV/EBITDA is different from the instantaneous effect. The enterprise value ratio multiple is defined as ratio of enterprise value to the earning. In general EV and EBITDA increase over time, but the ratio may go up, down or even stay flat depending on the relative changes. In the long-term treatment effect analysis, ATE on enterprise multiple is negative, which means the ratio EV/EBITDA falls after M&A. While both the numerator and denominator may rise, but the ratio falls, one possible explanation is that EBITDA in the denominator increases faster than EV in the numerator. In other words, during the three years after M&A activity, earnings grow farther than the corresponding enterprise value. This result is valid in technology-related firms, but not in energy-related companies.

From the perspective of high-tech business, the motivation of mergers and acquisitions are clear, to seek innovation in technology and acquire intellectual property. Acquirer firms could apply the new technology immediately and become more productive resulting in the raise of total revenue and profit in a short time period. Concurrently, firms are not required to largely expand total assets and market capitalization. Thus, the increase of enterprise value could be less than that of firm’s earnings during the three years after the M&A deal, which results in a fall of EV/EBITDA. Also, a lower EV/EBITDA means the firm is more valuable. Therefore, M&A is good for technology-intensive companies because of the enhancement in firms’ development.

However, Energy and Utilities firms show a different pattern. The main incentive for M&A in those sectors should be tangible advantage. Firms get geographic expansion and occupy more resources after a deal, especially in a cross-border deal. Firm’s earnings increase at the same pace as enterprise value or even slower, thus the EV/EBITDA ratio fluctuates much less during the post-merger three-year period. The payoff from M&A may take longer than three
years in resource-intensive firms. Therefore, the EV/EBITDA of Energy and Utilities sector does not dramatically change during that period.

In the instantaneous treatment effect analysis, ATE on EV/EBITDA is positive, which means the ratio of EV/EBITDA goes up at the time when mergers and acquisitions take place. While both the numerator and denominator raise up so does the ratio, and we conjecture instantaneously the EV in the numerator increases more than EBITDA in the denominator. In other words, enterprise value grows faster than firm’s earning in the year of M&A. When a deal is announced or completed, the acquirer expects greater gains from the combination or reconstruction as well as shareholders expect a profitable outcome. The stock price becomes very sensitive and responds fast, e.g. the first 7-day change or first 30-day change is much higher than normal. Thus, enterprise value has an upward tick at the moment of the M&A. But firm’s earnings cannot respond as quickly as the stock market, it responds in a much slower fashion. Therefore, we observe stimulation on EV/EBITDA ratio just at the year of the M&A, and firm value temporarily goes up. This instantaneous effect is significant, in general, on all four company sectors.

Finally, the DID estimations for the sequence of two consecutive years shows a significant negative effect of M&A activity on firm value in 2001 relative to 2000. However, it shows a strong positive effect of M&A activity in 2008 relative to 2007. The other years are not statistically significant. This is an important finding because relative to 2000, 2001 is a recession year and relative to 2007, 2008 represents the impact of the financial crisis. We show that in the universe of M&A activity, the financial crisis had a distinct positive impact on the value of firms through M&A relative to the recession of 2001.

5. Conclusions

We provide extensive empirical evidence of mergers and acquisitions (M&A) effects on firm value using a variety of econometric models and design. We use a large sample of 65,000 firms from the sectors of Communications, Technology, Energy and Utilities. It includes worldwide M&A deals during the years of 2000 to 2010.
We use an enterprise value multiple, the ratio of EV/EBITDA, as a measure of firm value, and other financial fundamental ratios as controls, specifically price to sale ratio, debt to equity ratio, market to book ratio and financial leverage. The small time and large cross-sectional dimensions make the Arellano-Bond dynamic panel methodology appropriate. Our first result shows consistent and robust evidence that market to book ratios provide a significant positive effect on enterprise multiple across the universe of firms in all four company sectors. Price to sale ratio has the similar effect but only significant in some cases. In the case of leverage, the debt to equity ratio has a significant negative impact on EV/EBITDA in Energy and Utilities sectors. A lower market-to-book ratio and a higher debt-to-equity ratio decrease the EV/EBITDA ratio indicating an undervalued firm. However, financial leverage is not consistent in all cases.

From a perspective of time, our evidence on firm value shows that the contemporaneous effect of price to sales, debt to equity and market to book ratios are significant and larger in magnitude in peak years of the business cycle. However, we do not find a significant impact from financial leverage for this set of firms. During trough years, those financial fundamental ratios are not good predictors of firm value. In addition, the firm current values are sensitive to lagged values indicating potential for over and under reaction of firm value.

The evidence from treatment effects shows that long-term and instantaneous effects on the EV/EBITDA are much different. In the long-term, three years pre- and post- the deal, M&A gives a net decrease in EV/EBITDA. This is because of a potential higher increase in firm’s earnings relative to enterprise value in the longer horizon. The time effects are significant in technology-intensive firms while not in resource-intensive firms. By contrast, the instantaneous effect of M&A on firm value is more uniform in all four sectors. The firm value gets an instantaneous increase at the time of the M&A deal, since the EV via the stock market moves much faster in response to the M&A activity while the enhancement in firms’ earnings is slow moving.

The difference-in-difference (DID) with propensity score matching estimations for the sequence of two consecutive years shows a significant negative effect of M&A activity on firm value in 2001 relative to 2000. However, it shows a strong positive effect of M&A activity in 2008 relative to 2007 and the other years are not statistically significant. We find this to be an important result because relative to 2000, 2001 is a recession year and relative to 2007, 2008
represents the impact of the financial crisis. We show that in the universe of M&A activity, the financial crisis had a distinct positive impact on the value of firms through M&A relative to the recession of 2001.

We only included the firm-level M&A effects in this work. A fruitful avenue for future research would be to expand a longer time period pre- and post- M&A, add market characteristic information at each year, include the original countries of acquirer and target and specify cash or stock financing method and horizontal or vertical deal structure, to better understand the trends and other potential effects of mergers and acquisitions on firm values.


Schulz, N. (2007), "Review of the literature on the impact of mergers on innovation".


SzüCs, F. (2013), "M&A and R&D: Asymmetric Effects on Acquirers and Targets?".


<table>
<thead>
<tr>
<th>Rank</th>
<th>Year</th>
<th>Acquirer</th>
<th>Target</th>
<th>Transaction value (in billion USD)</th>
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<tbody>
<tr>
<td>1</td>
<td>2000</td>
<td>AOL Inc. (America Online)</td>
<td>Time Warner</td>
<td>164.75</td>
</tr>
<tr>
<td>2</td>
<td>2000</td>
<td>Glaxo Wellcome Plc.</td>
<td>SmithKline Beecham Plc.</td>
<td>75.96</td>
</tr>
<tr>
<td>3</td>
<td>2004</td>
<td>Royal Dutch Petroleum Company</td>
<td>Shell Transport &amp; Trading Co.</td>
<td>74.56</td>
</tr>
<tr>
<td>4</td>
<td>2006</td>
<td>AT&amp;T Inc</td>
<td>BellSouth Corporation</td>
<td>72.67</td>
</tr>
<tr>
<td>5</td>
<td>2001</td>
<td>Comcast Corporation</td>
<td>AT&amp;T Broadband</td>
<td>72.04</td>
</tr>
<tr>
<td>6</td>
<td>2009</td>
<td>Pfizer Inc.</td>
<td>Wyeth</td>
<td>68</td>
</tr>
<tr>
<td>7</td>
<td>2000</td>
<td>Nortel Networks Corporation</td>
<td></td>
<td>59.97</td>
</tr>
<tr>
<td>8</td>
<td>2002</td>
<td>Pfizer Inc.</td>
<td>Pharmacia Corporation</td>
<td>59.52</td>
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<tr>
<td>9</td>
<td>2004</td>
<td>JPMorgan Chase &amp; Co</td>
<td>Bank One Corporation</td>
<td>58.76</td>
</tr>
<tr>
<td>10</td>
<td>2008</td>
<td>InBey Inc.</td>
<td>Anheuser-Busch Companies, Inc.</td>
<td>52</td>
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<tr>
<td></td>
<td>2014</td>
<td>Comcast Corporation</td>
<td>Time Warner Cable</td>
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</tr>
<tr>
<td>2</td>
<td>2012</td>
<td>Deutsche Telekom</td>
<td>MetroPCS</td>
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<tr>
<td>3</td>
<td>2013</td>
<td>Berkshire Hathaway</td>
<td>H. J. Heinz Company</td>
<td>28</td>
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<tr>
<td>4</td>
<td>2013</td>
<td>Softbank</td>
<td>Sprint Corporation</td>
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</tr>
<tr>
<td>5</td>
<td>2014</td>
<td>Facebook</td>
<td>WhatsApp</td>
<td>19</td>
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<tr>
<td>6</td>
<td>2011</td>
<td>Google</td>
<td>Motorola Mobility</td>
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<tr>
<td>7</td>
<td>2011</td>
<td>Berkshire Hathaway</td>
<td>Lubrizol</td>
<td>9.22</td>
</tr>
<tr>
<td>8</td>
<td>2011</td>
<td>Microsoft Corporation</td>
<td>Skype</td>
<td>8.5</td>
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Table 2. Company sectors classification

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<tr>
<th>Company Sectors</th>
<th>COMMUNICATIONS</th>
<th>ENERGY</th>
<th>TECHNOLOGY</th>
<th>UTILITIES</th>
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<tr>
<td>Sub-sectors</td>
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<td>Computers</td>
<td>Electric</td>
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<td>Internet</td>
<td>Energy-Alternte Sources</td>
<td>Office/Business Equip</td>
<td>Gas</td>
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<td>Media</td>
<td>Oil &amp; Gas</td>
<td>Semiconductors</td>
<td>Water</td>
<td></td>
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<tr>
<td>Telecommunications</td>
<td>Oil &amp; Gas Services</td>
<td>Software</td>
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<td>Pipelines</td>
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<tr>
<td>Year</td>
<td>Communication</td>
<td>Technology</td>
<td>Energy</td>
<td>Utilities</td>
</tr>
<tr>
<td>------</td>
<td>---------------</td>
<td>------------</td>
<td>--------</td>
<td>-----------</td>
</tr>
<tr>
<td>2000</td>
<td>4583</td>
<td>2421</td>
<td>1046</td>
<td>538</td>
</tr>
<tr>
<td>2001</td>
<td>3109</td>
<td>1718</td>
<td>973</td>
<td>471</td>
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<tr>
<td>2002</td>
<td>2115</td>
<td>1320</td>
<td>780</td>
<td>417</td>
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<tr>
<td>2003</td>
<td>1809</td>
<td>1312</td>
<td>887</td>
<td>345</td>
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<tr>
<td>2004</td>
<td>2333</td>
<td>1437</td>
<td>1051</td>
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<td>2005</td>
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<td>1203</td>
<td>404</td>
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<td>2006</td>
<td>2928</td>
<td>1821</td>
<td>1345</td>
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<td>2007</td>
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<td>2009</td>
<td>1907</td>
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<td>1264</td>
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<tr>
<td>2010</td>
<td>2160</td>
<td>1525</td>
<td>1392</td>
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<tr>
<td>Sum</td>
<td>29075</td>
<td>18145</td>
<td>13086</td>
<td>5215</td>
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Table 4a. Data distribution in sectors

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<tr>
<th>Sector</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Total</th>
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<td></td>
<td></td>
<td>67,608</td>
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<tr>
<td>Energy</td>
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<td>30,088</td>
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<td></td>
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<tr>
<td>Technology</td>
<td></td>
<td></td>
<td>46,419</td>
<td></td>
<td>46,419</td>
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<tr>
<td>Utilities</td>
<td></td>
<td></td>
<td></td>
<td>21,545</td>
<td>21,545</td>
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<tr>
<td>Total</td>
<td>67,608</td>
<td>30,088</td>
<td>46,419</td>
<td>21,545</td>
<td>165,660</td>
</tr>
<tr>
<td>Dt</td>
<td>Frequency</td>
<td>Percent</td>
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<td></td>
<td></td>
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<tr>
<td>-3</td>
<td>18,573</td>
<td>11.21</td>
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<tr>
<td>-2</td>
<td>21,123</td>
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<td>23,865</td>
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<td>24,144</td>
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<td>Total</td>
<td>165,660</td>
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Note: Dt refers to the timing of the M&A deal, where 0 is the year the deal takes place.
Table 5a. Descriptive statistics of original data

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<tr>
<th>Variable</th>
<th>Observation</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
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<tbody>
<tr>
<td>enterprise multiple (EV/EBITDA)</td>
<td>172736</td>
<td>45.48</td>
<td>809.79</td>
<td>0</td>
<td>1.05E+05</td>
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<td>enterprise value (EV)</td>
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<td>2.91E+05</td>
<td>4.13E+06</td>
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<td>Earnings</td>
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<td>2.52E+04</td>
<td>5.00E+05</td>
<td>-3.59E+06</td>
<td>2.88E+07</td>
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<td>market capitalization</td>
<td>300847</td>
<td>2.24E+05</td>
<td>3.71E+06</td>
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<td>2.24E+08</td>
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<tr>
<td>total debt</td>
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<td>5.44E+04</td>
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<td>market to book value</td>
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<td>3.00</td>
<td>156.42</td>
<td>-1.02E+04</td>
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### Table 5b. Descriptive statistics of trimmed data

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<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
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<td>enterprise multiple (EV/EBITDA)</td>
<td>165660</td>
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<td>18.49</td>
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<td>5.20E+06</td>
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<tr>
<td>Earning market capitalization</td>
<td>153959</td>
<td>3.43E+04</td>
<td>5.91E+05</td>
<td>-3.59E+06</td>
<td>2.88E+07</td>
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<tr>
<td>total debt</td>
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<td>4.94E+06</td>
<td>0.0012</td>
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<td>debt to equity</td>
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### Table 6. Pairwise correlations

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<th>market capitalization</th>
<th>total debt</th>
<th>price to sale</th>
<th>debt to equity</th>
<th>market to book value</th>
<th>financial leverage</th>
<th>zscore debt</th>
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<td>0.9138*</td>
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<td>0.6662*</td>
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<td>0.5977*</td>
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<tr>
<td>market to book value</td>
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<td>0.5586</td>
<td>0.5471</td>
<td>0.7341</td>
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<td>0.7780</td>
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* p<0.01
Figure 1. M&A deal volume by sector and year
Figure 2. Distribution of EV/EBITDA
Table 7. Fixed-effect panel regression results overall and by sector

<table>
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<tr>
<th>enterprise multiple</th>
<th>Coef. (Std. Err)</th>
<th>Coef. (Std. Err)</th>
<th>Coef. (Std. Err)</th>
<th>Coef. (Std. Err)</th>
<th>Coef. (Std. Err)</th>
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</thead>
<tbody>
<tr>
<td>price to sale</td>
<td>0.0079 **</td>
<td>0.0059 **</td>
<td>0.1929 **</td>
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<td>(0.0022)</td>
<td>(0.0694)</td>
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<td>(0.0292)</td>
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<td>0.0008</td>
<td>-0.0127 ***</td>
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<td>(0.0002)</td>
<td>(0.0006)</td>
<td>(0.0023)</td>
</tr>
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<td>market to book</td>
<td>0.0392 ***</td>
<td>0.0333 ***</td>
<td>0.1702 ***</td>
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<td>-0.0029 ***</td>
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<td>(0.0005)</td>
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* P<0.05, ** p<0.01, *** p<0.001
Table 8. Dynamic panel regression results overall and by sector

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<th></th>
<th>Over all</th>
<th>Communication</th>
<th>Energy</th>
<th>Technology</th>
<th>Utilities</th>
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<tbody>
<tr>
<td>enterprise multiple t-1</td>
<td>-0.2297 ***</td>
<td>-0.1302 ***</td>
<td>-0.3221 ***</td>
<td>-0.2287 ***</td>
<td>-0.3771 ***</td>
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<td>0.3438 **</td>
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<td>(0.0007)</td>
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* P<0.05, ** p<0.01, *** p<0.001
### Table 9. Panel regression results by year

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<td>Coef. (Std. Err)</td>
<td>Coef. (Std. Err)</td>
<td>Coef. (Std. Err)</td>
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<tr>
<td>enterprise multiple t-1</td>
<td>-0.1255 ***</td>
<td>-0.1374 ***</td>
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<td>(0.0289)</td>
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<td>(0.0014)</td>
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<td>-0.0130 **</td>
<td>-0.0014</td>
<td>-0.0115 ***</td>
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* P<0.05, ** p<0.01, *** p<0.001
Table 9. Panel regression results by year (continued)

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<td>Coef. (Std. Err)</td>
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<td>Coef. (Std. Err)</td>
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<td>(0.0166)</td>
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<td>price to sale</td>
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<td>1.5037 *</td>
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<tr>
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<td>-0.0011 ***</td>
<td>-0.0014</td>
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<td>0.0011 *</td>
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<td>0.0000</td>
<td>0.0000</td>
<td>(0.0005)</td>
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<td>market to book</td>
<td>0.0697***</td>
<td>0.1174 ***</td>
<td>0.2465 *</td>
<td>0.0233</td>
<td>0.1092 **</td>
<td>0.2292 *</td>
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<td>(0.0132)</td>
<td>(0.0398)</td>
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<td>(0.0447)</td>
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<td>(0.0277)</td>
<td>(0.0097)</td>
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* P<0.05, ** p<0.01, *** p<0.001
Table 10. Regression results with time dummy variables

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<tr>
<th>enterprise multiple</th>
<th>Over all Coefficient</th>
<th>Communication Coefficient</th>
<th>Energy Coefficient</th>
<th>Technology Coefficient</th>
<th>Utilities Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>price to sale</td>
<td>0.0075 **</td>
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<td>0.0000</td>
<td>-0.0011 ***</td>
<td>0.0015 **</td>
<td>-0.0123 ***</td>
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<tr>
<td>market to book</td>
<td>0.0343 ***</td>
<td>0.0265 ***</td>
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<td>0.0191</td>
<td>1.1131 ***</td>
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<tr>
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<td>0.0022</td>
<td>0.0048 ***</td>
<td>-0.0028 ***</td>
<td>0.0178 ***</td>
<td>0.1031 *</td>
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<tr>
<td>zscore debt</td>
<td>0.3704 **</td>
<td>0.0594</td>
<td>0.0191</td>
<td>0.7482 ***</td>
<td>0.8881 **</td>
</tr>
<tr>
<td>dt₃</td>
<td>1.3387 ***</td>
<td>1.8517 ***</td>
<td>0.5813</td>
<td>1.7828 ***</td>
<td>-1.0803 ***</td>
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<tr>
<td>dt₂</td>
<td>0.6347 ***</td>
<td>1.0444 ***</td>
<td>0.0558</td>
<td>0.6496 *</td>
<td>-0.5282</td>
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<tr>
<td>dt₁</td>
<td>0.7918 ***</td>
<td>1.4685 ***</td>
<td>-0.1248</td>
<td>0.2642</td>
<td>0.0635</td>
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<tr>
<td>dt₁</td>
<td>-1.6421 ***</td>
<td>-2.4170 ***</td>
<td>-1.0938 ***</td>
<td>-1.0953 ***</td>
<td>-0.1281</td>
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<tr>
<td>dt₂</td>
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<td>-3.7622 ***</td>
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<td>dt₃</td>
<td>-3.3057 ***</td>
<td>-4.7374 ***</td>
<td>-1.4874 ***</td>
<td>-2.6108 ***</td>
<td>-1.0557 **</td>
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<td>0.0171</td>
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<td>61972</td>
<td>28101</td>
<td>42964</td>
<td>20219</td>
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</table>

* P<0.05, ** p<0.01, *** p<0.001
Negative value of dt coefficient is marked in red.
Table 11. Long-term treatment effect of M&A

| enterprise multiple | Coefficient | Robust Std. Err. | Z     | P>|z|   | [95% Confidence Interval] |
|---------------------|-------------|-----------------|-------|-------|--------------------------|
| ATE treat           | -1.6920     | 0.0978          | -17.31| 0     | -1.8836 -1.5004          |
| (1 vs 0)            | -1.6534     | 0.1014          | -16.30| 0     | -1.8522 -1.4546          |
| ATET treat          | -1.6920     | 0.0978          | -17.31| 0     | -1.8836 -1.5004          |
| (1 vs 0)            | -1.6534     | 0.1014          | -16.30| 0     | -1.8522 -1.4546          |
| PO Means treat      | 17.3646     | 0.0585          | 296.60| 0     | 17.2499 17.4794          |
| 1                   | 17.3646     | 0.0585          | 296.60| 0     | 17.2499 17.4794          |
| 0                   | 19.0566     | 0.0784          | 242.96| 0     | 18.9029 19.2104          |

<table>
<thead>
<tr>
<th>Regression</th>
<th>Treated group</th>
<th>Untreated group</th>
</tr>
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<td>Coefficient</td>
<td>Robust Std. Err.</td>
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<tr>
<td>debt to equity</td>
<td>0.0000</td>
<td>0.0000</td>
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<tr>
<td>market to book</td>
<td>0.0325</td>
<td>0.0110</td>
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<td>financial leverage</td>
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<td>0.0010</td>
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<td>zscore debt</td>
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<tr>
<td>Constant</td>
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<td>0.0661</td>
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* P<0.05, ** p<0.01, *** p<0.001
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<th>Over all</th>
<th>Communication</th>
<th>Technology</th>
<th>Energy</th>
<th>Utility</th>
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<td>Coef. (Std. Err)</td>
<td>Coef. (Std. Err)</td>
<td>Coef. (Std. Err)</td>
<td>Coef. (Std. Err)</td>
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<td>-2.4118 ***</td>
<td>-1.6015 ***</td>
<td>-0.2232</td>
<td>-0.0887</td>
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<td>(0.1583)</td>
<td>(0.2145)</td>
<td>(0.2112)</td>
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<td>N/A</td>
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<td>(0.1943)</td>
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<td>-0.4720 ***</td>
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<td>(0.1243)</td>
<td>(0.2003)</td>
<td>(0.1695)</td>
<td>(0.1447)</td>
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* P<0.05, ** p<0.01, *** p<0.001
**Table 13. Instantaneous treatment effect of M&A**

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<th>enterprise multiple</th>
<th>Over all Coef. (Std. Err)</th>
<th>Communication Coef. (Std. Err)</th>
<th>Energy Coef. (Std. Err)</th>
<th>Technology Coef. (Std. Err)</th>
<th>Utilities Coef. (Std. Err)</th>
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<td>Coef. (Std. Err)</td>
<td>Coef. (Std. Err)</td>
<td>Coef. (Std. Err)</td>
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<td>ATE</td>
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<td></td>
<td></td>
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<td>M&amp;A</td>
<td>1.1999 ***</td>
<td>1.6885 ***</td>
<td>0.8610 ***</td>
<td>0.8156 ***</td>
<td>0.6176 **</td>
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<tr>
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<td>(0.1321)</td>
<td>(0.2137)</td>
<td>(0.2889)</td>
<td>(0.2486)</td>
<td>(0.2758)</td>
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<td>ATET</td>
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<td></td>
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<tr>
<td>M&amp;A</td>
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<td>0.8060 ***</td>
<td>0.6428 **</td>
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<tr>
<td>(1 vs 0)</td>
<td>(0.1321)</td>
<td>(0.2137)</td>
<td>(0.2989)</td>
<td>(0.2529)</td>
<td>(0.2758)</td>
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<tr>
<td>PO Mean</td>
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</tr>
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<td>M&amp;A</td>
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<td>17.9680 ***</td>
<td>16.7194 ***</td>
<td>18.9371 ***</td>
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<td>(0.1130)</td>
<td>(0.1032)</td>
<td>(0.1079)</td>
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<td>19.0610 ***</td>
<td>19.6564 ***</td>
<td>17.5804 ***</td>
<td>19.7*527 ***</td>
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<td>(0.1223)</td>
<td>(0.1984)</td>
<td>(0.2692)</td>
<td>(0.2302)</td>
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<td>(0.0029)</td>
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<td>0.0426 ***</td>
<td>0.1233 ***</td>
<td>0.0295 *</td>
<td>0.5107 ***</td>
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45
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<td>0.0000</td>
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<td>(0.0015)</td>
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<tr>
<td>debt to equity</td>
<td>(0.0014)</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>(0.0004)</td>
<td>***</td>
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<tr>
<td>market to book</td>
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<td>0.0923 ***</td>
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<td>(0.0433)</td>
<td>(0.0355)</td>
</tr>
<tr>
<td>financial leverage</td>
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<td>(0.0041)</td>
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<td>zscore debt</td>
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<td>(0.5552) ***</td>
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<td>(0.1397)</td>
<td>(0.0475)</td>
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<td>19.4929 ***</td>
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<td>(0.1561)</td>
<td>(0.2102)</td>
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* P<0.05, ** p<0.01, *** p<0.001
### Table 14a: DID design

<table>
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<th>Year 2000</th>
<th>Control group</th>
<th>M&amp;A treated group</th>
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<tr>
<td>Deal at 2002, (dt=-2)</td>
<td>Deal at 2001, (dt=-1)</td>
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<td>Deal at 2003, (dt=-3)</td>
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<table>
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<th>Year 2001</th>
<th>Control group</th>
<th>M&amp;A treated group</th>
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<tr>
<td>(no M&amp;A in 2001)</td>
<td>(with M&amp;A in 2001)</td>
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</tr>
<tr>
<td>Deal at 2002, (dt=-1)</td>
<td>Deal at 2001, (dt=0)</td>
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<td>Deal at 2003, (dt=-2)</td>
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### Table 14b: Data sample for DID

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<tr>
<th>Year</th>
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### Table 14a. Difference-in-differences estimations - 2001

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Control</th>
<th>Treated</th>
<th>Diff(BL)</th>
<th>Control</th>
<th>Treated</th>
<th>Diff(FU)</th>
<th>DIFF-IN-DIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV/EBITDA</td>
<td>22.143</td>
<td>23.683</td>
<td>1.539</td>
<td>21.433</td>
<td>20.983</td>
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<td>Std. Error</td>
<td>0.391</td>
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<td>18.43</td>
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<th>Outcome Variable</th>
<th>Control</th>
<th>Treated</th>
<th>Diff(BL)</th>
<th>Control</th>
<th>Treated</th>
<th>Diff(FU)</th>
<th>DIFF-IN-DIFF</th>
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<tr>
<td>EV/EBITDA</td>
<td>21.964</td>
<td>23.607</td>
<td>1.643</td>
<td>21.404</td>
<td>21.01</td>
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<td>Std. Error</td>
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<td>0</td>
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* P<0.05, ** p<0.01, *** p<0.001
### Table 15b. Difference-in-differences estimations - 2002

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<tr>
<th>Outcome Variable</th>
<th>2002 Baseline</th>
<th>2002 Follow-Up</th>
<th>DIFF-IN-DIFF</th>
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<tbody>
<tr>
<td>EV/EBITDA</td>
<td>Control</td>
<td>Treated</td>
<td>Diff(BL)</td>
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<td>23.46</td>
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<td>0</td>
<td>0.025**</td>
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<table>
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<th>2002 Follow-Up</th>
<th>DIFF-IN-DIFF</th>
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<tr>
<td>EV/EBITDA</td>
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<td>Treated</td>
<td>Diff(BL)</td>
<td>Control</td>
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* P<0.05, ** p<0.01, *** p<0.001
### Table 15c. Difference-in-differences estimations - 2003

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<tr>
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<td>Treated</td>
<td>Diff(BL)</td>
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<td>EV/EBITDA</td>
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<tr>
<td>P&gt;</td>
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<td>Treated</td>
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</tr>
<tr>
<td>T</td>
<td>50.07</td>
<td>18.24</td>
</tr>
<tr>
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<td>t</td>
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</tr>
</tbody>
</table>

* P<0.05, ** p<0.01, *** p<0.001
### Table 15d. Difference-in-differences estimations - 2004

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>2004</th>
<th></th>
<th></th>
<th>Number of observations: 12527</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV/EBITDA</td>
<td>18.71</td>
<td>18.796</td>
<td>0.086</td>
<td>Control</td>
</tr>
<tr>
<td>Std. Error</td>
<td>0.278</td>
<td>0.4</td>
<td>0.487</td>
<td>18.426</td>
</tr>
<tr>
<td>T</td>
<td>67.34</td>
<td>18.93</td>
<td>0.18</td>
<td>17.61</td>
</tr>
<tr>
<td>P&gt;</td>
<td>t</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
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#### Diff-in-Diff accounting for covariates

<table>
<thead>
<tr>
<th>Outcome</th>
<th>2004</th>
<th></th>
<th></th>
<th>Number of observations: 11916</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV/EBITDA</td>
<td>18.858</td>
<td>18.874</td>
<td>0.016</td>
<td>Control</td>
</tr>
<tr>
<td>Std. Error</td>
<td>0.286</td>
<td>0.407</td>
<td>0.489</td>
<td>0.27</td>
</tr>
<tr>
<td>T</td>
<td>65.91</td>
<td>18.9</td>
<td>0.03</td>
<td>16.96</td>
</tr>
<tr>
<td>P&gt;</td>
<td>t</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* P<0.05, ** p<0.01, *** p<0.001
### Table 15e. Difference-in-differences estimations - 2005

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>2005</th>
<th>DIFF-IN-DIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Treated</td>
</tr>
<tr>
<td>EV/EBITDA</td>
<td>18.394</td>
<td>18.52</td>
</tr>
<tr>
<td>Std. Error</td>
<td>0.252</td>
<td>0.372</td>
</tr>
<tr>
<td>T</td>
<td>72.91</td>
<td>18.73</td>
</tr>
<tr>
<td>P&gt;</td>
<td>t</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Diff-in-Diff accounting for covariates</th>
<th>DIFF-IN-DIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Treated</td>
</tr>
<tr>
<td>EV/EBITDA</td>
<td>17.638</td>
<td>17.84</td>
</tr>
<tr>
<td>Std. Error</td>
<td>0.255</td>
<td>0.374</td>
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<td>T</td>
<td>69.05</td>
<td>18.18</td>
</tr>
<tr>
<td>P&gt;</td>
<td>t</td>
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</tr>
</tbody>
</table>

* P<0.05, ** p<0.01, *** p<0.001
Table 15f. Difference-in-differences estimations - 2006

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>2006</th>
<th>Diff-in-Diff accounting for covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Treated</td>
</tr>
<tr>
<td>EV/EBITDA</td>
<td>17.381</td>
<td>18.557</td>
</tr>
<tr>
<td>Std. Error</td>
<td>0.247</td>
<td>0.339</td>
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<tr>
<td>T</td>
<td>70.49</td>
<td>20.85</td>
</tr>
<tr>
<td>P&gt;</td>
<td>t</td>
<td></td>
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<table>
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<tr>
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<th>2006</th>
<th>Diff-in-Diff accounting for covariates</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Treated</td>
</tr>
<tr>
<td>EV/EBITDA</td>
<td>16.686</td>
<td>17.811</td>
</tr>
<tr>
<td>Std. Error</td>
<td>0.249</td>
<td>0.342</td>
</tr>
<tr>
<td>T</td>
<td>66.96</td>
<td>19.97</td>
</tr>
<tr>
<td>P&gt;</td>
<td>t</td>
<td></td>
</tr>
</tbody>
</table>

* P<0.05, ** p<0.01, *** p<0.001
Table 15g. Difference-in-differences estimations - 2007

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Single Diff-in-Diff</th>
<th>2007</th>
<th>Number of observations: 15103</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Treated</td>
<td>Diff(BL)</td>
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<tr>
<td>EV/EBITDA</td>
<td>18.62</td>
<td>19.263</td>
<td>0.643</td>
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<td>Std. Error</td>
<td>0.303</td>
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<tr>
<td>T</td>
<td>61.51</td>
<td>20.43</td>
<td>1.38</td>
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<tr>
<td>P&gt;</td>
<td>t</td>
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</table>

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Treated</td>
<td>Diff(BL)</td>
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<tr>
<td>EV/EBITDA</td>
<td>18.181</td>
<td>19.005</td>
<td>0.824</td>
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<td>Std. Error</td>
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<td>T</td>
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<td>20.47</td>
<td>1.76</td>
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<tr>
<td>P&gt;</td>
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</tbody>
</table>

* P<0.05, ** p<0.01, *** p<0.001
### Table 15h. Difference-in-differences estimations - 2008

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Single Diff-in-Diff</th>
<th>2008</th>
<th>Diff-in-Diff accounting for covariates</th>
<th>DIFF-IN-DIFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV/EBITDA</td>
<td>Control</td>
<td>Treated</td>
<td>Diff(BL)</td>
<td>Control</td>
</tr>
<tr>
<td></td>
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*P<0.05, **p<0.01, ***p<0.001
Table 15i. Difference-in-differences estimations - 2009

<table>
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<tr>
<th>Outcome Variable</th>
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<tbody>
<tr>
<td></td>
<td>Base Line</td>
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<td>Follow Up</td>
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<tr>
<td></td>
<td>Control</td>
<td>Treated</td>
<td>Diff(BL)</td>
<td>Control</td>
</tr>
<tr>
<td>EV/EBITDA</td>
<td>12.97</td>
<td>13.718</td>
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<td>16.682</td>
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<td>Std. Error</td>
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<td>0.532</td>
<td>0.354</td>
</tr>
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<td>14.9</td>
<td>1.41</td>
<td>23.45</td>
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<td>P&gt;</td>
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Diff-in-Diff accounting for covariates

<table>
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<th>Outcome</th>
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<th>Number of observations: 8145</th>
</tr>
</thead>
<tbody>
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<td>Base Line</td>
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<td></td>
<td>Follow Up</td>
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<tr>
<td></td>
<td>Control</td>
<td>Treated</td>
<td>Diff(BL)</td>
<td>Control</td>
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<td>0</td>
</tr>
</tbody>
</table>

* P<0.05, ** p<0.01, *** p<0.001
Figure 3. Trend of enterprise multiple by sector
Figure 4. Enterprise multiple of pre- and post-M&A by sector