

Mergers & Acquisitions and the Valuation of Firms

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*This thesis is dedicated to my husband Jie Li,
for his love, endless support and trust in me.*

Abstract

Mergers and acquisitions are among the most visible and important phenomena of modern economies worldwide. The great development of information and high technology pushed global M&A activities to hit highest level of the history in both aspects of total deal volume and signal deal value. Firms engaging in M&A pursue economic growth or positive value in every facet of the organization.

This work focuses on the trend of firm value with M&A activities. We use enterprise multiple, EV/EBITDA ratio, as measure of firm value and some other financial fundamental ratios as the controls, like price to sale ratio, debt to equity ratio, market to book ratio and financial leverage. We conduct empirical research using a large dataset of 65,000 M&A deals globally from Communication, Technology, Energy and Utility sectors between the years of 2000 to 2010. The econometric models applied to this work are fixed-effect panel regression, Arellano-Bond dynamic panel methodology and treatment effect analysis with propensity score matching, nearest neighborhood matching and regression adjustment. We present the significant contemporaneous effects of the financial fundamental ratios on enterprise multiple, and provide the evidences for long-term and instantaneous impact on firm values pre- and post- M&A activities. The magnitude and significance level of these effects vary cross different company sectors and over different time period.

Keywords: Mergers and acquisitions (M&A), firm value, EV/EBITDA, treatment effect

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Chapter 1

Introduction

1.1 Background

Mergers and acquisitions (abbreviated M&A) is a general term used to refer to the consolidation of companies. It is an aspect of corporate strategy, corporate finance and management dealing with the buying, selling dividing 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 child entity or using a joint venture. The distinction between a merger and an acquisition has become increasingly blurred. 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 the two entities.

Mergers and acquisitions coincide historically with the existence of companies back to the year 1708. The economic history has been divided into six waves based on the M&A activities in the business world: 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 LBO in 2003-2008.

Mergers and acquisitions activity can be defined as a type of restructuring in some entity reorganization with the aim to provide growth or positive value. The most histories of M&A activities began at the late 19th century in U.S.. 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 huge wave of M&A deals occurred in automotive industry between 1910 and 1940, and a turbulent time for the airlines M&A was between 1970's and 1980's. Most important, the great revolution of information and telecommunications between 1985 and 2000 pushed global M&A activities in the technology and communication sectors to hit highest level in the 21st century. In the beginning of 2014, Comcast Corporation and Time Warner Cable merged friendly on February 13, creating a world-class technology and media company. The agreement is stock-for-stock transaction in which Comcast will 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. Also, Facebook announced in February 19 that it has 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.

1.2 Literature review

Mergers and acquisitions are among the most visible and important phenomena of modern economies worldwide. The magnitude of this phenomenon has raised questions related to why M&A occur and how M&A affect the outcome of corporate in terms of financial performance, research and development, productivity and market share. Since late 1990s, plenty of literature focused on this area in order to present the understanding in the theory of mergers and acquisitions, gain insight into the success or failure of M&A activities: the issues cover theories of the firm conceptualized into the motives for merged, their empirical investigation, performance measure 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 a great many studies in books, journals and published papers etc., there is no agreement about either the motives or the effects (Chapman 2003, Chen and Findlay 2003, DeYoung et al. 2009, Kwoka 2002, Menapara and Pithadia 2012, Schulz 2007).

Motivations of mergers and acquisitions

Mergers and acquisitions activity can be understood as a corporate strategy aiming to provide growth or positive value of the reorganization. The motivations come from financial performance, technology innovation and market trend.

The acquiring firms seek improved financial performance (Erel et al. 2012). The traditional view believes that mergers and acquisitions take place in order to lower the costs of the company relative to the same revenue stream and increase profit margins, thus

maximize 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 (Mergers 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, however, acquiring firms' financial performance does not positively change as a function of their acquisition activity (King et al. 2004).

Mergers and acquisitions activities appear to occur to different extents across different sectors. Additional motivations for M&A should be considered in some specific fields. In technology-intensive firms (i.e. Communication sector and Technology sector), their M&A appears to be strongly associated with R&D intensity and innovation. Due to fast growing technological, acquirer can take advances of target's product capability, patents and brand recognition by their customers (Sevilir and Tian 2012). The transfer of technologies and capabilities results in a faster growth of acquirers (Ranft and Lord 2002). More recent literature also argues that corporate managers conduct mergers and acquisitions to expand the power of their companies so as to facilitate their empire-

building (Ravenscraft and Scherer 1987). As a contrast, the resource-intensive firms (i.e. Energy sector and Utilities sector) focus more on the 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, decrease risk, and in the long run increase profits (Frohlich and Kavan 2000). Many other works (Baker et al. 1988, Conyon and Gregg 1994, Firth 1991) affirm the perspective by their findings that executive rewards increase with firm size in the wake of acquisitions. Also, the 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). Moreover, since the high volatility and the forecast uncertainty in energy field, the acquire must hedge against a downturn in an individual industry it may fail but these advantage not always deliver value to shareholders (Peter Lynch 2000).

Besides the motivations from the company's perspective, the bloom in mergers and acquisitions 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 (i.e. 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). The stock market often reflects economy. It is one of the most fundamental drivers of economic vitality, and also serves as a revealer of underlying weaknesses within the structure of the economy. Since stock trading provides the major source of funding for business development, the M&A trend in each sector also follows the stock market performance, as the NASDAQ indices shown in

Figure 1. As Barnes noted, “the United States remained attractive to investors because of a perceived stability of the North American market and predictable growth in the region.”

Effects of mergers and acquisitions

Mergers and acquisitions 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. Most of the studies have been done for the efficient markets of the developed world especially U.S. and U.K., but more available research turn into developing country like China and Indian since the year of 2000 (Menapara and Pithadia 2012), and also cross-board M&A deals (Chapman 2003, Chen and Findlay 2003, Jongwanich et al. 2013). Many appropriated ways in order to best measure pre- and post-mergers and acquisitions performance are recognized: synergy realization, absolute performance, and finally relative performance. The analytical methods include, but 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 outlined with theoretical framework and various example deals in the world market. Caves (1989) and Röller et al. (2000) provided supports that firms achieve or strengthen market power and the efficiency gains by being able to exploit economies of scale and scope. Kumar and Singh (1994)’s case study

concluded that rehabilitation of sick company by merging with the health company is the most effective way of 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, profitability etc; they observed that a sick company is takeover by a good management and makes serious attempts, which is possible 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 he merged firms performed better than industry in terms of profitability. Saple (2000) also found that the target firms were better than industry averages while the acquiring firm shad 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 then convincingly reject 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 underperformance; tt should be pointed out that the success of merger and acquisitions depend on proper integration of employees, organization culture, IT, products, operations and service of both the companies. Proper integration in merger 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 advantage M&A could offer, the statistical evidence supporting the hypothesis that profitability and efficiency increase following M&A is at best weak, while there is considerable variation from the central tendencies (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 argue the negative impact of mergers and acquisitions 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) and (2008) conducted a research aims to study the impact of M&A on the operating performance of acquiring corporate in different periods in India, by examining some pre and post merger financial ratios with chosen sample firms and mergers between 1991-2003; the result suggested 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; it was found that the post-

merger profitability, assets turnover and solvency of the acquiring companies, on average, show no improvement when compared with pre- merger values. Some other studies links M&A and R&D (Hall 1990). Hitt et al. (1991) and (1996) said 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.

As summary, none can afford to neglect the strong influence of mergers and acquisitions, no matter good or bad. A new global market has been opened by promoting liberalization of international capital movements and investments. Communications, Technology and other sectors most involve in this major international change. These industries are starting to open worldwide leading in the dramatic increase in M&A. The ease of external funding may encourage M&A deals, although it appears to often then reduce internal polish up effort as a result of a greater occurs on short-term objectives.

Despite the goal of performance improvement, results from mergers and acquisition are sometimes disappointing compared with what predicted or expected. Numerous empirical studies show high failure rates of M&A deals. They develop 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.

1.3 Thesis motivation and objectives

Mergers and acquisitions activity is a corporate strategy aiming to provide economic growth or positive value of the reorganization. The acquirer expects great enhancement to firm development as well as shareholders wealth. Despite a great many studies in this area, there is no agreement on either the motives or the effects of M&A. Many existing literature analyze the performance characteristics of acquirer and target (merging and merged) firms in very specific fields, like firm size, growth rate, profitability, and risk diversification in the pre- and post- takeovers periods, and most of them conduct case study.

We are of curiosity to the general effect of M&A activities on firm values. To get a better metric measuring firm value during mergers and acquisitions, we choose enterprise multiple as analyze target since it takes debt into account, which the acquirer will have to assume, and eliminate the influence from inflation and tax policy. Thus, we can compare the results on firm value cross countries and time periods.

We aim to investigate whether mergers and acquisitions have impact on the firm value, which factor(s) have highly significant effect, and how they influence firm value instantaneously and in long-run. Moreover, as we know that enterprise multiple vary depending on the industry type, we will proceed this research in different company sectors, i.e. Communication, Technology, Energy and Utilities, in order to understand well the

difference of this issue in technology-intensive and resource-intensive firms. These are the main issues I have considered in this thesis work. Based on the above description of the thesis motivation and objective, we choose a large sample consisting of global M&A deals for a long time period between the year of 2000 and 2010, and the applicable analysis methodologies include fixed-effect and dynamic panel regression and treatment effect models.

The thesis is comprised of five chapters: Chapter 1 presents the background introduction and literature review; Chapter 2 outlines the definition and descriptive statistics of the variables in sample dataset; Chapter 3 provides the contemporary impact on firm value from financial fundamental ratios by panel regressions; Chapter 4 discusses the instantaneous and long-term effect of M&A activities on firm values; and Chapter 5 summarizes the major findings of this thesis and gives recommendations for future research work.

Table 1. Top-value M&A global deals in 21st century

	Rank	Year	Acquirer	Target	Transaction value (in billion USD)
2000's	1	2000	AOL Inc. (America Online)	Time Warner	164.75
	2	2000	Glaxo Wellcome Plc.	SmithKline Beecham Plc.	75.96
	3	2004	Royal Dutch Petroleum Company	Shell Transport & Trading Co.	74.56
	4	2006	AT&T Inc	BellSouth Corporation	72.67
	5	2001	Comcast Corporation	AT&T Broadband	72.04
	6	2009	Pfizer Inc.	Wyeth	68
	7	2000	Nortel Networks Corporation		59.97
	8	2002	Pfizer Inc.	Pharmacia Corporation	59.52
	9	2004	JPMorgan Chase & Co	Bank One Corporation	58.76
	10	2008	InBey Inc.	Anheuser-Busch Companies, Inc.	52
2010-	1	2014	Comcast Corporation	Time Warner Cable	45.2
	2	2012	Deutsche Telekom	MetroPCS	29
	3	2013	Berkshire Hathaway	H. J. Heinz Company	28
	4	2013	Softbank	Sprint Corporation	21.6
	5	2014	Facebook	WhatsApp	19
	6	2011	Google	Motorola Mobility	9.8
	7	2011	Berkshire Hathaway	Lubrizol	9.22
	8	2011	Microsoft Corporation	Skype	8.5

Table 2. Company sectors classification

Company Sectors	BASIC MATERIALS	COMMUNICATIONS	ENERGY	TECHNOLOGY	UTILITIES
Sub-sectors	Chemicals Forest Products & Paper Iron/Steel Mining	Advertising Internet Media Telecommunications	Coal Energy-Alternate Sources Oil & Gas Oil & Gas Services Pipelines	Computers Office/Business Equip Semiconductors Software	Electric Gas Water
Company Sectors	CONSUMER, CYCLICAL	CONSUMER, NON-CYCLICAL	DIVERSIFIED	FINANCIAL	INDUSTRIAL
Sub-sectors	Airlines Apparel Auto Manufacturers Auto Parts & Equipment Distribution/Wholesale Entertainment Food Service Home Builders Home Furnishings House wares Leisure Time Lodging Office Furnishings Retail Storage/Warehousing Textiles Toys/Games/Hobbies	Agriculture Beverages Biotechnology Cosmetics/Personal Care Commercial Services Food Healthcare-Products Healthcare-Services Household Products/Wares Pharmaceuticals	Holding Companies-Divers	Banks Closed-end Funds Country Funds-Closed-end Diversified Financial Service Insurance REITS Private Equity Real Estate Investment Companies Savings & Loans	Aerospace/Defense Building Materials Electrical Compo & Equip Engineering & Construction Electronics Environmental Control Hand/Machine Tools Machinery-Diversified Machinery-Construction & Mining Metal Fabricate/Hardware Miscellaneous Manufacture Packaging & Containers Shipbuilding Transportation Trucking & Leasing

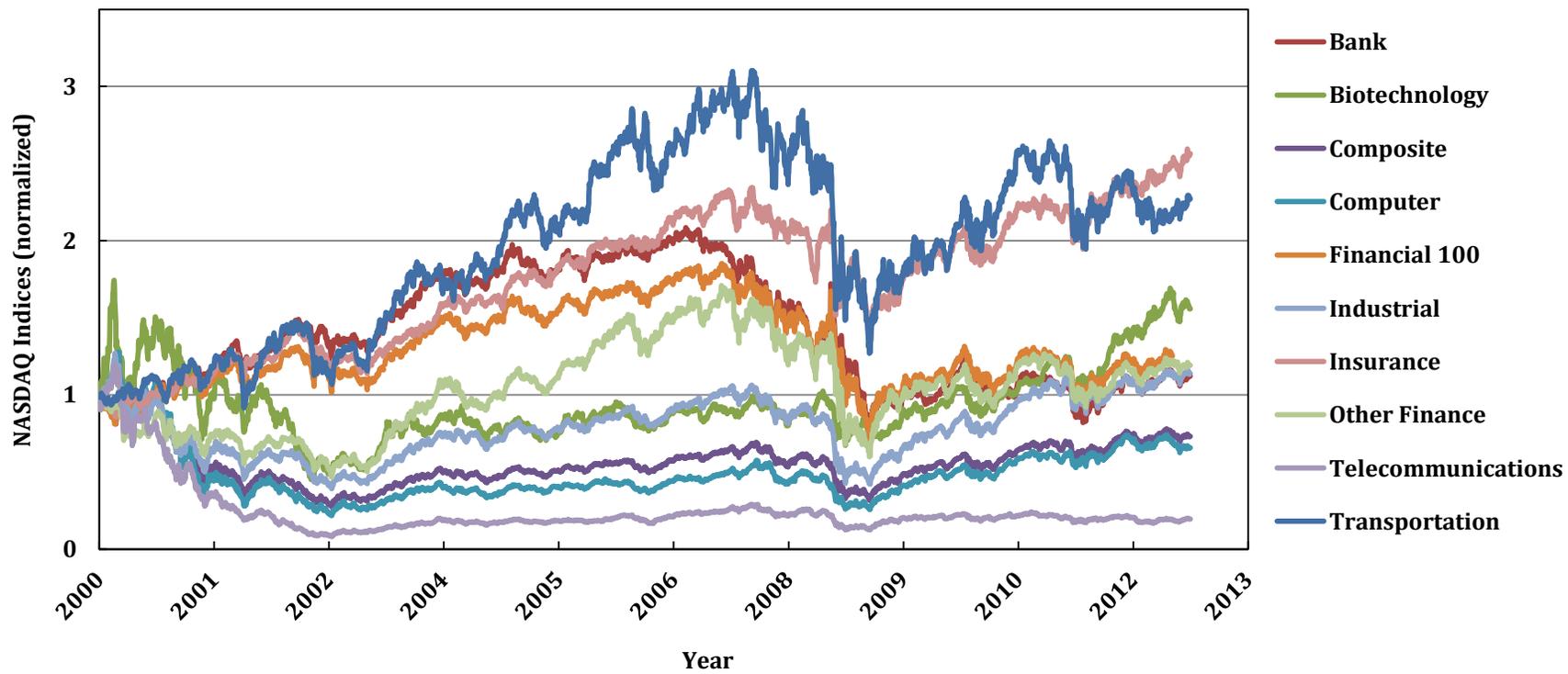


Figure 1. Normalized NASDAQ indices

Chapter 2

Data and Descriptive Statistics

2.1 Data structure

The sample of firm-level financial data was collected from the Bloomberg database. We looked for the firms worldwide with mergers and acquisition activities (completed) during the year of 2000 to 2010, and the deals were both domestic and cross-board. For each deal, we focused on the acquirer firm's financial fundamental data for a time period of seven years: three-year before M&A, one-year when M&A takes place and three-year after. This panel dataset was organized by Microsoft Excel and analyzed by Stata 12 and Stata 13 on Tufts computing cluster.

2.2 Definitions and interpretations

To get a comprehensive valuation of firms with mergers and acquisitions activity, 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. The definitions and interpretations of these variables are elaborated as follows; and a complete list of terms describing M&A activity is in Appendix A.

Enterprise Value - EV

Enterprise value (abbreviated EV) is an economic measure reflecting the market value of a whole business. It is one of the fundamental metrics used in accounting, business valuation, financial modeling and portfolio analysis. 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 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. 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

Earnings before interest, taxes, depreciation and amortization (abbreviated 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

Enterprise multiple (abbreviated 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).

Enterprise 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. Compare 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 has to pay for every dollar it finances, then determine the economic feasibility of expansionary opportunities and mergers.

Price To Sales Ratio – P/S

Price to sale ratio (abbreviated 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 (i.e. less than 1.0) is usually thought to be a better investment 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

Debt to equity ratio (abbreviated 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, then 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

Market to book ratio (abbreviated 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-FL

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.

2.3 Descriptive statistics

We collect data of firms worldwide from four company sectors, e.g. Communication, Technology, Energy and Utilities, who have mergers and acquisitions activities during the year of 2000 to 2010. In Table 3, the total volume of mergers and acquisitions activities per year within these four company sectors varied between 4,000 and 9,000 for the first 10 years of 21th 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 2, the trend of M&A deal number follows the macroeconomics in general: the largest amount of deals was observed at the year of 2000, followed by a fast decline during the busts year of 2001 to 2003; along with the financial market turned better, the deals number climbed up from the year of 2004 and kept

increasing to another peak of deals number at the year of 2007; after the subprime crisis at 2008, the amount of deals falls down until the year of 2010.

Compare the four company sectors, higher amount of mergers and acquisitions deals emerge in the Communication sector followed by Technology industry and the trend follows the macroeconomic conditions closely; while a much lower amount of deals, around 1,000 per year, arise in the recourse-intensive industry, like Energy and Utilities, and doesn't fluctuant with market as well. 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 cost has also been identified as a major factor behind the latest M&A wave.

In this paper, the sample includes 65,521 firms with 458,647 observations in total. We aim to analyze the trend of firm's enterprise multiple (EV/EBITDA) for a period of seven years and effect of mergers and acquisitions 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 data available were also eliminated from this panel. As a result, the panel dataset consists of 31,284 mergers and acquisition 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 enterprise multiple (EV/EBITDA), 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 definition and interpretation of these variables are described in section 2.2. The descriptive statistics of raw and trimmed data are summarized in Table 5a and 5b. First, we note that the enterprise multiple is in the range of 1 to 150 with mean of 18.22 and standard deviation of 18.49 (see Figure 3 for the distribution of EV/EBITDA), the shape ratio (mean/standard deviation) is 1 for trimmed data. 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 enterprise multiple and short- and long-term debt is significant at 5% level, thus we take total debt into account after normalization (zscore). To meet the assumption of no perfect multicollinearity in the multiple linear regression, we also check the pair-wised correlations between five control variables; they are not correlated at 1% significant level, except between financial leverage and market to book ratio.

Table 3. M&A deal volume by sector and year

Year	Sector				Total
	Communication	Technology	Energy	Utilities	
2000	4583	2421	1046	538	8588
2001	3109	1718	973	471	6271
2002	2115	1320	780	417	4632
2003	1809	1312	887	345	4353
2004	2333	1437	1051	406	5227
2005	2588	1588	1203	404	5783
2006	2928	1821	1345	490	6584
2007	3008	1913	1656	548	7125
2008	2535	1718	1489	632	6374
2009	1907	1372	1264	496	5039
2010	2160	1525	1392	468	5545
Sum	29075	18145	13086	5215	65521

Table 4a. Data distribution in sectors

Sector	Group (sector)				Total
	1	2	3	4	
Communication	67,608	0	0	0	67,608
Energy	0	30,088	0	0	30,088
Technology	0	0	46,419	0	46,419
Utilities	0	0	0	21,545	21,545
Total	67,608	30,088	46,419	21,545	165,660

Table 4b. Data distribution in years

dt	Frequency	Percent
-3	18,573	11.21
-2	21,123	12.75
-1	23,865	14.41
0	26,081	15.74
1	26,184	15.81
2	25,690	15.51
3	24,144	14.57
Total	165,660	100

Table 5a. Descriptive statistics of original data

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
enterprise multiple	172736	45.48	809.79	0	1.05E+05
enterprise value	277619	2.91E+05	4.13E+06	-1.00E+06	2.34E+08
earning	218129	2.52E+04	5.00E+05	-3.59E+06	2.88E+07
market capitalization	300847	2.24E+05	3.71E+06	0	2.24E+08
total debt	293223	5.44E+04	6.24E+05	-225	5.95E+07
price to sale	284253	49.80	2956.86	0	5.02E+05
debt to equity	280310	289.57	3.18E+04	-611.57	7.57E+06
market to book value	279568	14.65	2.36E+03	-8.67E+04	5.88E+05
financial leverage	279986	3.00	156.42	-1.02E+04	3.12E+04
zscore debt	293223	-9.58E-19	1	-0.09	95.20

Table 5b. Descriptive statistics of trimmed data

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
enterprise multiple	165660	18.22	18.49	1.00	149.71
enterprise value	165572	3.58E+05	5.20E+06	-1108.40	2.34E+08
earning	153959	3.43E+04	5.91E+05	-3.59E+06	2.88E+07
market capitalization	164645	3.14E+05	4.94E+06	0.0012	2.24E+08
total debt	158680	5.10E+04	6.17E+05	-225	2.69E+07
price to sale	164725	4.13	63.31	0	9606.70
debt to equity	156381	114.5116	2942.81	0	4.47E+05
market to book value	164937	3.43	157.40	-1171.59	4.48E+04
financial leverage	156834	2.69	48.24	-10215.23	1635.59
zscore debt	158680	-7.26E-18	1	-0.08	43.54

Table 6. Pair-wised correlation of all variables

	enterprise multiple	enterprise value	earning	market capitalization	total debt	price to sale	debt to equity	market to book	financial leverage	zscore debt
enterprise multiple	1									
enterprise value	-0.0147*	1								
earning	0.0000	0.0000	1							
market capitalization	-0.0151*	0.9887*	0.9138*	1						
total debt	-0.0059	0.6662*	0.6494*	0.5977*	1					
price to sale	0.0241*	-0.0022	-0.0021	-0.0020	-0.0032	1				
debt to equity	0.0035	-0.0013	-0.0015	-0.0015	-0.0009	-0.0006	1			
market to book value	0.0031	-0.0001	-0.0002	0.0000	-0.0006	0.0002	0.0023	1		
financial leverage	0.0045	-0.0002	-0.0007	-0.0005	-0.0001	-0.0007	0.0052	0.0233*	1	
zscore debt	-0.0059	0.6662*	0.6494*	0.5977*	1.0000*	-0.0032	-0.0009	-0.0006	-0.0001	1
	0.0196	0.0000	0.0000	0.0000	0.0000	0.1972	0.7341	0.8028	0.9624	

* p<0.01

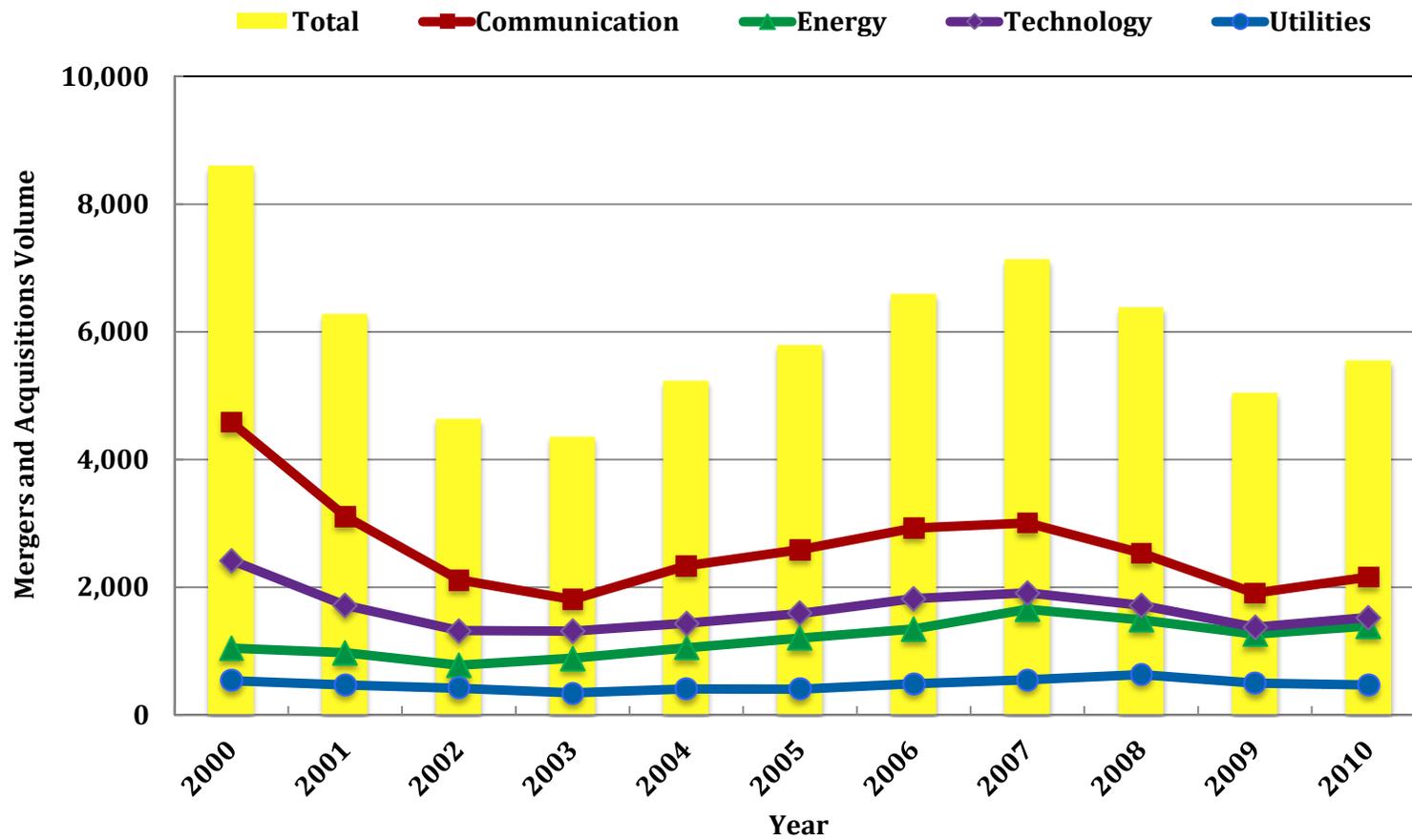


Figure 2. M&A deal volume by sector and year

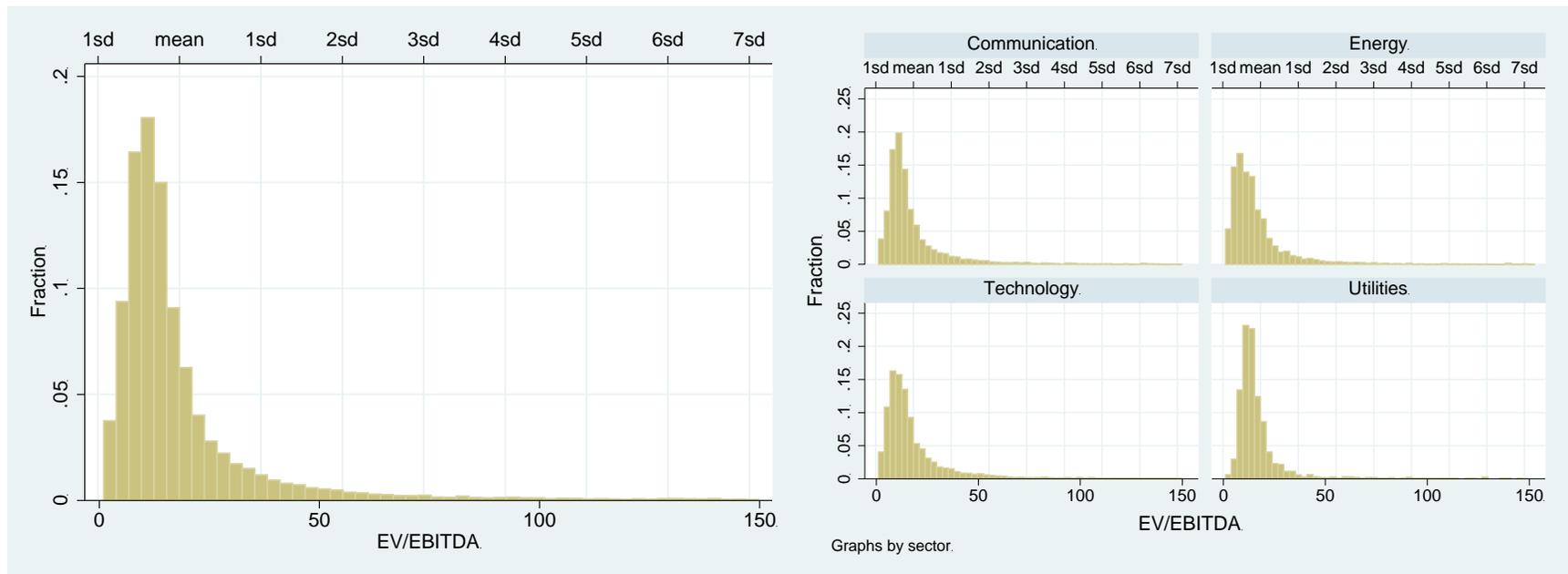


Figure 3. Distribution of enterprise multiple

Chapter 3

Econometric Models and Empirical Results

3.1 Econometric Models

To perform the regression analysis of the panel data, we apply two econometric models: panel fixed effects and Arellano and Bond dynamic panel methodology. The panel fixed effects model is given by

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

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

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

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

3.2 Fixed-effect panel regressions

First we set up the panel with *deal* as panel variable and *dt* as time variable. The results of fixed-effect panel regression 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 price to sale ratio and market to book ratio have significant positive effects on enterprise multiple, while debt to equity ratio and financial leverage are 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 conditional on each one of those four company sectors, Communication, Technology, Energy and Utilities, to capture the industry type effects. The main identification results of columns 1 continue to hold. More than that, 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.

3.3 Dynamic panel regressions

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. To test this hypothesis, we conduct the Wooldridge test for autocorrelation in panel data; the result 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

Thus, we perform the Arellano and Bond dynamic panel regression including one-lagged enterprise multiple in the model. As shown in Table 8, the coefficient on $EV/EBITDA_{t-1}$ is highly significant; and the value indicates a negative shock from firm's previous value on current value. The magnitude is much larger than expected, about -23% in this dynamic model, indicating a highly turbulent pattern in the trend of EV/EBITDA. This cross-time effect is well identified in all company sectors.

In column 1 of Table 8, the effects of independent variables are to the similar extent as that in fixed-effect model shown in Table 7, which indicating consistent impact of financial ratios on firm value. However, in column 2 to 5, we find some changes in the result of dynamic panel model conditional on each company sector. In Communication and Technology sectors, the contemporary effect of financial leverage in dynamic model is occurring not as significant as that in fixed-effect model; this phenomenon also appears at price to sale ratio in Communication firms. The effect of market to book ratio is still highly significant, but with lower magnitude on firm value.

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 universal factor cross-sector, while others are not significant in all cases.

3.4 Regression analysis by years

We perform the Arellano and Bond dynamic panel regression again condition on fiscal years not company sectors. Table 9 presents the regression results for overall and 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, we experienced business booms in the market, during which total number of mergers and acquisitions activities increased rapidly. Stocks suddenly became very popular and gained strong elevated market profits as the result of a stock boom, and firm's market capitalization dramatically grew. An example of this is the internet technologies boom or "dot-com bubble" that occurred during the late '90s, this was one of the most famous booms in stock market history. Later, in the information age, financial institutions got greatly development, they raised huge amount of money and pour into investment and venture capital. There was bloom in emerging market and existing firms were also eager to expansion. Market globalization was another sign of that time. Therefore, mergers and acquisitions grew both domestic and cross-board. From the regression results in Table 9, almost all the financial fundamental ratios (excludes financial leverage) command significant effect on firm value in the year of 2000 and 2004~2007. For

example, an increase of one unit in market to book ratio can even bring up the enterprise multiple by 39% in the year of 2004, say from 1.00 to 1.39.

As often occurs in a boom-and-bust cycle, this boom was followed by one of the biggest busts in history. This occurs because the 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, the contemporaneous effect of the price to sale, debt to equity and market to book ratios on enterprise multiple are more likely to be significant in booms years in the 2000s and qualitatively larger in magnitude than financial leverage. During busts years, firms operate less efficiently even go bankrupt; under the pressure of total market 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 during the entire years.

Table 7. Fixed-effect panel regression results by sector

enterprise multiple	Over all Coef. (Std. Err)	Sector			
		Communication Coef. (Std. Err)	Energy Coef. (Std. Err)	Technology Coef. (Std. Err)	Utilities Coef. (Std. Err)
price to sale	0.0079 ** (0.0027)	0.0059 ** (0.0022)	0.1929 ** (0.0694)	1.2714 *** (0.1806)	0.0404 (0.0292)
debt to equity	0.0000 (0.0000)	0.0000 (0.0000)	-0.0012 *** (0.0002)	0.0008 (0.0006)	-0.0127 *** (0.0023)
market to book	0.0392 *** (0.0086)	0.0333 *** (0.0085)	0.1702 *** (0.0236)	0.0260 (0.0164)	1.1303 *** (0.1575)
financial leverage	0.0020 (0.0012)	0.0047 *** (0.0006)	-0.0029 *** (0.0005)	0.0183 *** (0.0055)	0.1035 * (0.0453)
zscore debt	0.1316 (0.1301)	-0.4205 (0.3490)	-0.0363 (0.1079)	0.5856 ** (0.1870)	0.8925 ** (0.2954)
Constant	17.8932 *** (0.0305)	18.0859 *** (0.0353)	16.1007 *** (0.1667)	15.9760 *** (0.4188)	15.5759 *** (0.4032)
R-squared	0.0023	0.0027	0.0140	0.0469	0.0182
N. of observation	153256	61972	28101	42964	20219

* P<0.05, ** p<0.01, *** p<0.001

Table 8. Dynamic panel regression results by sector

	Sector				
	Over all	Communication	Energy	Technology	Utilities
	Coef. (Std. Err)				
enterprise multiple t-1	-0.2297 *** (0.0064)	-0.1302 *** (0.0110)	-0.3221 *** (0.0134)	-0.2287 *** (0.0110)	-0.3771 *** (0.0158)
price to sale	0.0053 (0.0034)	0.0029 (0.0020)	0.3438 ** (0.1214)	1.8373 *** (0.2832)	0.0268 * (0.0121)
debt to equity	0.0000 0.0000	0.0000 0.0000	-0.0008 *** (0.0002)	-0.0005 (0.0007)	-0.0183 *** (0.0040)
market to book	0.0269 *** (0.0070)	0.0293 ** (0.0095)	0.1133 *** (0.0323)	0.0203 (0.0107)	1.3128 *** (0.1837)
financial leverage	0.0008 (0.0017)	0.0177 (0.0131)	-0.0017 *** (0.0004)	-0.0282 (0.0445)	0.2384 * (0.1090)
zscore debt	-0.6316 ** (0.2412)	-1.1244 *** (0.2286)	-0.5027 (0.4578)	0.5881 (0.3781)	0.9942 *** (0.1805)
Constant	20.7979 *** (0.1502)	18.8044 *** (0.2543)	20.2336 *** (0.4057)	18.1071 *** (0.6924)	21.5336 *** (0.4405)
N. of observation	88496	35628	16007	23935	12926

* P<0.05, ** p<0.01, *** p<0.001

Table 9. Panel regression results by year

	Year					
	Over all	2000	2001	2002	2003	2004
	Coef. (Std. Err)					
enterprise multiple						
enterprise multiple t-1	-0.2297 *** (0.0064)	-0.1255 *** (0.0223)	-0.1374 *** (0.0255)	-0.1127 *** (0.0216)	-0.2191 *** (0.0220)	-0.2463 *** (0.0215)
price to sale	0.0053 (0.0034)	0.1259 *** (0.0316)	0.0416 ** (0.0143)	0.0408 (0.0289)	0.0008 (0.0008)	0.0104 *** (0.0014)
debt to equity	0.0000 (0.0000)	-0.0069 *** (0.0016)	-0.0012 (0.0008)	-0.0130 ** (0.0048)	-0.0014 (0.0021)	-0.0115 *** (0.0031)
market to book value	0.0269 *** (0.0070)	0.0454 *** (0.0103)	0.0927 ** (0.0315)	0.4319 ** (0.1475)	0.0197 (0.0150)	0.3961 *** (0.1019)
financial leverage	0.0008 (0.0017)	-0.0314 *** (0.0089)	-0.0014 (0.0223)	0.0232 (0.0497)	0.0807 (0.0420)	0.0126 (0.0092)
zscore debt	-0.6316 ** (0.2412)	-1.6952 (1.0825)	-2.1066 * (0.8215)	-1.1069 (0.6145)	-0.1622 (0.2182)	0.1230 (0.6580)
Constant	20.7979 *** (0.1502)	22.1798 *** (0.5691)	21.0109 *** (0.6023)	20.0131 *** (0.5662)	22.2190 *** (0.5784)	21.1546 *** (0.5088)
N. of observation	88496	6979	6484	5927	5993	7534

* P<0.05, ** p<0.01, *** p<0.001

Table 9. Panel regression results by year (continued)

	Year					
	2005	2006	2007	2008	2009	2010
	Coef. (Std. Err)					
enterprise multiple						
enterprise multiple t-1	-0.2486 *** (0.0280)	-0.1726 *** (0.0215)	-0.2159 *** (0.0194)	-0.2800 *** (0.0206)	-0.2860 *** (0.0231)	-0.3284 *** (0.0166)
price to sale	0.0128 * (0.0061)	0.0043 (0.0023)	0.0024 * (0.0011)	0.5071 (0.3030)	1.5037 * (0.6605)	0.2060 ** (0.0743)
debt to equity	-0.0006 *** (0.0002)	-0.0011 *** (0.0003)	-0.0014 (0.0008)	0.0000 (0.0000)	0.0001 * (0.0000)	0.0011 * (0.0005)
market to book	0.0697*** (0.0202)	0.1174 *** (0.0282)	0.2465 * (0.1065)	0.0233 (0.0132)	0.1092 ** (0.0398)	0.2292 * (0.0922)
financial leverage	0.0322 * (0.0136)	-0.0017 *** (0.0005)	0.0547 (0.0447)	-0.0115 (0.0113)	0.0508 (0.0277)	0.0293 ** (0.0097)
zscore debt	-0.6079 (1.2213)	-0.0492 (0.3576)	1.2135 *** (0.2922)	-0.9411 (0.5742)	-0.2837 (0.4269)	-0.1021 (0.1274)
Constant	20.0708 *** (0.5824)	18.5376 *** (0.4393)	18.9030 *** (0.4925)	18.7921 *** (0.7625)	17.1286 *** (1.5835)	19.8344 *** (0.5232)
N. of observation	8321	10004	11494	10301	7835	7624

* P<0.05, ** p<0.01, *** p<0.001

Chapter 4

Treatment Effects of Mergers and Acquisitions

4.1 Regression with time dummy variables

To find the trend of firm values in the period of seven years, we apply a regression model with time dummy variables given by:

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

where i indexes the observation and dt_{it} is the time dummy defined by relative year (dt):

$$dt_{-3} = \begin{cases} 1, & \text{if the observation is for 3 - year before MA } (dt = -3) \\ 0, & \text{otherwise } (dt \neq -3); \end{cases}$$

⋮

$$dt_0 = \begin{cases} 1, & \text{if the observation is for the year of MA } (dt = 0) \\ 0, & \text{otherwise } (dt \neq 0); \end{cases}$$

⋮

$$dt_3 = \begin{cases} 1, & \text{if the observation is for 3 - year after MA } (dt = 3) \\ 0, & \text{otherwise } (dt \neq 3). \end{cases}$$

The regression results with time dummy variables are shown in Table 10. We note that the extent of effect on firm value is different from each year. First, the dummy dt_0 is omitted because of the multicollinearity between seven time dummy variables; 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. This result indicates that the firm value at a specific year highly depends on the relative time to mergers and acquisitions 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 overall data; but the results for Energy and Utilities sectors are a little different since we observe negative and insignificant coefficients appear before M&A. Figure 4 describes the trend of firm value in each of the four company sector over relative years (dt). The difference of enterprise multiple between pre- and post- M&A can be easily observed, and the year of M&A is a changing point. So next we use treatment effect methods to analyze this difference qualitatively and quantitatively, aim to explain the effect of M&A on firm value pre- and post- this activity.

4.2 Long-term effect of M&A

Each observation contains a valuation outcome of a firm either before or after mergers and acquisitions activity. So M&A can be considered as a treatment to some firms, for those don't 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 regression adjustment method. First we note that the potential outcome mean is 17.36 for treated group and 19.05 for

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 M&A, and this difference is significant. Moreover, from the regressions, the P/S, D/E and M/B ratios are highly significant in both two 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.

As we learned from the definition and interpretation, enterprise multiples varies from sector to sector. Higher enterprise multiples 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 those four company sectors should be also different and need to be further analyzed each one apart from others.

Table 12 summarizes the average treatment effect of M&A specific in each company sector. These results are estimated by three different econometric methods: regression adjustment, propensity score matching and nearest neighborhood matching (theoretical models are described in Appendix B). The ATEs are always significant in Communication and Technology sectors, but insignificant in Energy and Utilities sectors. As shown in Figure 5, the mergers and acquisitions activities in different sectors affect firm values to different extent. And this finding specific in each industry is much more important than the general result for overall sample.

4.3 Instantaneous effect of M&A

Besides the inequality of firm values pre- and post- mergers and acquisitions activities, another pattern may not be ignored from Figure 5: there is a bump in the middle on each line of EV/EBITDA. The enterprise multiple gets stimulated at the time when M&A takes place. So we design another experiment to test this hypothesis. Again we separate all the observations into two groups but with different assignment as before: 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 from 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 important, this instantaneous effect of M&A activity on EV/EBITDA is significant on all firms no matter which company sector it belongs to. We also note that the greatest increase of 1.6 in the enterprise multiple appears at Communication sector, followed by a fewer increase of 0.8 from Technology and Energy sectors, and a lowest 0.6 from the Utilities sector. Therefore, a firm generally has higher EV/EBITDA ratio when M&A takes place.

4.4 Difference-in-Difference estimation of M&A

Now we apply the difference-in-difference method to analyze the data in year of 2000 and 2001 as an example. The experiment is designed as follow:

	Control group	M&A treated group
Year 2000	(no M&A in 2000) Deal at 2002, dt=-2 Deal at 2003, dt=-3	(no M&A in 2000) Deal at 2001, dt=-1
Year 2001	(no M&A in 2001) Deal at 2002, dt=-1 Deal at 2003, dt=-2	(with M&A in 2001) Deal at 2001, dt=0

The sample set includes 10,192 observations, in which 5,849 of them are from control group (no M&A activity in both year of 2000 and 2001) and other 4,343 are from treated group (no M&A in year 2000 but M&A in year of 2001):

Year2001	<u>M&A2001</u>		Total
	0	1	
0	2,777	2,129	4,906
1	3,072	2,214	5,286
Total	5,849	4,343	10,192

We take the regression of firm's $EV/EBITDA$ with time dummy $Year2001$, state dummy $M\&A2001$, and composite dummy $DiD2001 = Year2001 * M\&A2001$. The coefficient of $DiD2001$ is -1.99 with p -value 0.016. This result indicates that the firm's $EV/EBITDA$

value after mergers and acquisitions is lower than those without M&A activities, and this effect is highly significant. The theoretical framework of difference-in-differences models are described in Appendix C.

This OLS regression analysis is equivalent to diff estimation in STATA with only binary period and treatment variables. The results above may be subject to biases, because simple diff estimation is proceeding under the assumption that the treatment and control groups are the same in every respect apart from the treatment. However, this assumption is too strong to keep in many cases. We cannot guarantee that, in the absence of treatment, the unobserved differences between treatment and control groups are the same over time. Thus, we could specify some pre-treatment covariates of the model as optional controls; when option kernel is selected these variables are used to estimate the propensity score. The difference-in-differences estimate with covariates (P/S, D/E, M/B, FL and ZD) is -2.037, closed to the results above, and also highly significant. The results with and without optional controls are listed in Table 14.

In this example, mergers and acquisitions activities in the year of 2001 lower the firm's EV/EBITDA, thus M&A promotes firms' value in 2001 compares to those in 2000. This effect is significant in specific years, such as positive in the year of 2001 and negative in 2008, but it may not be significant in other periods. We will try some modified Diff-in-Diff models, such as Kernel Propensity Score Matching diff-in-diff, in the future research in order to obtain better treatment effect estimations.

4.5 Results and discussions

From the two treatment experiments above, we find that the long-term effect of M&A activity on firms' enterprise multiple is different from the instantaneous effect. To better understand the difference between the two impact on EV/EBITDA, we should go back to the definition of enterprise multiple and look for the meaning behind that.

Enterprise multiple is defined as ratio of enterprise value to the earning. In general EV and EBITDA increase over time, but the ratio may goes up, down or even flat. 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 rise but the ratio falls, the only possible explanation is that EBITDA at denominator increases more than EV at numerator. In other words, during the three years after M&A activity, their earning grows further 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 motivations of mergers and acquisitions are patent, innovation technology and other intellectual property. Acquirer firms could apply the new technology immediately and get great enhancement in their productivity, which results in the raise of total revenue and profit in a short time period. Meanwhile, firms are not required to largely expand total asset and market capitalization. Thus, the increase of enterprise value could be less than that of firm's earning during three years after M&A, which results in a fall of EV/EBITDA. Also, a lower enterprise multiple means the firm is more valuable. Therefore, M&A is good for technology-intensive companies because of the enhancement in firms' development.

However, the Energy and Utilities firms are in different conditions: the main incentive of mergers and acquisitions is tangible advantage. Firms get geographically expansion and occupy more resource after combination, especially in a cross-board deal. Firm's earning increases in the same pace with enterprise value or even a little slowly, thus the EV/EBITDA ratio doesn't fluctuate much during a three-year period. The payoff from M&A takes long in resource-intensive firms. Therefore, the enterprise multiple of Energy and Utilities sector is not dramatically changing during that period.

In the instantaneous treatment effect analysis, ATE on enterprise multiple 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, the only explanation for that is EV at numerator increases more than EBITDA at denominator. In other words, enterprise value grows faster than firm's earning at the year of M&A. When a deal is announced or completed, the acquirer expects great enhancement to the combination or reconstruction as well as their shareholders expect a profitable future. The stock price becomes very sensitive and responses to this activity very fast, e.g. the first 7-day change or first 30-day change is much higher than normal. Thus, enterprise value gives a quick response at the moment of M&A. But firm's earning cannot respond as promptly as stock market, it takes time to see the improvement in profit and sometimes it takes long. Therefore, we observe stimulation on EV/EBITDA ratio just at the year of mergers and acquisitions, and firm value temporarily goes down. This instantaneous effect is significant generally on all four company sectors.

Table 10. Regression results with time dummy variables

enterprise multiple	Over all Coefficient	Sector				
		Communication Coefficient	Energy Coefficient	Technology Coefficient	Utilities Coefficient	
price to sale	0.0075 **	0.0055 **	0.1911 **	1.1946 ***	0.0407	
debt to equity	0.0000	0.0000	-0.0011 ***	0.0015 **	-0.0123 ***	
market to book	0.0343 ***	0.0265 ***	0.1665 ***	0.0191	1.1131 ***	
financial leverage	0.0022	0.0048 ***	-0.0028 ***	0.0178 ***	0.1031 *	
zscore debt	0.3704 **	0.0594	0.0191	0.7482 ***	0.8881 **	
dt ₃	1.3387 ***	1.8517 ***	0.5813	1.7828 ***	-1.0803 ***	
dt ₂	0.6347 ***	1.0444 ***	0.0558	0.6496 *	-0.5282	
dt ₁	0.7918 ***	1.4685 ***	-0.1248	0.2642	0.0635	
dt ₁	-1.6421 ***	-2.4170 ***	-1.0938 ***	-1.0953 ***	-0.1281	
dt ₂	-2.8018 ***	-3.7622 ***	-1.4333 ***	-2.4959 ***	-0.9884 **	
dt ₃	-3.3057 ***	-4.7374 ***	-1.4874 ***	-2.6108 ***	-1.0557 **	
Constant	18.6876 ***	19.1775 ***	16.6380 ***	16.7320 ***	16.0693 ***	
R-squared	0.0173	0.0339	0.0171	0.0561	0.0202	
N. of observation	153256	61972	28101	42964	20219	

* 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 vs 0)	-1.6920	0.0978	-17.31	0	-1.8836	-1.5004
ATET treat (1 vs 0)	-1.6534	0.1014	-16.30	0	-1.8522	-1.4546
PO Means treat						
1	17.3646	0.0585	296.60	0	17.2499	17.4794
0	19.0566	0.0784	242.96	0	18.9029	19.2104
		Treated group			Untreated group	
Regression	Coefficient	Robust Std. Err.	Significance	Coefficient	Robust Std. Err.	Significance
price to sale	0.0052	0.0018	***	0.0154	0.0022	***
debt to equity	0.0000	0.0000	***	-0.0011	0.0003	***
market to book	0.0325	0.0110	***	0.0942	0.0285	***
financial leverage	0.0003	0.0010		0.0020	0.0019	
zscore debt	-0.1951	0.0565	***	0.0963	0.1172	
Constant	17.2332	0.0661	***	18.8051	0.1081	***

* P<0.05, ** p<0.01, *** p<0.001

Table 12. Long-term treatment effect of M&A by sector

	ATE	Over all	Communication	Technology	Energy	Utility
Treatment effects		Coef. (Std. Err)	Coef. (Std. Err)	Coef. (Std. Err)	Coef. (Std. Err)	Coef. (Std. Err)
regression adjustment		-1.6920 *** (0.0978)	-2.4118 *** (0.1583)	-1.6015 *** (0.2145)	-0.2232 (0.2112)	-0.0887 (0.2036)
propensity score matching		N/A	N/A	-0.9542 *** (0.2153)	0.1417 (0.1795)	-0.0555 (0.1943)
nearest neighborhood matching		-0.2071 *** (0.0753)	-0.4720 *** (0.1243)	-0.5461 ** (0.2003)	0.1397 (0.1695)	0.2377 (0.1447)

* P<0.05, ** p<0.01, *** p<0.001

Table 13. Instantaneous treatment effect of M&A

enterprise multiple	Over all Coef. (Std. Err)	Sector			
		Communication Coef. (Std. Err)	Energy Coef. (Std. Err)	Technology Coef. (Std. Err)	Utilities Coef. (Std. Err)
ATE					
M&A (1 vs 0)	1.1999 *** (0.1321)	1.6885 *** (0.2137)	0.8610 *** (0.2889)	0.8156 *** (0.2486)	0.6176 ** (0.2758)
ATET					
M&A (1 vs 0)	1.2128 *** (0.1321)	1.7185 *** (0.2137)	0.9999 *** (0.2989)	0.8060 *** (0.2529)	0.6428 ** (0.2758)
PO Mean					
M&A					
0	17.8611 *** (0.0502)	17.9680 *** (0.0795)	16.7194 *** (0.1130)	18.9371 *** (0.1032)	16.8576 *** (0.1079)
1	19.0610 *** (0.1223)	19.6564 *** (0.1984)	17.5804 *** (0.2692)	19.7527 *** (0.2302)	17.4752 *** (0.2552)
Regression					
		Untreated group			
price to sale	0.0093 *** (0.0026)	0.0062 *** (0.0020)	0.3892 *** (0.1091)	0.8133 *** (0.2917)	0.0086 (0.0062)
debt to equity	0.0000 * (0.0000)	0.0000 *** (0.0000)	(0.0008) *** (0.0001)	(0.0003) (0.0008)	0.0027 (0.0029)
market to book	0.0449 ***	0.0426 ***	0.1233 ***	0.0295 *	0.5107 ***

	(0.0109)	(0.0121)	(0.0171)	(0.0168)	(0.0930)
financial leverage	0.0012	0.0040 ***	(0.0019) ***	0.0105 **	(0.5574) ***
	(0.0010)	(0.0008)	(0.0004)	(0.0053)	(0.1643)
zscore debt	(0.0781)	(0.3943) ***	(0.9768) ***	(0.9071) ***	0.9283 ***
	(0.0621)	(0.0273)	(0.1071)	(0.2199)	(0.1285)
Constant	17.6706 ***	17.7654 ***	15.5676 ***	16.8710 ***	17.5986 ***
	(0.0607)	(0.0897)	(0.2559)	(0.6614)	(0.3623)
Regression	Treated group				
price to sale	0.0026	0.0000	1.3035 ***	2.2073 ***	0.0040
	(0.0018)	(0.0015)	(0.2248)	(0.1915)	(0.0079)
debt to equity	(0.0014) ***	(0.0010) ***	(0.0006)	(0.0010)	0.0142 ***
	(0.0004)	(0.0004)	(0.0004)	(0.0021)	(0.0046)
market to book	0.1559 ***	0.0923 ***	0.0857	0.3310 ***	1.0775 **
	(0.0433)	(0.0355)	(0.0619)	(0.1029)	(0.5064)
financial leverage	0.0043	0.0053	0.0411 **	0.0646	(1.1535) ***
	(0.0040)	(0.0041)	(0.0196)	(0.0643)	(0.1720)
zscore debt	(0.1871)	(0.5552) ***	(0.9338) **	0.9644 **	1.1579 ***
	(0.1397)	(0.0475)	(0.4219)	(0.4722)	(0.4288)
Constant	18.6959 ***	19.4929 ***	14.2510 ***	13.3477 ***	17.9251 ***
	(0.1561)	(0.2102)	(0.5411)	(0.4514)	(0.9532)

* P<0.05, ** p<0.01, *** p<0.001

Table 14. Difference-in-differences estimations

Single Diff-in-Diff				Number of observations:10192			
Outcome Variable	-----Base Line-----			-----Follow Up-----			DIFF-IN-DIFF
	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	
EV/EBITDA	22.143	23.683	1.539	21.433	20.983	-0.45	-1.99
Std. Error	0.391	0.447	0.594	0.372	0.438	0.574	0.826
t	56.63	25.59	2.59	20.23	18.43	-1.92	-2.41
P> t	0	0	0.010**	0	0	0.433	0.016*

Diff-in-Diff accounting for covariates				Number of observations:9664			
Outcome	-----Base Line-----			-----Follow Up-----			DIFF-IN-DIFF
	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	
EV/EBITDA	21.964	23.607	1.643	21.404	21.01	-0.394	-2.037
Std. Error	0.413	0.47	0.607	0.397	0.472	0.593	0.848
t	53.15	25.46	2.71	20.55	18.73	-1.79	-2.4
P> t	0	0	0.007**	0	0	0.506	0.016*

* P<0.05, ** p<0.01, *** p<0.001

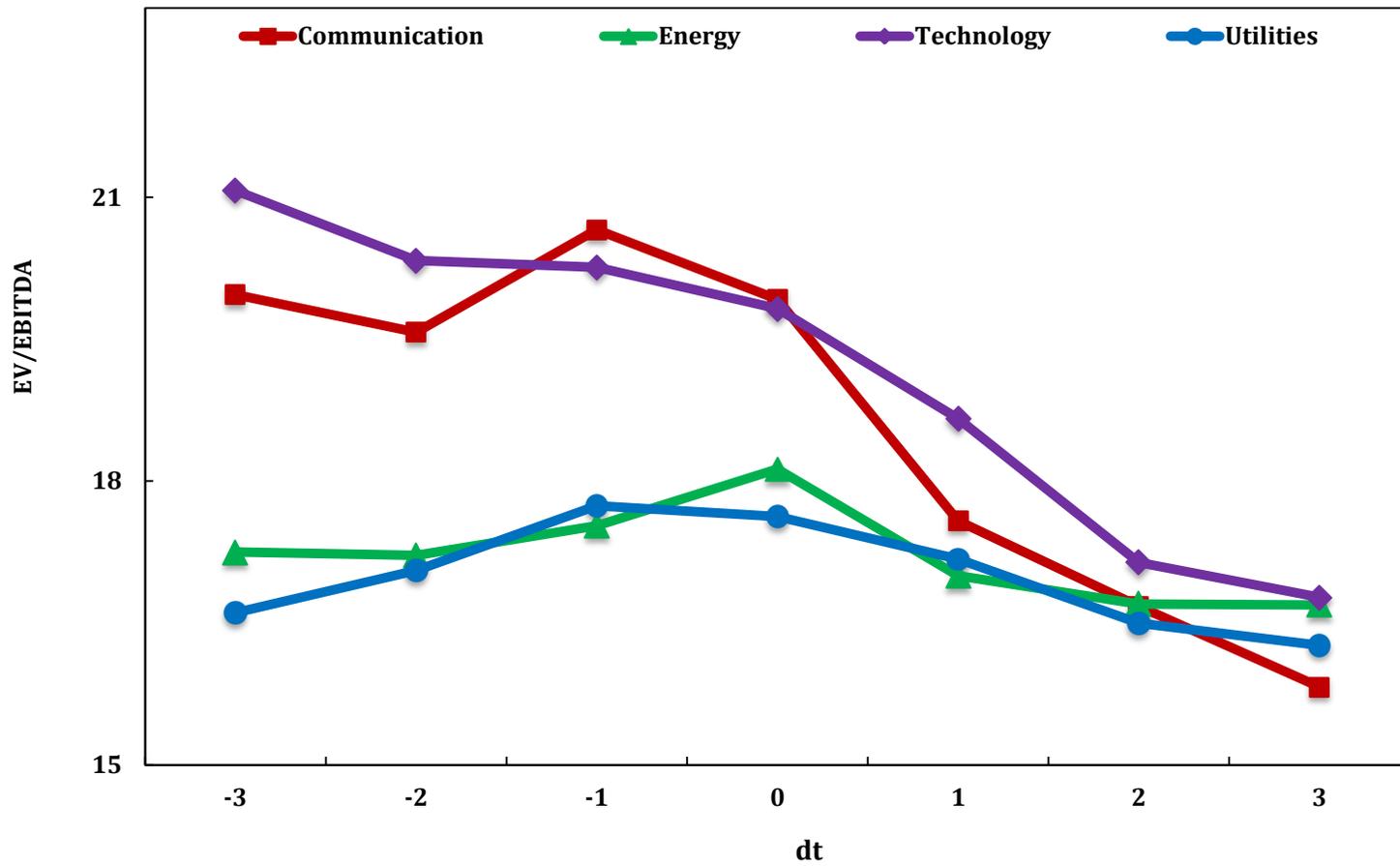


Figure 4. Trend of enterprise multiple by sector

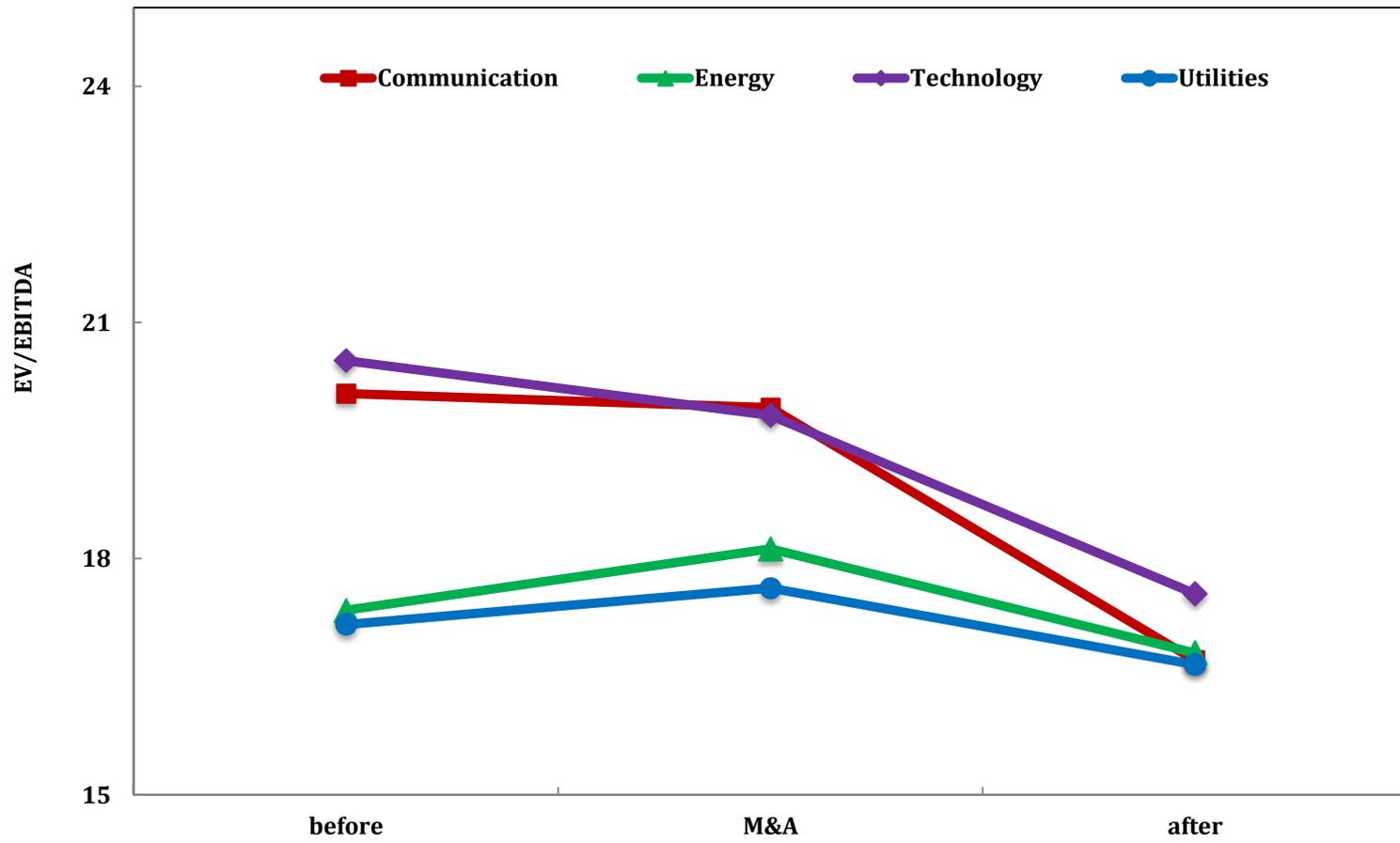


Figure 5. Enterprise multiple of pre- and post- M&A by sector

Chapter 5

Summary

5.1 Conclusion

We provide evidence of mergers and acquisitions effects on firm value using dynamic panel regression and treatment effects analysis. We present empirical models using a large sample of 65,000 firms from the sectors of Communication, Technology, Energy and Utilities. It includes worldwide M&A deals during the year of 2000 to 2010.

We use enterprise multiple, the ratio of EV/EBITDA, as measure of firm value, and some other financial fundamental ratios as the controls, like 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 appropriated. Our first result shows consistent and robust evidence that market to book ratios provides 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. Moreover, the debt to equity ratio has a significant negative impact on EV/EBITDA in Energy and Utilities sectors. A lower M/B ratio and higher D/E 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 the price to sale, debt to equity and market to book ratios are

significant and larger in magnitude in booms years. But we do not find a significant impact from financial leverage for this set of firms. During busts years, those financial fundamental ratios are not good in estimating firm value. In addition, the firm current values are much sensitive to the lagged one.

The next evidence on the determinants of mergers and acquisitions from treatment effects shows that long-term and instantaneous effect on enterprise multiple are much different. In the long-term, three years pre- and post- the deal, M&A gives a net decrease in enterprise multiple indicating a raise of firm value. This is because of a further increase in firm's earning than enterprise value. The trend is significant in technology-intensive firms while not in resource-intensive firms. By contrast, the instantaneous effect of M&A on firm value is more generally in all four sectors. The enterprise multiples get a simulation at the time of M&A, since the enterprise value give much quicker response to the M&A activity while the enhancement in firms' earning takes long.

5.2 Recommendation

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 trend and the comprehensive effect of mergers and acquisitions on firm values.

Appendix A

List of terms in M&A activity by Bloomberg

Term	Definition
# Deals	The number of deals within categorized search results.
% Credit	The portion of a specific role in which an adviser is participating in a deal.
10D Change	The change in premium in the past 10 days.
1D Change	The change in premium in the past day.
5D Change	The change in premium in the past five days.
Acquirer	The company buying the target. This buyer can be made up of an investor group, management group, consortium, or joint venture company.
Acquirer Industry	Indicates the business sectors each target and acquirer are grouped by, using Bloomberg standards.
Acquirer Name	See Acquirer.
Acquirer Ownership in New Company	The acquirer stock ownership of the resultant entity upon completion of the transaction.
Acquirer Region	The region in which the acquirer resides.
Acquirer Ticker	The equity ticker of the acquiring company.
Acquirer to Target	The fee payable by the acquirer to the target/seller, upon withdraw from the merger agreement.
Active	Allows you to indicate if the alert is active.
Adviser	The adviser on the deal. Provides a criteria selector that allows you to search for deals by adviser.
Adviser Type	Allows you to search specific categories of financial or legal advisers.
Amendment Date	The date on which the deal terms were amended, which is then factored into deriving new values. When an offer is amended, based on the form of

payment, Bloomberg recalculates the total value and premium. Bloomberg recalculates the offer by using the 20-day average trading price of the target company from the original announce date of the deal. Then, if necessary, Bloomberg takes the 20-day average trading price of the acquirer from the day prior to amendment, which is only done when the payment involves stock on a per-share basis. For more information on how values and premiums are generated (Announced Total Value), see Calculations.

Announce Date	The date on which the deal was officially announced. Bloomberg utilizes news wires, regulatory filings, and company releases to identify announcements.
Announced Date	See Announce Date.
Announced Date - Activity Breakdown	Allows you to set a default time period for announced dates in activity breakdown.
Announced Date Range	The announced date period by which you want to search for deals.
Announced Premium	The premium indicated when the deal was officially announced.
Announced Total Value	The total dollar value of the entire offer, which includes all disclosed payment types (cash, stock, net-debt, or a combination). For a Calculation, see Calculations: Announced Total Value.
Announced Total Value (mil)	See Announced Total Value.
Announced/Amended Dates - Largest Deals	Allows you to set a default time period for announced/amended dates in largest deals.
Annualized Premium	The premium value prorated to an annualized basis.
Apply to	Allows you to designate a set of companies by which you want to search as a specific party in the deal, such as the target or acquirer.
Approval	Allows you to search for deals based on different approval attributes.
Approval By	The parties from whom approval is needed on a deal.
Approval Date Range	Allows you to search for deals with specified approval dates.
Approval Status	Allows you to search for deals based on different approval statuses, such as Pending, Approved, and Extended.
Approved By	Allows you to search for deals based on different approvers.
Arb Spread (1 Day)	The arbitrage spread between the target's value and the target offer after a one-day change.

Arb Spread (10 Days)	The arbitrage spread between the target's value and the target offer after a 10-day change.
Arb Spread (5 Days)	The arbitrage spread between the target's value and the target offer after a five-day change.
Arb Spread (Annual)	The arbitrage spread between the target's value and the target offer, on an annual basis.
Arb Spread (Gross)	The arbitrage spread between the target's value and the target offer in terms of its overvaluation or undervaluation. For example, a spread above zero indicates the multiple by which the deal is valued above the target's current value.
Arbitrage Profit	The difference between the cash value and the current trading price of the target, represented in USD terms.
Audio Alert	Allows you to set an audio alert for your search results.
Auditor	The firm that examines the company's accounting records and books.
Average	See Average Deal Size.
Average Deal Size	The average value of all deals. The magnitude is expressed with a letter, such as 24.91B for 24.91 billion.
Average Deal Size (USD, M)	The average value of all deals in which an adviser is participating in either the financial or legal deal category.
Average Premium	The average premium of all deals within your search results or a specific category, such as all deals for one buyer.
Average Premium (%)	See Average Premium.
Average Size	The average value of all the deals within a region of your search.
Avg	The average value for key fundamentals, such as the earnings before interest and taxes (EBIT) of all comparable deals.
Avg Disclosed Deal Size	The average size of all disclosed deals within your search results.
Board Size	The number of Directors on the company's board, as reported by the company.
Book Value	The original cost of an asset minus depreciation, as stated on a company's balance sheet. In corporate terms, book value equals the net asset value.
Book Value Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. The book value is a trailing 12-month figure.

Buyer Name	See Acquirer.
Cash Contingency Payment	The cash payment outlined in the merger agreement, to be paid if certain pre-defined conditions have been met.
Cash Terms	The portion of the total value payable in cash, displayed on per share or millions basis.
Cash Value	The real-time dollar value of the offer on a per-share basis, which is the current trading price of the acquirer multiplied by the stock swap ratio.
Cashflow From Ops.	The sum of net income, depreciation, and amortization, other non-cash adjustments, and changes in non-cash working capital.
Cashflow From Ops. Multiple	A multiple derived by dividing the announced total value of the deal by the underlying target fundamental.
Chart	Allows you to display a chart based on specific deal attributes (in the Deal Breakdown tab). Also allows you to overlay the chart in the Time Series tab with volume, deal count, and average premium data. For more information, see Updating the Results: Deal Breakdown and Updating the Results: Time Series.
Classified Board	A structure for a board of directors in which a portion of the directors serve for different term lengths, depending on their particular classification.
Combined Revenue	The total value, if applicable, of the target and acquirer's individual product lines.
Command Line	Allows you to indicate if the alert appears in the command line of a screen.
Company	The type of company, such as public or private.
Company List	Allows you to select the companies you want represented in your search.
Competing Bid Prem	The premium offered by competing acquirers for the deal.
Completion Date	Indicates the date the deal has been consummated. A publicly traded target's completion date coincides with the delisting date.
Cost Synergy Amount	The expected savings in operating costs upon the completion of the deal and the integration of the target and acquirer as disclosed by the company.
Cost Synergy Realization Date	The expected effective date of the cost synergy.
Count	The number of deals within your search results or for a specific buyer.
Country	The available list of countries and regions by which you can search. Also can be the country in which the target or acquirer does business.

Currency	The currency by which you want to filter your search. Also can be the currency in which the deal/deals are listed. For more information on currency codes, see Currency/Exchange Codes.
Current Premium	The most recent trading prices of the target in reference to the Target Offer. This value is listed as a percentage.
Date	The date displayed for the deal. The date can be an amendment date or announced date, as well as the date on which an approval status became effective.
Date Range	The period during which you want to search for deals.
Deal Attribute	The attributes, such as target multiples and deal size breakdown, that you can analyze to determine how many deals in your search results apply to specific ranges of data.
Deal Count	The number of deals in which an adviser is participating in either the financial or legal deal category. Can also appear for other search categories, such as the number of financial buyers versus strategic buyers.
Deal Multiple	Allows you to search for deals based on enterprise value or equity value ranges for key fundamental data, such as revenue and net income.
Deal Multiple Currency	Indicates the unit in which the values for the transaction have been denominated.
Deal Premium	The initial premium of the deal. Calculated based off the 20-day trading average price prior to the announcement date.
Deal Price	The price-per-share of the deal.
Deal Probability	The likelihood, on a percentage basis, of the transaction's successful completion.
Deal Size	The monetary value of the deal.
Deal Status	The current status of the transaction, which can be Pending, Completed, or Terminated. A pending deal is still active and awaiting completion. A completed deal has been consummated and no longer needs approvals. A terminated deal has been dissolved and does not continue.
Deal Type	The type of transaction taking place, which includes merger, acquisition, or divestiture. A merger involves the combining of two or more companies, generally by offering the stockholders of one company securities in the acquiring company in exchange for the surrender of their stock. An acquisition is a corporate action in which a company buys most, if not all, of the target company's ownership stakes to assume control of the target firm. A divestiture is the partial or full disposal of an investment or asset through sale, exchange, closure, or bankruptcy.

Deals	The total number of deals within your search results.
Description	Allows you to search for a set of companies based on specific keywords or brands maintained by the company.
Display Currency	The currency in which the search results appear. For more information on currency codes, see Currency/Exchange Codes.
Dissenter Rights	Allows shareholders of a corporation the right to receive a cash payment for the fair value of their share, in the event of a share-for-share merger or acquisition to which the shareholders do not consent.
Divisions	The Standard Industry Classification (SIC) industries. For more information, see SIC <HELP>.
Drop Dead Date	Date the deal is terminated if all conditions set out in the merger agreement haven't been met.
EBIT	The trailing 12-month operating income, calculated by adding the operating income for the most recent four quarters.
EBIT Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. EBIT is a trailing 12-month figure.
EBITDA	The trailing 12-month earnings before interest, taxes, depreciation, and amortization (EBITDA), which is calculated by adding EBITDA from the most recent four quarters. EBITDA is operating income plus depreciation expense from the statement of cash flows.
EBITDA Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. EBITDA is a trailing 12-month figure.
Email	Allows you to indicate if an alert is sent via the Bloomberg Message (MSG) function. For more information, see MSG <HELP>.
Enter Keywords	Allows you to search by specific keywords.
Enterprise Value	Indicates a value that equals market capitalization + preferred equity + minority interest + short-term & long-term debt - cash and equivalents.
Enterprise Value Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Enterprise Value is a snapshot from the announcement.
Equity Value	A deal multiple calculated on transactions that is equal to the equity value of the transaction divided by the book value of the target company.
ESG Disc Score	A proprietary Bloomberg score that measures the extent of a company's Environmental, Social, and Governance (ESG) disclosure.
Exchange	Allows you to search by a set of companies listed on a specific exchange.

Expiration Time	A specified time, after which the contract is no longer valid.
Expiration Time Zone	The time zone of the expiration.
Expires	Allows you to select when the alert expires.
Fee	The adviser's fee for a specific role.
Fees Disclosed	Allows you to search for deals based on whether fees have been disclosed.
FFO Fundamental	Funds from operations, which represents net income after preferred dividends plus depreciation on real estate income-producing assets.
FFO Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. FFO is a trailing 12-month figure.
Filter by Adviser	Allows you to filter by a specific adviser.
Final Premium	The premium of the deal upon the completion date.
Final Value	The value of the deal upon the completion date.
Financing Conditions	The provision allowing the acquiring company to terminate the agreement if it is unable to obtain the necessary financing.
Fractional Shares	Indicates less than one share of a stock, created by such factors as stock splits, investment plans, and stock dividends.
Free Cashflow	A number calculated by taking cash from operations minus capital expenditures.
Free Cashflow Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Free Cashflow is a trailing 12-month figure.
Fundamental Currency	The currency in which the fundamental data is reported. For more information on currency codes, see Currency/Exchange Codes.
Fundamentals	Allows you to search for deals based on general fundamental data ranges.
Go-Shop End	The expiration date of the go-shop period. Usually 30 to 60 days following the start date.
Go-Shop Period	The total number of days elapsed under the go-shop period.
Go-Shop Start	The date from which a public target is allowed to solicit competing bids following the receipt of an initial offer.
Gov Disc Score	A proprietary Bloomberg score that measures the extent of a company's governance disclosure as part of Environmental, Social, and Governance (ESG) data.

Governing Law	The country, state, or local political subdivision under which the agreement is regulated.
Gross Profit	The difference between the total income and total payment.
Gross Spread	The exponent by which the deal is overvalued or undervalued. A positive value indicates an overvalued deal, while a negative value indicates an undervalued deal.
High Disclosed Deal Size	The largest deal expressed in monetary value among the buyer's total deals.
High Premium (%)	The largest deal expressed in terms of premium among the buyer's total deals.
Include deals that meet	Allows you to select if your search results must meet all selected criteria or specific criteria.
Include deals with unspecified approval dates	Allows you to search for deals with unspecified approval dates.
Income B/F XO	Excludes the effects of discontinued operations, accounting standard changes, natural disasters, and early cancellation of debt.
Income B/F XO Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Income before XO (extraordinary items) is a trailing 12-month figure.
Index	Allows you to search for a set of companies that are members of a specific index.
Industry	The industry in which the target or acquirer does business.
Issue Type	The source of funds from which principal and interest payments are made.
Issuer	The name of the entity that sells and distributes the security.
Launchpad Popup	Allows you to indicate if an alert appears via a Launchpad (BLP) function popup. For more information, see BLP <HELP>.
Low Disclosed Deal Size	The smallest deal expressed in monetary value among the buyer's total deals.
Low Premium (%)	The smallest deal expressed in terms of premium among the buyer's total deals.
Market Cap	The market cap is equal to the number of shares outstanding times the stock price at the period end. Market capitalization is the company's worth calculated by multiplying the shares outstanding by the price per share.

Market Cap Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Market Capitalization is a snapshot from the announcement of the deal.
Market Share (%)	The adviser's share of all deals with advisers in either the financial or legal deal category.
Material Adverse Effect	The provision allowing the acquiring company to terminate the agreement if the target company suffers an adverse event or change.
Maturity	The date upon which the financial instrument ceases to exist and the principal is repaid.
Max	The maximum end of the range.
Median	The median value for key fundamentals, such as the earnings before interest and taxes (EBIT) of all comparable deals.
Merger Agreement Date	The date the definitive merger agreement is signed by all parties.
Min	The minimum end of the range.
Name	The name of, for example, the monitor containing the source of companies for which you want to search or the folder you are creating.
Nature Of Bid	Discloses the intent of an acquirer regarding a particular transaction. This is identified as Friendly or Hostile (Unsolicited).
Net Debt	The portion of the total value, which involves the net-debt of the target. The calculation is (ST Borrowings + LT Borrowings) - (cash & near cash + marketable securities).
Net Income	The profit of a firm's businesses after all expenses of the company have been deducted.
Net Income + Depreciation	The profit after all expenses have been deducted, plus depreciation and amortization expenses, included as a part of cost of goods sold and selling, as well as general and administrative expenses (operating expenses).
Net Income + Depreciation Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Net income + depreciation (cashflow) is a trailing 12-month figure.
Net Income Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Net Income is a trailing 12-month figure.
Number of Deals	The number of deals in your search results.
Operating Profit	Indicates any profit a company makes through its normal operations.

Other Criteria	Indicates deal search criteria that cannot be fit into another category. Examples include deals subject to proration and deals with contingency payments.
Panel	Allows you to indicate if an alert appears in a panel.
Payment Type	Indicates how the acquirer intends to pay for the target.
Percent Owned	Indicates any stake previously purchased by the acquirer, listed as a percent. This amount may not be reflected in a previous acquisition unless the previous deal was at least 5% or more of a purchase in common equity of the target.
Percent Sought	The amount of the target being sought in the current deal. Bloomberg compiles details on all global acquisitions in which at least 5% or more of a target is being purchased.
Period	The period during which you want to search for deals.
Premium	Allows you to search for deals by selecting different premium type ranges, based on a minimum and maximum level, as well as arbitrage spreads.
Premium (%)	The percentage above the value of the target being paid on the deal by the acquirer. A green value indicates the premium exceeds the value. A red value indicates the premium falls below the value.
Price	The stock price of the either the target or acquirer.
Prim Exch	The name of the main exchange on which the security is listed.
Product Line	The product line represented by one or both sides in a merger.
Product Segment	Allows you to search for keywords in company product lines.
Proforma	The projected financial statements based upon certain assumptions, such as projected sales.
Proposed Date	The proposed completion date of the merger.
Proposed Total Value (USD, M)	The proposed value of the deal in millions of U.S. dollars.
Proration Percent	The prorated amount of shares that have been accepted by the entity making the tender offer.
Public/Private	Allows you to search by public and/or private companies.
Purpose	The strategic reason for the transaction. This includes: bankruptcy, geographic expansion, product diversification, restructuring, market share,

and vertical integration.

Quick Search	Allows you to search by specific keywords.
Range	Indicates where one deal's monetary value or premium is in terms of the range of all the buyer's deals. For example, if the circle appears in the middle of the range line, the deal is at the middle of all values of the deals in which the buyer is involved.
Rank	The adviser's rank versus all other advisers in either the financial or legal deal category.
Region	The region by which you want to filter your search.
Region/Country	Allows you to search for companies by a specific region or country.
Revenue	The sum of interest income, trading account profits (losses), investment income (losses), other operating income, and interest expense.
Revenue Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Revenue is a trailing 12-month figure.
Revenue Synergy Amount	The expected additional revenue to be generated as a result of the completion of the deal and the integration of the target and acquirer.
Revenue Synergy Realization Date	The expected effective date of the revenue synergy.
Role	The role of a specific adviser, such as target legal adviser, on a deal.
Search Name	The default and custom search names. Also a field in which you can enter the default or custom search name for which you want to set an alert.
Search Result View	The view (tab) in which your saved search opens.
Sector/Industry	Allows you to search for a set of companies that fall within a specific sector or industry. Also the available list of sectors and industries by which you can search.
Selected	The selected set of criteria.
Seller	See Seller Name.
Seller Name	The selling company in a divestiture. The transaction often involves a subsidiary unit or asset that is being disposed.
Seller Ticker	The selling firm's equity ticker for a divestiture. The transaction is only available under this ticker, not the target ticker if one is listed next to the Target Name.

Shares Outstanding (M)	The number of a company's stock certificates held by public investors or by the company's officers.
Shortcut	The shortcut corresponding to the default or custom search.
SIC Code	Allows you to search for a set of companies based on a Standard Industry Classification (SIC) code. For more information, see SIC.
Source	The source of the companies, such as a Launchpad monitor, by which you want to search.
State	For the countries that have states (US, Canada, and Australia), allows you to search for companies by a specific state. Also a field that displays, if applicable, the state in which an approver operates.
Stats	Allows you to select statistical overlays, such as a median or average value, for a list of comparable deals.
Status	The current status of an approval, such as Pending or Approved.
Stock Contingency Payment	The stock payment outlined in merger agreement, to be paid if certain pre-defined conditions have been met.
Stock Terms	The portion of the total value payable in the acquirer's stock. This appears on a per-share or millions of shares basis.
Stockholder Equity	Shareholders equity is calculated using the following formula: preferred equity + minority interest+ total common equity. Stockholder equity is a company's net worth, or its liabilities subtracted from the value of its assets.
Stockholder Equity Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Stockholder equity is a snapshot from the latest 10-Q.
T	The deal type. You can see a tooltip with a description of the one-letter code by positioning your cursor over the code.
Target	Indicates the company or unit being purchased in a transaction. The acquirer can be made up of a stand alone company, joint venture firm, investor group, management group, or individual. Also appears as Target Name.
Target Industry	Indicates the business sectors the Target has been grouped by using Bloomberg standards. In the event of a divestiture, the industry listed is the seller's.
Target Ownership in New Company	The target stock ownership of the resultant entity upon completion of the transaction.
Target Region	The top-level region by which you want to search for deals. Also the region in which the target resides.

Target Ticker	The equity ticker of the target company. In a divestiture, the target ticker is listed on the Divestiture Details screen, if one exists for the company. If a target ticker is listed, the transaction details does not appear under the target in the Corporate Actions (CACS) function. For more information, see CACS <HELP>.
Target to Acquirer	The fee payable by the target/seller to the acquirer, upon withdraw from merger agreement.
Taxable	The tax consequences of the transactions: taxable or tax-free.
Termination Date	The date on which the deal was officially withdrawn.
Tot Value	See Total Value.
Total Assets	Indicates anything owned by a business that has commercial or exchange value. Assets may consist of specific property or claims against others. This is the sum of all current assets, non-current assets, and other assets.
Total Assets Multiple	A multiple derived by dividing the Announced Total Value of the deal by the underlying target fundamental. Total assets are a snapshot from the most recent 10-Q.
Total Contingency Payment	The total dollar value of any existing cash and stock contingency payments.
Total Deal Size	The aggregate value of all deals. The magnitude is expressed with a letter, such as 4.66T for 4.66 trillion.
Total Deal Size (USD, M)	The aggregate value of all deals in which an adviser is participating in either the financial or legal deal category.
Total Value	The value of the transaction at a specific time during the life of the transaction and upon completion of the deal. The value is saved as a final total value.
Total Value Deal Multiples	See Total Assets Multiple.
Transmittal Letter	The letter a seller attaches to the document or securities he or she is sending to the buyer describing the shipment's purpose and contents.
Value	The aggregate value of all the deals within the search category, such as the aggregate value of all targets that fall under the oil and gas category.
View	Allows you to select the pro-forma view you want to see. Pro-forma results are projections based on the combined value of the target and acquirer in the merger.
Volume	The aggregate value of all the deals within a region for which you searched.

Appendix B

Treatment effects by Stata 13

Introduction

Suppose we have observed a sample of subjects, some of whom received a treatment and the rest of whom did not. A “treatment” could indeed be a medical treatment such as a new drug regimen or surgical procedure. We would like to know if a treatment (T) has an effect on an outcome (Y). In an ideal world, we would observe Y when a subject is treated (Y_1), and when the same subject is not treated (Y_0). We would be careful to make both observations under identical conditions so that the only difference is the presence or absence of the treatment. Unfortunately, this ideal experiment is almost never available in observational data because it is not possible to observe a specific subject having received the treatment and having not received the treatment. A classic solution to this problem is to randomize the treatment. The goal of the estimators implemented by treatment effects is to utilize covariates to make treatment and outcome independent once we condition on those covariates.

Definition

Consider a subject that did not receive treatment so that we observe Y_0 , we call Y_1 the potential outcome or counterfactual for that subject; for a subject that did receive treatment, we observe Y_1 , so Y_0 would be the counterfactual outcome for that subject. Potential-outcome models provide a solution to this missing-data problem and allow us to estimate. Treatment effects use

observational data to estimate the effect caused by getting one treatment instead of another.

Treatment-effect estimators allow us to estimate three parameters:

POM: The POM for treatment level t is the average potential outcome for that treatment level:

$$POM_t = E(y_t)$$

ATE: The ATE is the average effect of the treatment in the population:

$$ATE = E(y_1 - y_0)$$

ATET: The ATET is the average treatment effect among those that receive the treatment:

$$ATET = E(y_1 - y_0 | t = 1)$$

In defining these parameters, t denotes a random treatment, t_i denotes the treatment received by individual i , $t = 1$ is the treatment level, and $t = 0$ is the control level. **ATET** reduces to the **ATE** when the mean of the covariates among the treated is the same as the mean of the covariates in the population and when the average contribution from the unobservables for the participants is zero.

Assumptions

We must make some assumptions to use treatment-effects estimators:

CI: The conditional-independence assumption restricts the dependence between the treatment model and the potential outcomes.

Overlap: The overlap assumption ensures that each individual could receive any treatment level.

i.i.d.: The independent and identically distributed (i.i.d.) sampling assumption ensures that the potential outcomes and the treatment status of each individual are unrelated to the potential outcomes and treatment statuses of all other individuals in the population.

Model Description

Treatment effects can be estimated using inverse-probability weights (IPW) and via matching on the propensity score or nearest neighbors. The outcome models can be continuous, binary, count, or nonnegative. Continuous outcomes can be modeled using linear regression; binary outcomes can be modeled using logit, probit, or heteroskedastic probit regression; and count and nonnegative outcomes can be modeled using Poisson regression. The treatment model can be binary or multinomial. Binary treatments can be modeled using logit, probit, or heteroskedastic probit regression, while multinomial outcomes are modeled using multinomial logit regression.

Regression adjustment (RA)

RA estimators use means of predicted outcomes for each treatment level to estimate each POM. ATEs and ATETs are differences in estimated POMs. The CI assumption implies that we can estimate $E(y_0|x)$ and $E(y_1|x)$ directly from the observations for which $t = 0$ and $t = 1$, respectively. Regression adjustment fits separate regressions for each treatment level and uses averages of the predicted outcomes over all the data to estimate the POMs. The estimated ATEs are differences in the estimated POMs. The estimated ATETs are averages of the predicted outcomes over the treated observations.

RA is a venerable estimator. See Lane and Nelder (1982); Cameron and Trivedi (2005); Wooldridge (2010); and Vittinghoff et al. (2012). The usefulness of RA has been periodically questioned in the literature because it relies on specifying functional forms for the conditional means and because it requires having sufficient observations of each covariate pattern in each treatment level; see Rubin (1973) for an early salvo.

Nearest neighbor matching (NNM)

Matching estimators use an average of the outcomes of the nearest individuals to impute the missing potential outcome for each sampled individual. The difference between the observed outcome and the imputed potential outcome is an estimate of the individual-level treatment effect. These estimated individual-level treatment effects are averaged to estimate the ATE or the ATET.

NNM determines the “nearest” by using a weighted function of the covariates for each observation. It is nonparametric in that no explicit functional form for either the outcome model or the treatment model is specified. This flexibility comes at a price; the estimator needs more data to get to the true value than an estimator that imposes a functional form. More formally, the NNM estimator converges to the true value at a rate slower than the parametric rate, which is the square root of the sample size, when matching on more than one continuous covariate. Abadie and Imbens (2006) and (2011) derived the rate of convergence of the NNM estimator and the bias-corrected NNM estimator and the large-sample distributions of the NNM and the bias-corrected NNM estimators. These articles provided the formal results that built on methods suggested in Rubin (1973) and (1977). Treatment effect-NNM is based on the results in Abadie and Imbens (2006) and (2011) and a previous implementation in Abadie et al. (2004).

Propensity score matching (PSM)

PSM determines the “nearest” by using the estimated treatment probabilities, which are known as the propensity scores. Instead of performing bias correction to handle the case of more than one continuous covariate, propensity scores is a common solution to combine all the covariate information into estimated treatment probabilities, and use this single continuous covariate as the matching variable. In effect, the PSM estimator parameterizes the bias-correction term in the treatment probability model. One advantage of matching on the estimated treatment probabilities

over the bias-correction method is that one can explore the fit of different treatment probability models using standard methods before performing the nonparametric matching. For example, one can select the treatment model by minimizing an information criterion under i.i.d. sampling.

Matching on estimated treatment probability models has been very popular since Rosenbaum and Rubin (1983) showed that if adjusting for covariates x_i is sufficient to estimate the effects, then one can use the probability of treatment to perform the adjustment. (Abadie and Imbens (2012)) derived a method to estimate the standard errors of the estimator that matches on estimated treatment probabilities, and this method is implemented in *teffects psmatch* in Stata 13.

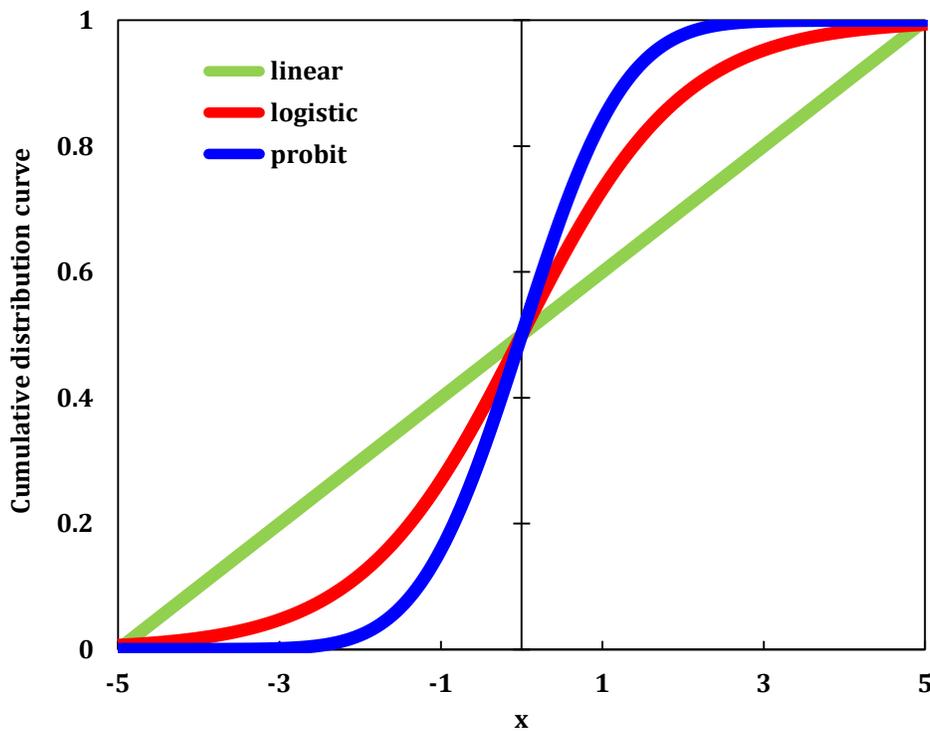


Figure 6. Estimating models in treatment effect

Appendix C

Difference-in-Differences Estimations

Introduction

In the treatment effects analysis above, we have come across the estimation of differences by simple comparison of the mean of the outcome in treatment and control groups, where they should not have any systematic differences in any other pre-treatment variable. In this section, we apply standard difference-in-differences method, which has been widespread used to study numerous policy questions. The idea of difference-in-differences method is to find equivalents of treatment and control groups in which everything apart from the variable of interest, or other things that can be controlled for are assumed to be the same. In other word, in the absence of treatment, the unobserved differences between treatment and control groups are the same over time.

But this is often a very difficult claim to make as it is rarely possible to do this perfectly, in which observed differences between treatment and control groups may be the result of some other omitted factors. In this case one could use data on treatment and control group before the treatment to estimate the normal difference between treatment and control group and then compare this with the difference after the receipt of treatment.

Definition

The simplest set up is one where outcomes are observed for two groups at two time periods: one of the groups is exposed to a treatment in the second period but not in the first period; the

second group is not exposed to the treatment during either period. In the case where the same units within a group are observed in each time period, the average gain in the second (control) group is subtracted from the average gain in the first (treatment) group. This removes biases in second period comparisons between the treatment and control group that could be the result from permanent differences between those groups, as well as biases from comparisons over time in the treatment group that could be the result of trends.

The table and graph as follow make this idea clearer:

y_{st}	state = 1	state = 2	Difference
time = 1	y_{11}	y_{12}	$y_{12} - y_{11}$
time = 2	y_{21}	y_{22}	$y_{22} - y_{21}$
Change	$y_{21} - y_{11}$	$y_{22} - y_{12}$	$(y_{22} - y_{21}) - (y_{12} - y_{11})$

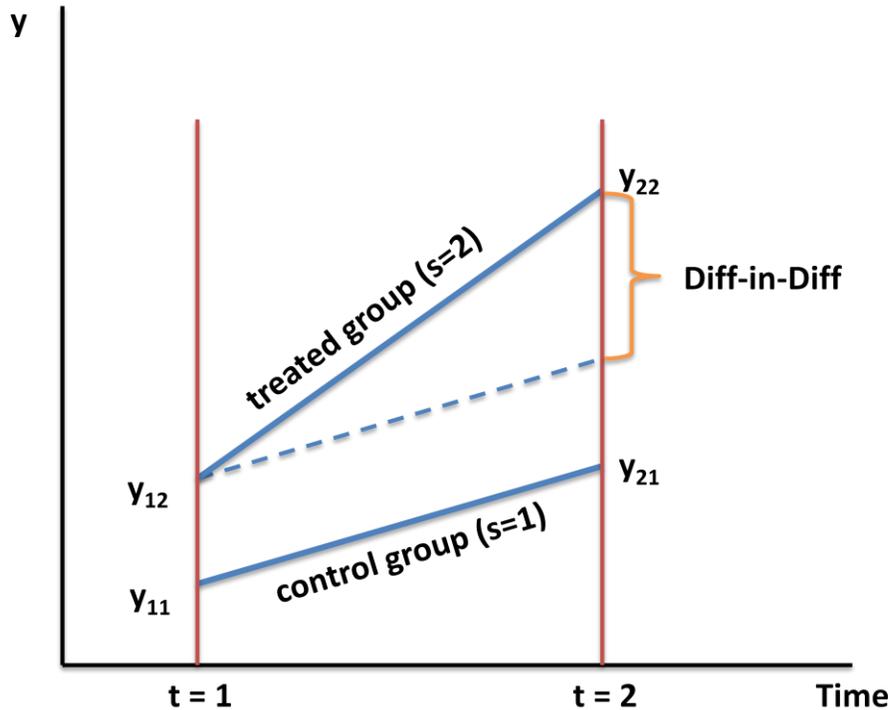


Figure 7. Idea of difference-in-differences method

Model Description

We can write the OLS model for difference-in-differences method:

$$y = \beta_0 + \beta_1 \cdot T + \beta_2 \cdot S + \beta_3(T \cdot S) + \varepsilon,$$

where y is the outcome of interest, T is a time dummy variable for the second time period $t=2$, S is a state dummy variable for treated group $s=2$, and the composite variable $(T \cdot S)$ is then a dummy variable indicating when $S=T=1$. The coefficient β_3 captures possible differences between the treatment and control groups.

The estimates in this model are:

$$\widehat{\beta}_0 = (y|T = 0, S = 0);$$

$$\widehat{\beta}_1 = (y|T = 1, S = 0) - (y|T = 0, S = 0);$$

$$\widehat{\beta}_2 = (y|T = 0, S = 1) - (y|T = 0, S = 0);$$

$$\widehat{\beta}_3 = [(y|T = 1, S = 1) - (y|T = 0, S = 1)] - [(y|T = 1, S = 0) - (y|T = 0, S = 0)],$$

which is equivalent to

$$\widehat{\beta}_3 = (y_{22} - y_{21}) - (y_{12} - y_{11}).$$

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