An Investment-based Explanation for the Post-merger Underperformance Puzzle

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Abstract

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Extant evidence of acquirers' post-merger underperformance is often viewed as support for the behavioral theory of mergers that investors overvalue acquirers during the pre-acquisition period. Motivated by recent developments in asset pricing, which show that firms' expected returns and investment rates are negatively related, this paper proposes a neoclassical-based explanation for acquirers' post-merger poor returns. Acquirers are predominantly high q firms with rich growth opportunities and high investment rates, and are thus vulnerable to investment shocks. It follows that the negative investment-expected return relation is especially important in pricing acquirers. The underperformance puzzle arises because of the failure of traditional asset pricing models to account for heterogeneous impacts of investment shocks and the links between firms' investment rates and expected returns. To solve the problem, I use an investment factor-augmented Fama French model and a q theory based model to examine acquirers' long-term performance, and find the puzzle largely disappears. Rather than interpreting negative abnormal returns as evidence of overvaluation of stock-financed acquirers and high q acquirers, I show that their low returns are explained by high investment rates.

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DEDICATION

To my parents Chin-chen Chang and Ling-hui Huang, my husband Hao-wei Liu, and my sister Ching-yun Chang

Chapter 1

INTRODUCTION

Over the past three decades, extensive research has studied the long-run post-merger returns. Several studies report strong evidence of long-term underperformance of the acquirers[1]. But, there is no consensus as to why acquirers underperform in the long run. Most of the proposed explanations assume market inefficiency, arguing that the acquirers are overvalued before the mergers or as a result of the mergers. As the market slowly reassesses the value of mergers, acquirers experience low post-merger returns.

In this paper, I propose a new, investment-based explanation that links the long-run post-merger returns of acquirers to the acquirers' real investment rates. My rationale comes from the q theory of investment and the real business cycle literature, which have rationalized a negative relation between investment rates and expected returns. I find that acquirers are predominantly high Tobin's q firms, a group that is characterized by relatively high real investment rates and is typically mispriced by the CAPM and the Fama and French (1993) three-factor model. Therefore, I augment the model of expected returns with an investment factor, long in low investment-to-assets stocks and short in high investment-to-assets stocks, and apply it to the pricing of acquirers. I show that the post-merger underperformance puzzle disappears once I account for the negative investment-expected return relation. I also test my investment-based hypothesis on several subsets of acquirers according to the payment methods and outcomes of the transactions. My evidence suggests that acquirers' low

[1]See, for example, Asquith (1983), Agrawal, Jaffe, and Mandelker (1992), Loderer and Martin (1992), Anderson and Mendelker (1993), Rau and Vermaelen (1998), and Mitchell and Stafford (2000).

post-merger returns are expected given their high investment rates.

The study of acquirers' long-run performance is important because large post-merger negative abnormal returns are inconsistent with market efficiency. Behavioral theories, such as Shleifer and Vishny (2003) and Rhodes-Kropf and Viswanathan (2004), argue that mergers and acquisitions happen due to managerial timing of market overvaluation: Acquirers experience long-run low returns because acquirers' shares and wealth gains from acquisitions are overstated and stock markets initially underreact to merger announcements. Empirical evidence by Loughran and Vijh (1997) and Savor and Lu (2009) supports the means of payment hypothesis that the managers tend to pay for the acquisitions with shares when they believe the shares are overvalued and pay with cash otherwise, resulting in long-run underperformance of stock-financed acquirers. Rau and Vermaelen (1998) propose the performance extrapolation hypothesis, which relates the long run returns to the nature of the acquirers (glamour vs. value[2]). They argue that the market and the acquirers' management assess the value of acquisition based on acquirers' past stock returns and earnings growth record. Consequently, glamour acquirers are overvalued around the announcement of acquisition, and in turn, their long run performance reverses.

Different from the existing behavioral literature, this paper aims at providing a neoclassical-based explanation that could explain all aspects of acquirers' post-merger underperformance. As pointed out in the real business cycle literature[3], fundamental economic shocks have different impacts on firms due to firms' heterogeneous composition of assets in place and growth opportunities. Firms with high investment rates exhibit high sensitivity to investment shocks, i.e., shocks to the cost of new capital.[4]

[2]Rau and Vermaelen (1998) define glamour (value) acquirers to be acquirers with low (high) book-to-market ratio.

[3]See, e.g., Berk, Green, and Naik (1999), Kogan and Papanikolaou (2012), Papanikolaou (2011), and Kogan and Papanikolaou (2011).

[4]Papanikolaou (2011), for example, models the different risk characteristics of assets in place and growth opportunities in a two-factor structural model. He argues that investment shocks represent a systematic source of risk. Kogan and Papanikolaou (2011) argue that firms differing

This argument is consistent with Campbell and Vuolteenaho (2004), who hypothesize that firms with abundant future opportunities, long duration of cash flows, and high dependence on external equity finance are more sensitive to discount rate shocks. I argue that acquirers are predominantly high q firms with rich growth opportunities and high investment rates, and thus vulnerable to investment shocks. It follows that the negative relation between investment and stock return is especially important in pricing acquirers. Standard asset pricing models used in the extant literature, such as the CAPM and the Fama-French three-factor model, do not account for the undiversifiable investment shocks. Ignoring the links between firms' investment rates and expected returns therefore results in long-term negative abnormal returns.

In this paper, I evaluate the post-merger performance using an investment-augmented model and a newly proposed model by Chen, Novy-Marx, and Zhang (2011) (hereafter, the q theory based model or CNMZ). I show that acquirers' long-run underperformance can be traced to low returns of the high q group. But such underperformance decreases in magnitude and even disappears after controlling for the investment factor.

This study proceeds by examining the long-term performance of 11,173 M&A transactions from 1984 to 2007. Using the Fama (1998) calendar-time approach, I examine the portfolio returns of all firms that completed M&A transactions in the previous 12, 24, or 36 calendar months. I confirm the findings in the existing literature that acquirers experience large negative abnormal returns when evaluated by the CAPM and the Fama and French (1993) three-factor model. To test my investment-based hypothesis, I employ an investment-augmented Fama-French model and the q theory based model. For my investment-based hypothesis to hold, the post-merger underperformance puzzle should be pronounced in the group of high q acquirers, but should substantially decline in magnitude and even disappear once the investment factor is introduced. In this case, the investment factor should load negatively on

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in past investment rates are likely to have different exposure to investment shocks.

the performance of high q acquirers because high investment rate of high q acquirers is negatively related to their long-term average returns. Since Tobin's q is highly correlated with the book-to-market ratio, my investment-based hypothesis also helps explain why so-called glamour acquirers earn relatively low returns compared to value acquirers. Instead of a mis-valuation story, my findings suggest that glamour acquirers earn low average returns because of their high tendency to invest.

I further examine cash-financed and stock-financed acquisitions separately. Instead of viewing the negative long-term abnormal returns of stock acquirers as evidence of performance reversal of the overpriced stocks, I argue that the empirical link between the means of payment and post-merger performance is driven by the acquirers' Tobin's q and their corresponding investment rates. Indeed, I find that the long-term underperformance of stock-financed acquirers can be explained by a high fraction of high q firms, a group characterized by high investment rates and low discount rates. Since equity issuers are typically high q firms, my argument is also consistent with Li, Livdan, and Zhang (2007), who argue that equity issuance leads to high investment and thereby low returns.

The tests conclude with an examination of long-term post-announcement performance of failed acquirers. Savor and Lu (2009) find that failed stock acquirers underperform in the long run more than successful ones. They view the disparity as value created for acquirers' long-term shareholders. They find even more pronounced results for failed glamour stock acquirers and interpret it as evidence that failure is more costly for highly valued stocks. Instead of a mis-valuation explanation, I argue that investment is the key factor that explains their low average returns. The documented low returns for both successful stock acquirers and failed stock acquirers can be traced to high q firms. The underperformance goes away once the investment factor is included in the asset pricing models.

Beyond applying the investment-based asset pricing theory to the empirical post-merger underperformance puzzle, this paper bridges the real business cycle literature

and the neoclassical theory of mergers. I document that, because both stock-financed acquirers and glamour acquirers have disproportionately high fractions of high q firms, which are characterized by high investment rates, investment is likely to be the key factor that links their underperformance. I provide an underlying explanation to the post-merger underperformance phenomenon and unify the empirical observations into a general framework. Rather than interpreting negative abnormal returns as evidence of overvaluation of glamour acquirers and stock-financed acquirers, I show that the low returns in the data are expected given acquirers' high investment rates.

The remainder of the paper is organized as follows. Chapter 2 briefly reviews the literature. Chapter 3 derives testable hypotheses and describes the methods. Chapter 4 describes the data and descriptive statistics. Chapter 5 presents the main results. Chapter 6 and Chapter 7 reports the extensions and the robustness tests. Chapter 8 concludes.

Chapter 2
RELATED RESEARCH

There is considerable disagreement about the cause of mergers. Neoclassical theory asserts that economic shocks trigger merger activities, while behavioral theory argues that mergers occur due to managerial timing of market overvaluation. Consequently, behavioral theory predicts that acquirers experience negative abnormal returns following the mergers, whereas neoclassical theory predicts that acquirers will perform better post-merger than they would have been without the merger. In the following sections, I will give a brief introduction of these competing literatures.

2.1 Behavioral theory

Behavioral theory argues that mergers occur when managers take advantage of stock market mispricing by using overvalued stocks to buy the assets of lower-valued firms. It follows that acquirers should endure poor long run post-merger performance when the market slowly corrects its mis-valuation of the acquirers. For example, Shleifer and Vishny (2003) develop a model in which overvalued firms finance acquisitions with stocks in order to purchase hard assets at an effective discount. Rhodes-Kropf and Viswanathan (2004) argue that target managers overestimate synergies during market valuation peaks and accept offers from overvalued acquirers. In what follows, I will briefly review two widely adopted explanations stemming from the behavioral theory.

2.1.1 Method of payment hypothesis

The method of payment hypothesis of mergers assumes market inefficiency. From the acquirers' perspective, stock-financed mergers involve two simultaneous transactions: a merger and an equity issue. In the presence of information asymmetry, Myers and Majluf (1984) show that firms will issue equity only when it is overpriced. It follows that the equity issuance is associated with long-term negative abnormal returns if the market fails to react fully at announcement. Managers exploit market inefficiencies by paying for their acquisitions with shares when they are overvalued and paying with cash otherwise (see, e.g. Shleifer and Vishny (2003)). Gregory (1997) and Loughran and Vijh (1997) tie the long-term negative abnormal returns to the method of payments and find that stock-financed acquirers perform worse than cash-financed acquirers. Their results suggest that the long-term underperformance is predominantly caused by the poor post-merger performance of stock-financed acquirers. Savor and Lu (2009) test whether stock-financed mergers benefit the acquirers' long-term shareholders. They use the long-term post-merger performance of failed acquirers as a proxy for how the successful ones would have performed had they not completed the merger transactions. Using calendar-time portfolio regression with the Fama-French three-factor model, they document much worse post-announcement performance of failed stock acquirers than that of successful stock acquirers over the 2-year holding period. In contrast, failed cash acquirers experience no underperformance compared to successful ones. They therefore conclude that stock acquirers create value by issuing overpriced equity to purchase hard assets at an effective discount as evidenced by the huge post-merger performance differential.

2.1.2 Performance extrapolation hypothesis

The performance extrapolation hypothesis ascribes the long-term negative abnormal return to glamour, i.e. high market-to-book, acquirers. Fama and French (1992) ar-

gue that value firms earn relatively high returns because they are exposed to higher distress risk. In contrast, Lakonishok, Shleifer, and Vishny (1994) argue that the value premium is not associated with risk, but instead arises because the market extrapolates the past performance of the firms when evaluating their future performance. Building on these arguments, Rau and Vermaelen (1998) develop the performance extrapolation hypothesis which asserts that both the market and the top management of the acquirers extrapolate past performance when assessing the value of new acquisitions. Glamour acquirers have high past stock returns and high past earnings growth, and are thus more likely to be overvalued than value acquirers. As the market slowly reassesses the quality of the acquirers, the initially overvalued glamour firms should experience negative long-term post-merger abnormal returns. Using the value/glamour classification, Rau and Vermaelen (1998) document negative post-merger abnormal returns for glamour acquirers and positive for value acquirers over the three-year period. Savor and Lu (2009) report that the post-merger performance disparity is more pronounced between failed and successful glamour stock acquirers than that between failed and successful value stock acquirers. They interpret it as evidence that failure is more costly for glamour stocks.

2.2 Neoclassical theory

2.2.1 Mergers and acquisitions

Neoclassical theory argues that mergers happen in an attempt to reap benefits from profitable reallocation opportunities following economic shocks, such as technological change, deregulation, and input price fluctuation. Economic shocks and widened dispersion in q ratios lead high q firms to buy low q firms in waves (see, e.g. Gort (1969) and Jovanovic and Rousseau (2002)).

Several papers provide empirical evidence supporting the neoclassical theory. For example, Mitchell and Mulherin (1996) tie the industry clustering in asset sales to

the industry economic shocks. Andrade, Mitchell, and Stafford (2001) confirm that industry economic shocks induce merger waves in 1980s and 1990s. Maksimovic and Phillips (2001) attribute asset sales between less and more productive plants to positive demand shocks. Harford (2005) highlights the role of macro-level liquidity in aggregate merger waves.

Under the neoclassical theory, mergers are viewed as an efficiency-improving response to various industry shocks. As such, it predicts that profitability improves following a merger. Acquirers will have better operating performance than they would have had without the merger. Since neoclassical theory is developed within a rational framework, it predicts that acquirers' post-merger abnormal returns are indifferent from zero.

2.2.2 Asset pricing

My investment-based hypothesis is motivated by the q theory of investment, which suggests that a firm's investment rate rises with its q and falls with its discount rate. In addition, recent developments in real business cycle theory investigate such a relation and link firms' risk premia and investment rates to their exposure to investment shocks. Below I introduce my theoretical motivation.

2.2.2.1 Negative relation between investment rates and expected returns

The negative relation between investment and expected return has been intensively studied in the q theory of investment, which was proposed by Tobin (1969) and advanced by Cochrane (1991). Tobin (1969) introduces the q ratio, the ratio of the market value of a firm to the replacement cost of its capital stock, and argues that a firm's investment should be positively related to its q. The higher the q ratio, the greater the incentive to invest. Cochrane (1991) develops a production-based asset pricing model and was the first to derive the negative relation between investment and expected returns through a discount rate channel. Intuitively, firms invest more

when the net present values (NPVs) of new projects are high. Meanwhile, the NPVs of projects are inversely related to the costs of capital or expected returns, controlling for the expected cash flows. Consequently, high (low) costs of capital lead to low (high) NPVs and low (high) investments.

Li et al. (2007) propose a cash flow channel, which implies a negative investment-expected return relation under decreasing returns to scale. Intuitively, positive productivity shocks lead to increases in q and investment. Assuming decreasing returns to scale, a higher investment is associated with a lower marginal product of capital and lower expected returns.

The real option model also builds on the relation between expected returns and firms' investment decisions. For example, Carlson, Fisher, and Giammarino (2004) argue that investment converts riskier expansion options into less risky assets in place. As such, firms with high investment rates are less risky and should earn lower expected returns. On the contrary, Ai and Kiku (2011) show that growth options are less risky than value assets in a general equilibrium setting. In their model, growth options are long lived and compete for scarce capital goods to exercise. The price of these capital goods are procyclical, and thus help offset the cyclical fluctuations in assets in place. As a result, option-intensive growth firms are less vulnerable to aggregate risks and yield lower returns than value firms.

This implication is consistent with a growing number of real business cycle models that highlight the role of investment shocks in driving economic growth and fluctuations in real business cycle (see, e.g., Papanikolaou (2011)). In this line of research, growth firms are more sensitive to investment shocks, i.e., shocks to the cost of new capital, than value firms. Since the risk premium of investment shocks is negative, growth firms earn lower average returns than value firms. Firms' investment rates are informative about firms' exposure to investment shocks, and therefore are negatively related to firms' expected returns.

2.2.2.2 Investment factor in models of expected returns

Recent studies about the empirical failures of the CAPM highlight the fact that firms with high valuation are difficult to price (e.g. Rosenberg et al. (1985), Fama and French (1992), and Fama and French (2004)). For example, Campbell and Vuolteenaho (2004) build a two-beta model and find that growth stocks have negative CAPM alphas because their betas are predominantly composed of good discount rate betas. However, their two-beta model fails to explain the performance of small-growth stocks. Cochrane (1991) introduces a different perspective on asset pricing from the production side of economy and ties the stock returns to investment returns. Cochrane (1996) finds that this production-based asset pricing model performs better than a simple consumption-based model as it connects asset returns to investment, which is far more volatile and characterizes the business cycle fluctuations better than the smooth nondurable consumption growth. However, in the subsequent empirical study by Li, Vassalou, and Xing (2006), Cochrane's model fails to explain the returns of the 25 book-to-market- and size-sorted Fama-French portfolios.

More recently, Chen et al. (2011) find that firm's real investment rate and return-on-equity help explain variation in stock returns in addition to the market beta. They augment CAPM with an investment factor and a profitability factor and show that this model outperforms traditional asset pricing models, such as CAPM and Fama-French three factor model, in explaining numerous anomalies, such as those associated with net stock issues and stock valuation ratios, and even helps explain the return of a small-growth portfolio, a group that is notoriously challenging to price.

The real business cycle literature rationalizes why return patterns obtained by sorting firms on investment rates are associated with expected returns. Researchers, such as Berk et al. (1999), Papanikolaou (2011), and Ai and Kiku (2011), argue that models built on only one source of risk cannot account for the failure of the conditional CAPM. Kogan and Papanikolaou (2011) propose a two-sector model with

two aggregate shocks: a productivity shock and an investment shock modeled as shocks to the cost of new capital. They decompose firm value, V_{ft}, into assets in place, VAP_{ft}, and the present value of growth opportunities, $PVGO_{ft}$. The value of assets in place depends only on the productivity shock, while the present value of growth opportunities depends positively on the productivity shock and negatively on the investment shock. Consequently, firm's stock return betas with respect to systematic shocks are time-varying, and depend linearly on the weight of growth opportunities in firm value. The expected excess return can be written as:

$$ER_{ft} - r_f = b_x\sigma_x - \frac{\alpha}{(1-\alpha)} b_z\sigma_z \frac{PVGO_{ft}}{V_{ft}} \tag{2.1}$$

where b_x, b_z, σ_x, and σ_z denote constant risk premia and volatility of productivity shock X and investment shock Z respectively, and α is the decreasing-returns-to-scale parameter, $\alpha \in (0, 1)$.

In their model, CAPM fails because differences in asset composition across firms are not fully captured by the market risk alone. Firms' investment rates are informative about their future excess stock returns because they are correlated with firm's exposure to investment shocks, i.e., the weight of growth opportunities in firm value. For example, a high investment rate signals a relatively large weight of growth opportunities in the firm value, implying that the firm is likely to be in a high marginal valuation state with low cost of new capital.

People might think that the book-to-market factor in the Fama-French three-factor model should capture the investment rate dimension well. However, the investment rate dimension is not priced properly in the Fama-French three-factor model because book-to-market ratio is a noisy measure of the weight of growth opportunities in firm value. Low book-to-market ratio may imply that the firm has rich growth opportunities. But it could also be the case that the firm's assets in place are highly profitable. Therefore, the book-to-market factor is an imperfect proxy for investment shocks. Since the traditional asset pricing models, such as CAPM and Fama-French three-

factor model cannot price the investment rate dimension well, I propose two ways to address this concern in the following chapter.

Chapter 3
HYPOTHESES AND METHODS

Building on the insights from q theory of investment and the real business cycle literature, I propose an investment-based hypothesis to explain the post-merger performance of acquirers. Below I first introduce my investment-based hypothesis and then briefly describe the empirical methods that I use to test my hypothesis.

3.1 The investment-based hypothesis of long run post-merger underperformance of acquirers

The neoclassical theory asserts that economic shocks lead to mergers and acquisitions. However, as pointed out in the real business cycle literature, firms do not have identical exposures to these shocks. The exposures to such shocks are determined by the relative weight of growth opportunities in firms' market value. Firms with rich growth opportunities exhibit relative high sensitivity to such shocks (Kogan and Papanikolaou (2011)). Since acquirers are generally high q firms with plentiful growth opportunities, I propose that acquirers' high investment rates are associated with low expected returns. The post-merger underperformance of acquirers can then be traced to low returns of high q acquirers. The underperformance puzzle arises because of the failure of traditional asset pricing models to account for heterogeneous impacts of investment shocks and the links between firms' investment rates and expected returns. To solve the problem, an investment factor should be included in empirical tests.

My investment-based hypothesis should also explain the performance disparity between glamour and value acquirers. Several researchers show that glamour firms invest more than value firms. Theoretical works, such as Abel and Blanchard (1983) and

Abel and Eberly (1994), suggest that optimal investment increases with productivity. Zhang (2005) develops an equilibrium model, which allows firms to make investment decisions based on their productivity. His model predicts that glamour firms are more productive and thus, are likely to invest more and grow faster, especially in good times.[1] In bad times, value firms are less flexible than glamour counterparts, and are likely to cut more capital than glamour firms because of asymmetric adjustment costs and a countercyclical price of risk. Because glamour acquirers have high tendency to invest compared to value acquirers, I hypothesize that the post-merger underperformance of glamour acquirers results from using empirical asset pricing models that are missing the investment factor.

My investment-based hypothesis predicts that stock acquirers underperform because they tend to be high q firms, have abundant profitable investment opportunities, and thereby are expected to earn low returns. Martin (1996) finds that firms with more investment projects are more willing to finance the merger with shares, which is consistent with my prior. If I divide the sample of stock acquirers into groups by their Tobin's q, I should be able to attribute the low post-merger returns to high q group. The investment-based argument is also coherent with equity issuance literature. For example, Li et al. (2007) augment the q theory to model the post-issuance underperformance. In their model, constraint on the flow of funds requires that the sources of funds equal the uses of funds, and implies that equity issuing firms are disproportionately high investment firms, whereas cash-distributing firms are disproportionately low investment firms. One resulting testable implication is that firms raising capital are associated with high investment and low expected returns. Lyandres, Sun, and Zhang (2008) conduct an empirical study and find that equity or debt issuers are likely to invest more and earn lower expected returns than non-issuers, a

[1] Zhang (2005) defines good times as times when aggregate productivity is more than one unconditional standard deviation above its unconditional mean, and bad times as times when aggregate productivity is more than one standard deviation below its unconditional mean.

result consistent with Li et al. (2007).

One prediction that distinguishes between behavioral and neoclassical theories focuses on the divergence between the performance of successful and failed stock-financed acquirers. Since behavioral theory predicts that market-timing benefits stock acquirers, bid failure is more costly to highly valued stock acquirers. It follows that the return differential between successful and failed stock acquirers should be more pronounced for glamour stocks. On the other hand, my investment-based hypothesis makes no such prediction. My hypothesis postulates that glamour stock acquirers should experience low returns because they have abundant growth opportunities regardless of whether they close the deals or not. After controlling for the investment factor, the disparity in performance should disappear.

In summary, the investment-based hypothesis suggests that a high fraction of acquirers is characterized by high Tobin's q, a proxy for growth opportunities. The negative relation between investment and expected return explains acquirers' post-merger underperformance. Empirical expected return models used in extant literature lead to a post-merger underperformance puzzle because they are mis-specified and miss the investment factor. Once this factor is added, the underperformance puzzle should disappear. Table 1 summarizes the predictions of the investment-based and behavioral hypotheses of acquirers' post-merger performance.

3.2 Methods

I investigate the role of investment in explaining the post-merger underperformance using Fama (1998)'s calendar-time portfolio regressions[2]. For each calendar month t between 1984 and 2010, I calculate both the equal-weighted and value-weighted

[2]A number of papers, e.g. Kothari and Warner (1997), Barber and Lyon (1997), Lyon, Barber, and Tsai (1999), Jegadeesh (2000), and Mitchell and Stafford (2000), address the difficulties raised by the cross-sectional dependence of sample returns and criticize the methodologies of long run return studies. Fama (1998)'s approach avoids the bad model problem and develops better statistical inferences.

returns, R^k_{pt}, on a portfolio consisting of all firms that have completed a merger transaction during the k months (k = 12, 24, 36) prior to the month of portfolio formation. The following two regressions are then estimated:

$$R^k_{pt} - R_{ft} = \alpha_{CAPM} + \beta_{CAPM} MKT_t + \epsilon^{CAPM}_{pt}. \tag{3.1}$$

$$R^k_{pt} - R_{ft} = \alpha_{FF} + \beta_{FF} MKT_t + s_{FF} SMB_t + h_{FF} HML_t + \epsilon^{FF}_{pt}. \tag{3.2}$$

The dependent variable is the monthly excess return of the post-merger portfolios. The risk-free rate, R_{ft}, is the one-month Treasury bill rate. MKT is the monthly return of the CRSP value-weighted index less the risk-free rate, SMB is the monthly premium of the size factor, and HML is the monthly premium of the book-to-market factor. The monthly premia of the Fama and French (1993) factors are obtained from Kenneth French's website. β, s, h denote the factor loadings. The intercept, α, stands for the monthly average abnormal return, or the unexplained part of the portfolio returns if the model is mis-specified (Fama (1998)). Following Loughran and Ritter (2000), I estimate calendar-time portfolio regressions using weighted least squares (WLS), in which the weight of each month corresponds to the number of event firms having non-missing returns during that month.[3]

To investigate whether the observed post-merger underperformance can be explained by a missing investment factor. I adopt two different factor models: the Fama-French three-factor model augmented with an investment factor and a q theory based model proposed by Chen et al. (2011)[4].

First, I augment Fama-French three-factor model with an investment factor. Similar to Lyandres et al. (2008), I construct the investment factor using the zero-cost portfolio return from buying stocks whose investment-to-assets ratio falls into the bottom 30% of the distribution and shorting stocks whose investment-to-asset ratio falls

[3]I focus my discussion on results obtained using WLS regressions, but the results are comparable when using OLS regressions. These results are available upon request.

[4]I thank Long Chen and Lu Zhang for kindly providing the data.

into the top 30% of the distribution, controlling for size and book-to-market ratio. The investment-to-asset ratio is defined as the annual change in plant, property, and equipment plus the annual change in inventories divided by the lagged book value of assets. In June of each year, all NYSE, Amex, and NASDAQ stocks are sorted into three book-to-market groups, three investment-to-assets groups, and two size groups, yielding 18 portfolios. Breakpoints of book-to-market ratio and investment-to-asset ratio are the low 30%, medium 40% and high 30% of the ranked values. The median NYSE market equity is also used to split NYSE, Amex and NASDAQ stocks into two size groups. Monthly value-weighted returns on the eighteen portfolios are calculated from July of year t to June of $t+1$. The investment factor (INV) is then defined as the average returns on the six low investment-to-assets portfolios minus the average returns on the six high investment-to-assets portfolios. Formally, let r_{ijk} be the value-weighted returns of portfolios composed by firms in the i^{th} group of size, the j^{th} group of book-to-market, and k^{th} group of investment-to-assets for i =1, 2 and j, k = 1, 2, 3. The investment factor is defined as:

$$INV \equiv \frac{1}{6}\sum_{i=1}^{2}\sum_{j=1}^{3} r_{ij1} - \frac{1}{6}\sum_{i=1}^{2}\sum_{j=1}^{3} r_{ij3}.$$

The average INV premium is 0.28% per month (t-statistic = 2.50) from 1984 to 2010. Compared to contemporaneous SMB of -0.05% (t-statistic = -0.54) and HML of 0.40% (t-statistic = 2.18), the average INV premium is economically significant. The correlation between INV and SMB is -0.07, and the correlation between INV and HML is 0.25. By design, the investment factor captures a large part of variation in cross-sectional returns that is independent of the Fama-French three factors.

To document the extent to which post-merger performance is determined by the investment factor, I repeat the regression analyses from above, but now include INV:

$$R^k_{pt} - R_{ft} = \alpha_{INV} + \beta_{INV} MKT_t + s_{INV} SMB_t + h_{INV} HML_t + \lambda INV_t + \epsilon^{INV}_{pt}. \quad (3.3)$$

Second, I apply the q theory based model proposed by Chen et al. (2011), in

which they replace Fama and French's (1993) size and book-to-market ratio with two neoclassical factors - an investment factor (IA) and a profitability factor (ROE). Similar to Fama and French (1993), they construct 27 portfolios by triple sorting stocks on size, investment-to-assets, and return-on-equity using the 30% and the 70% breakpoints of the ranked value. Their investment factor (IA) is then defined as the difference between the simple average of the returns on the nine low-investment portfolios and the simple average of the returns on the nine high-investment portfolios. The ROE factor is then defined as the difference between the simple average of the returns on the high-ROE portfolios and the simple average of the returns on the nine low-ROE portfolios. The average factor returns are economically significant, with the average IA return of 0.34% (t-statistic = 3.21) per month and the average ROE return of 0.93% (t-statistic = 3.29) per month during the sample period. To investigate the extent to which post-merger performance is explained by the investment factor, I use the calendar-time portfolio returns to estimate the following regressions:

$$R_{pt}^{k} - R_{ft} = \alpha_q + \beta_q MKT_t + s_q IA_t + h_q ROE_t + \epsilon_{pt}^{q}. \tag{3.4}$$

Chapter 4
DATA AND DESCRIPTIVE STATISTICS

I select all transactions between 1984 and 2007 that are classified either as a merger or an acquisition of majority interest from Thomson Financial's Securities Data Company (SDC) Platinum U.S. Mergers & Acquisitions database. To be included in the sample, the transaction must be listed as completed with a deal value of at least $1 million, and the acquirer must be a public firm covered by Compustat and the Center for Research in Security Prices (CRSP) with usable returns during the event window, i.e. three-year post-merger period.

The final sample consists of 11,173 mergers. To investigate the method of payments used by acquirers in the sample, I check if the total value of the transaction as reported by SDC is equal to the value paid through common shares or through cash. Accordingly, I classify the event as 100% stock-financed or 100% cash-financed respectively. The rest is categorized as mixed payments. The sample consists of 3,396 (30.4%) cash payments, 4,204 (37.6%) stock payments, and 3,573 (32.0%) mixed payments. Panel A of Table 2 reports the number of consummated deals by the three financing types for each year.

I also collect a sample of failed bids using SDC Platinum U.S. Mergers & Acquisitions database. To be included in the sample, acquirers must be U.S. public firms, and the announcement date must fall within 1984 to 2007 with a deal value of at least $1 million. The deal status must be classified as withdrawn. I follow Savor and Lu (2009) in limiting the failed bids to be the first offer by a given acquirer for a given target to avoid overweighting contested deals with multiple bids. Specifically, I use the Challenged Deal Flag as a filter to screen for challenged deals and then manually

sort the data based on the announcement date to determine the first bidder. The final sample consists of 1,266 failed acquisitions grouped into three financing categories: 259 (20.5%) cash payments, 524 (41.4%) stock payments, and 483 (38.1%) mixed payments. Panel B of Table 2 reports the number of unconsummated deals by the three financing types for each year.

The frequency distributions by size and Tobin's q of the acquiring firms are presented in Table 3 and Table 4. Tobin's q is defined as the ratio of market value to the replacement cost of capital (see, e.g. Andrade et al. (2001), Rhodes-Kropf and Viswanathan (2004)). Following Kaplan and Zingales (1997) and Gompers, Ishii, and Metrick (2003), I compute Tobin's q as market value of assets divided by the book value of assets, where market value of assets is calculated as the book value of assets plus the market value of common stock less the sum of book value of common equity and balance sheet deferred taxes. I measure acquirers' q at the most recent fiscal year-end prior to the deal announcement date. For firms that announce acquisitions in the period from July of year t to June of year t+1, I calculate Tobin's q at the fiscal year-end of calendar year t. Table 3 shows the frequency distribution over size and Tobin's q quintiles for the successful acquirers. I test each q category whether the proportion is smaller than or equal to 20% using z-test and find a disproportionately high fraction of acquirers in the highest q quintile regardless of payment methods. In the stock-financed sample, 37.79% of firms fall into the highest Tobin's q category relative to the universe of stocks traded on the NYSE, AMEX, or NASDAQ, while only 27.95% of cash-financed deals have acquirers in the highest q group. This might imply that potential growth opportunities influence the financing of acquisitions. Table 4 shows the frequency distributions by size and Tobin's q ratio of the failed acquirers. Similar to the sample of consummated deals, the sample of failed acquirers tilts towards small and high q acquirers, a group that is notoriously difficult to price. This skewness toward small cap firms is pronounced in failed stock-financed sample, with 48.12% of the failed stock acquirers in the smallest quintile. The distribution of failed

stock acquirers across Tobin's q quintiles is similar to that of failed cash acquirers, with approximately 30% falling into the highest q quintile.

In untabulated results, I find that median value of the q ratio for the successful acquirers is 3.03, with 3.99 for successful stock acquirers and 2.08 for successful cash acquirers. For failed acquirers, the median q ratio is 2.13, with 2.40 for failed stock acquirers and 1.68 for failed cash acquirers. Compared to the contemporaneous median q ratio of 1.35 for all stocks listed on AMEX, NYSE, and NASDAQ, the sample of acquirers is skewed towards high Tobin's q firms. Figure 1 plots successful and failed acquirers' median Tobin's q (Panel A) and the ratio of capital expenditure plus R&D to asset (Panel B) from two years before the deal announcement to three years after the deal announcement. Acquirers' Tobin's q ratios are well above the market median q and reach a peak in the year of mergers and acquisitions. Similar pattern can be found in acquirers' CAPEX plus R&D-to-asset ratios, which climb steadily and reach a plateau in the event year.

It is documented that real investment and profitability explains cross-sectional expected returns of stocks (e.g., Chen et al. (2011) and Kogan and Papanikolaou (2011)). Theoretically, high investment can result from high profitability and/or low cost of capital (e.g., Fama and French (2006a) and Liu, Whited, and Zhang (2009)). Thus, the negative relation between investment-to-assets and average returns is conditional on a given level of profitability. Similarly, the positive relation between profitability and average returns is conditional on a given level of investment. Here I investigate the investment and profitability evolution for acquirers and matching nonacquirers.

Panel A of Figure 2 plots the median investment-to-assets for acquirers and the industry-, size-, and book-to-market-matched nonacquirers during the three-year post-merger window. Panel A shows that acquirers' median investment-to-assets is about twice of nonacquirers' median investment-to-assets in the first post-merger year. It drops sharply during the second post-merger year and converges to the same level

as that of nonacquirers around month 30. The pattern of this positive investment-to-assets spread is consistent with the acquirers' underperformance, with the poorest returns appearing in the first post-merger year.

Panel B of Figure 2 plots the median return-on-equity for acquirers and nonacquirers during the three-year post-merger window. I measure return-on-equity as income before extraordinary items divided by one-quarter-lagged book equity. Panel B documents that acquirers are more profitable than the industry-, size-, and book-to-market-matched nonacquirers. The median return-on-equity of acquirers is about 50% more than that of nonacquirers in the first post-merger year. This positive profitability spread cannot explain why acquirers underperform nonacquirers. As such, the preliminary evidence here suggests that real investment is more important than profitability in explaining acquirers' post-merger returns.

Chapter 5

MAIN RESULTS

5.1 Evidence on post-merger underperformance

The CAPM and the Fama and French (1993) three-factor model are used in the first test to confirm the literature that there exists post-merger underperformance in my sample. Strong evidence of underperformance following the merger is documented in Table 5. In Panel A, the monthly equal-weighted CAPM alpha is -0.63% (t-statistic = -3.73), -0.51% (t-statistic = -3.10), and -0.33% (t-statistic = -2.00) for one-, two-, and three-year post-merger horizon, respectively. The results from the Fama-French (1993) three-factor model are similar. The monthly equal-weighted Fama-French alpha is -0.46% (t-statistic = -3.24), -0.44% (t-statistic = -3.18) , and -0.33% (t-statistic = -2.34) over one-, two-, and three-year post-merger horizon, respectively. Panel B reports results for value-weighted portfolio returns. Consistent with Loughran and Ritter (2000) and Fama (1998), I find that the three-year value-weighted Fama and French alpha shrinks to -0.20% per month (t-statistic = -1.16) and becomes insignificant, whereas the one- and two-year value-weighted Fama-French abnormal returns are still negative and significant.

5.2 Post-merger performance after controlling for the investment factor

In this section, I investigate whether the observed post-merger underperformance can be explained by a missing investment factor. I adopt two different factor models: the Fama-French three-factor model augmented with an investment factor and a q theory based model proposed by Chen et al. (2011).

The third column of Panel A and B in Table 5 presents regression results estimated

using the investment-augmented Fama-French model. First, notice that the coefficient on INV is always significantly negative at 1%, suggesting that INV helps explain the returns of acquirers over long-term post-merger period. The significantly negative sign of investment factor is consistent with my conjecture that high investment rates of the acquirers impact the long-term average returns. The magnitude of post-merger abnormal returns is reduced when the investment factor is included. The monthly equal-weighted Fama-French alpha shrinks from -0.46% (t-statistic = -3.24) to -0.36% (t-statistic = -2.53), from -0.44% (t-statistic = -3.18) to -0.30% (t-statistic = -2.20), and from -0.33% (t-statistic = -2.34) to -0.20% (t-statistic = -1.47) per month over one-, two-, three-year post-merger horizon, respectively.

The fourth column of Panel A and B in Table 5 presents regression results estimated using the q theory based model. The equal-weighted and value-weighted post-merger abnormal returns become smaller (in absolute value) and insignificant. Since percentage mis-valuations are usually greater among small firms than among big firms, value-weighting the portfolio returns tends to reduce abnormal returns. In the subsequent analysis, I focus on results using equal-weighted returns. The equal-weighted portfolio has abnormal return of -0.01% (t-statistic= -0.08), 0.07% (t-statistic = 0.50), and 0.17% (t-statistic = 1.17) per month over one-, two-, and three-year post-merger horizons, respectively. Note that the loadings on the q theory investment factors are negative and highly significant, suggesting that acquirers have large exposures to investment shocks and thus earn low average returns.

Taken together, the results presented in Table 5 suggest that investment factor explains post-merger performance. The abnormal returns are statistically significantly negative under the CAPM and Fama-French three-factor specifications. Adding an investment factor into the Fama-French specification substantially reduces the magnitude of underperformance. Using the q theory based model, the alphas become insignificant. Furthermore, the negative and significant coefficients on the investment factor support my conjecture that investment is the key variable that explains the

acquirers' post-merger performance.

5.3 Evidence on acquirers' Tobin's q and the investment-based explanation

Thus far, I have emphasized that the nature of the acquirers (i.e. high Tobin's q ratio) leads acquirers to invest more and in turn earn lower average returns than non-acquirers. I have shown that a new investment factor is negatively related to acquirers' long-term post-merger returns. To provide more evidence on the role of investment factor in explaining the observed post-merger underperformance, I perform calendar-time portfolio regression on the following two subsamples: 1) high q acquirers (i.e. the acquirers with Tobin's q ratio higher than the 70% Tobin's q breakpoint of stocks listed on AMEX, NYSE, and NASDAQ), and 2) low q acquirers (i.e. the acquirers with Tobin's q ratio lower than the 30% Tobin's q breakpoint).

Turning first to the CAPM and Fama-French (1993) specifications for post-merger performance in Table 6, the results are consistent with my prior that the underperformance of acquirers is predominately caused by high q acquirers. For example, over one-, two-, and three-year horizons, the portfolio containing high q acquirers has a monthly equal-weighted CAPM alpha of -1.10% (t-statistic= -5.00), -0.95% (t-statistic= -4.60), and -0.67% (t-statistic=-3.18), respectively, while the portfolio of low q acquirers earn insignificant abnormal returns. Consistent with Fama and French (2006b), I find that high q acquirers, with low average returns, have high market betas, and therefore CAPM fails to explain the data.

I also form a long-short portfolio by buying stocks of low q acquirers and shorting stocks of high q acquirers, and find positive and significant abnormal returns under the CAPM and the Fama-French three-factor model. The results presented in Table 6 suggest that the difference in performance between the high q and low q acquirers is striking when using the conventional asset pricing model.

Turning next to the investment-augmented Fama-French model for post-merger

performance in Table 6, I show that the long-term underperformance can be explained by the investment factor. Adding the investment factor to the Fama-French model reduces the magnitude of underperformance of high q acquirers; for example, the equal-weighted alpha from Fama-French model decreases in magnitude from -0.68% (t-statistic = -3.40) to -0.34% (t-statistic = -1.79) and from -0.68% (t-statistic= -3.60) to -0.35% (t-statistic = -1.91) per month over the one- and two-year post-merger horizon, respectively. The abnormal return becomes insignificant even at 10% level, from -0.50% (t-statistic= -2.54) to -0.26% (t-statistic = -1.37) per month over the three-year post-merger window. Noteworthy, the loadings on the investment factor for the portfolio formed by high q acquirers range from -0.70 to -0.57, and are significant at 0.1% level. The negative effect of the investment factor on post-merger performance is only traced to high q acquirers, corroborating my prior that high q acquirers are exposed to more investment opportunities and should have lower loadings on the investment factor than low q firms.

Employing the q theory based model yields similar results. High q acquirers earn insignificant abnormal returns of -0.05% (t-statistic = -0.27), 0.05% (t-statistic = 0.31), and 0.20% (t-statistic = 1.16) per month over the one-, two-, and three-year post-merger window, while low q acquirers earn insignificant abnormal returns over two-and three-year post merger window. Investment appears to have a negative effect on the performance of high q acquirers while positive effect on the performance of low q acquirers. These subsample differences suggest that the exposure to the investment factor is highly correlated with the nature of the acquiring firms and is likely to be the underlying driving force for the observed difference in post-merger performance. The results from the long-short portfolio show that the differential in long-term performance between high q and low q acquirers is negligible after the investment factor is included. In the untabulated results, the long-short portfolio has significantly positive loadings on the investment factor, meaning that the low q acquirers have a significantly lower average investment rate than the high q group.

Taken together, the results presented in Table 6 strongly suggest that the nature of the acquirers influences post-merger performance. The investment factor explains not only the poor post-merger returns of high q acquirers but also the performance differential between high q and low q acquirers, thereby resolving the post-merger underperformance puzzle.

Chapter 6

EXTENSIONS

6.1 Evidence on glamour vs. value acquirers

I also report the regressions in Table 6 for glamour vs. value acquirers. Since the book-to-market ratio is highly related to the inverse of Tobin's q,[1] it is not surprising that the results for glamour vs. value acquirers are quite similar to those for high q vs. low q acquirers. I document that the observed disparity in long-term performance between glamour acquirers and value acquirers is determined by their exposure to investment factor, rather than mispricing (Rau and Vermaelen (1998)). The glamour firms have lower loadings on the investment factor than value firms, so glamour acquirers should earn lower average returns.

6.2 Evidence on the method of payment and the investment-based explanation

Having shown that the investment factor helps interpret the difference of post-merger performance between glamour and value acquirers, I now evaluate the role of investment factor in explaining the performance heterogeneity of cash-financed acquirers and stock-financed acquirers. Previous studies establish that the mode of payment impacts post-merger returns, with stock-financed acquirers experience greater underperformance than cash-financed acquirers (see, e.g., Loughran and Vijh (1997)). I propose an alternative interpretation of their observed differences in post-merger returns. I argue that the substantial underperformance of stock-financed acquirers can be traced to high q stock acquirers, a group that is characterized by high investment-

[1]The difference arises because firms are financed both by equity and by debt.

to-asset ratio and low discount rates.

First, I reexamine the empirical link between means of payment and post-merger returns. I split the sample according to the means of payment and perform calendar-time factor regressions to the mergers solely financed by cash and those solely financed by equity. In untabulated results, I find that the equal-weighted CAPM and Fama-French alphas are negative and statistically significant for the stock-financed acquirers. In contrast, the CAPM and Fama-French alphas are virtually never statistically significant different from zero for cash-financed acquirers. The differences in long-term returns between cash-financed group and stock-financed group are highly significant under traditional asset pricing models. For example, the performance differential between cash and stock-financed acquirers over the three-year post-merger horizon is 0.43% per month (t-statistic = 2.94) under the CAPM and 0.28% per month (t-statistic = 1.98) under the Fama-French three-factor model. The evidence under the CAPM and Fama-French three-factor specifications confirms the predominant literature that stock-financed acquirers underperform cash-financed acquirers in the long run. However, this pronounced performance difference becomes an insignificant 0.05% per month (t-statistic = 0.38) under the q theory based model.

In order to test whether the underperformance of stock acquirers can be attributed to the disproportionately high fraction of high q firms, I further partition the sample of stock acquirers. Consistent with the previous classification, calendar-time portfolio regression is performed for two subsamples: 1) high q stock acquirers (i.e. the stock-financed acquirers with Tobin's q higher than the 70% q ratio breakpoint), and 2) low q stock acquirers (i.e. the stock-financed acquirers with Tobin's q lower than the 30% q ratio breakpoint).

Table 7 reports the calendar-time portfolio regression results for high q and low q stock acquirers, respectively. In the CAPM and the Fama-French three-factor regression, I note that the portfolio containing high q stock acquirers has significantly negative equal-weighted returns over all three horizons, whereas the portfolio of low

q stock acquirers has insignificant returns over two- and three-year post-merger windows. This subsample difference shows that the long-term underperformance of stock acquirers is caused by poor performance of high q stock acquirers.

Augmenting the Fama-French model with an investment factor substantially reduces the magnitude of such underperformance and makes it insignificant. In Table 7, the high q stock acquirers' equal-weighted abnormal return from the Fama-French model decreases from -0.71% (t-statistic = -2.22) to -0.19% (t-statistic= -0.59), from -0.94% (t-statistic=-3.06) to -0.34% (t-statistic= -1.16), and from -0.68% (t-statistic= -2.21) to -0.20% (t-statistic= -0.64) per month over one-, two-, and three-year post-merger horizon, respectively. Notably, the investment factor has substantial negative effects on the performance of high q stock acquirers, suggesting that high q stock acquirers have high investment rates and face lower discount rates than low q stock acquirers.

Turning next to the q theory based model presented in the fourth column of Table 7, the portfolio of high q stock acquirers has insignificant returns over one- and two-year post-merger windows and even earns a positive abnormal return of 0.49% (t-statistic =1.89) per month over the three-year horizon. As predicted, strong and persistent negative loadings on the investment factor explain the low returns on the high q stock acquirer portfolio, while the low q stock acquirer portfolio has a positive exposure to the investment factor, which contributes positively to average returns.

I assert that it is the nature of the firm, rather than the method of financing, that drives the investment factor and in turn influences the returns. For robustness, I partition the sample of cash-financed acquirers and perform the same study on high q and low q cash acquirers. In the untabulated results, I find that the portfolio return of high q cash acquirers loads negatively on the investment factor over all three horizons but the loadings are positive or insignificant for low q cash acquirers. The evidence supports the conclusion that high q firms have lower loadings on investment factors than low q firms and thus earn lower average returns.

To sum up, the stock-financed acquirers are largely composed of high q firms, with 41% classified as high q firms and only 11% low q firms. The high q firms are characterized by abundant investment opportunities and low discount rates. Therefore, the observed underperformance of stock-financed acquirers results from the low average returns of high q firms. Once the investment factor is taken into account, the stock-financed acquirers exhibit no underperformance compared to cash-financed acquirers.

6.3 Post-announcement performance of failed acquirers

Thus far, I have emphasized that the nature of the acquirers determines the investment rates, which in turn impact their performance, and I have presented results from successful acquirers. In this section, the sample of failed acquirers is examined. This investigation builds upon Savor and Lu (2009), who use the performance of failed stock acquirers as a proxy for how stock acquirers would have performed in the absence of merger. They point out a substantial difference between successful and failed stock acquirers in contrast to inconsequential difference between successful and failed cash acquirers, which therefore supports the behavioral theory that overvalued firms create value by converting their overpriced equity into hard assets. Further, they document more pronounced results for glamour stock acquirers and interpret this as evidence that failure is more costly for richly valued acquirers.[2]

Instead of viewing low average returns of failed stock acquirers as per se evidence of failures to take advantage of mispricing in the market, I link the low returns to firm's Tobin's q. Specifically, I argue that firms making offers share the same characteristics: high Tobin's q, plentiful investment opportunities, high sensitivity to investment shocks, and low discount rates. Like the underperformance of successful stock acquir-

[2]Other than the all failed sample, Savor and Lu (2009) also create a subsample of those failed for exogenous reasons, such as regulatory disapproval, subsequent competing offers, or unexpected target developments. This alleviates the concern that the cause of bid termination was related to the acquirer's valuation.

ers, the negative abnormal returns of failed stock acquirers are driven by the poor performance of failed high q stock acquirers and can be explained by the investment factor.

I begin by reexamining the performance of failed stock acquirers using calendar-time portfolio regressions with CAPM and Fama-French three-factor model. Different from the previous sections in which the portfolio consists of firms that have completed acquisitions during the three horizons, here the portfolio contains firms that have initiated failed bids during the one-year, two-year, and three-year prior to the month of portfolio formation. In untabulated results, I find that portfolio of failed stock acquirers earn negative and significant abnormal returns, consistent with previous studies. For example, the portfolio of failed stock acquirers earns an equal-weighted CAPM alpha of -1.90% (t-statistic = -4.74), -0.82% (t-statistic = -2.81), and -0.80% (t-statistic = -3.35) per month over one-, two-, and three- post-announcement window, respectively.

In the unconsummated deals, 39% of failed stock sample is composed by high q firms and only 21% by low q firms. Therefore, I argue this underperformance can be attributed to low average returns of high q group. Table 8 presents the long-run post-announcement returns of failed high q and low q stock acquirers. Turning first to the CAPM and the Fama-French three-factor specifications in Table 8, failed high q stock acquirers underperform, especially over the one-year post-announcement window, while failed low q stock acquirers earn insignificant abnormal returns over all three post-announcement horizons. Turning next to the investment-augmented Fama-French model and the q theory based model, failed high q stock acquirers do not underperform the market over all three windows. More importantly, the loadings on the investment factors are negative and significant for failed high q stock acquirers whereas insignificant for failed low q stock acquirers. This subsample differences suggest high investment rates of failed high q stock acquirers impact their post-announcement performance.

As a robustness check, I run calendar-time portfolio regressions for failed high q and low q cash acquirers. I predict that the failed high q cash acquirers exhibit high sensitivity to the investment shocks, and thus should load more negatively to the investment factor than the failed low q cash acquirers. In the untabulated results, the negative effect of the investment factor on performance is traced only to the high q group, consistent with my earlier interpretation that high q firms are exposed to more investment opportunities than low q firms, which thereby lowers the average returns of high q group. Moreover, the results here suggest that my hypothesis holds regardless of the method of financing.

The behavioral theory predicts pronounced long-run performance difference between successful and failed glamour stock acquirers. The large performance disparity is viewed as evidence that failure is more costly for richly valued stocks. I form a long-short portfolio by buying stocks of successful glamour stock acquirers and shorting failed glamour stock acquirers. Table 9 presents the results. The performance differential is positive and significant under the CAPM and Fama-French three-factor models over three-year post-announcement windows. After including the investment factor in Fama-French specification, the magnitude of the difference remains about 0.3% per month. When q theory based model is employed, the performance disparity becomes insignificant.

Taken together, the poor performance of failed stock acquirers can be traced to the high q firms. High q firms are exposed to rich investment opportunities and sensitive to investment shocks; therefore, their high investment rates are associated with low discount rates. This result holds regardless of the methods of payment. Traditional asset pricing models, such as CAPM and Fama-French three-factor model, fail to take into account the link between investment and performance, and hence, produce negative and significant abnormal returns. Once the investment factor is included, I observe neither pronounced underperformance for failed stock acquirers nor substantial performance disparity between successful and failed glamour stock

acquirers.

Chapter 7

ROBUSTNESS

7.1 Event-time factor regression

To closely examine the evidence on the role of the investment factor in explaining the post-merger underperformance, I perform the event-time factor regressions (see, e.g. Ball and Kothari (1989), Lyandres et al. (2008)). Six different portfolios are formed in event-time regressions. The first portfolio is composed by firms that have initiated merger bids within the preceding six months, the second portfolio is composed of firms that have completed M&A transactions between 7 and 12 months ago, and so on. The last portfolio is composed by firms that have completed M&A transactions between 31 and 36 months ago.

Figure 3 reports the event-time equal-weighted alphas of the portfolios from CAPM, the Fama-French three-factor model, the investment-augmented Fama-French model, and the q theory based factor regressions. The lines in Panel A show that the underperformance of the successful acquirer portfolio appears mostly in the first post-merger year. The worst underperformance, -0.63% per month, appears during months 7-12. On the other hand, the q theory based model produces none of the negative abnormal returns. In Panel B, the portfolio of successful high q acquirers has worst abnormal return, -1.15% per month, during the first six month post-acquisition. The underperformance is quite persistent over the three-year horizon. However, the abnormal returns are indistinguishable from zero under the q theory based model. In Panel C, the portfolio returns of successful stock acquirers are examined. The underperformance of the stock acquirer portfolio appears mostly in the first two post-merger years, with the worst abnormal return, -1.08% per month, in the first 12 months. The magnitude

of poor performance falls substantially when the investment-augmented Fama-French model is employed - the abnormal returns become -0.49% and -0.44% per month during month 1-6 and month 7-12, respectively. Such underperformance disappears under the q theory based model. The model even yields positive abnormal return, 0.34% per month, during month 31-36. The result suggests that when the investment factor is included, the stock acquirers no longer underperform. Panel D examines the portfolio abnormal returns of failed high q stock acquirers. The worst performance, -3.47% per month, appears in the first six month. This underperformance decreases in magnitude when the investment factor is added in the Fama-French three-factor model. Under the q theory based model, the poor performance is only pronounced in the first six months, and the magnitude shrinks to -0.87% per month. The results from event-time factor regression confirm that the investment factor largely eliminates acquirers' post-merger underperformance.

7.2 Buy-and-hold abnormal returns

To study the role of real investment rate as a matching characteristic, I calculate long-term buy-and-hold abnormal returns using the reference portfolio approach (Lyon et al. (1999)). I construct two reference portfolios that match acquirers and control firms on industry, size, and book-to-market, with and without matching on investment-to-assets. The first reference portfolio is constructed as follows. For each acquirer, I select all firms that (i) were not involved in a merger bid in the prior 36 months, (ii) belong to the same industry (two-digit SIC code) as the sample firm, and (iii) belong to the same size, book-to-market quintile as the sample firm. The approach to construct the second reference portfolio is similar, except that I require firms to be in the same size, book-to-market, and investment-to-assets quintile as the sample firm in (iii). If the control firm in reference portfolio is delisted, I fill its returns with the average monthly returns of the remaining firms in the reference portfolios. The buy-and-hold abnormal return (BHAR) for

acquirer i is calculated as $BHAR_{i,\tau} = BHR_{i,\tau} - BHR_{p_i,\tau}$, where $BHR_{i,\tau}$ is the buy-and-hold returns over horizon τ, and $BHR_{p_i,\tau}$ is the buy-and-hold returns of the corresponding reference portfolio. The mean BHARs are calculated as $BHAR_\tau = \frac{\sum_{k=1}^{n_\tau} BHR_{k,\tau} - BHR_{p_k,\tau}}{n_\tau}$, where n_τ is the number of event firms that have BHRs over horizon τ. Since the distribution of long-run abnormal stock returns is positively skewed (e.g., Barber and Lyon (1997) and Lyon et al. (1999)), I use Lyon et al. (1999)'s skewness-adjusted t-statistic: $t_{sa,\tau} = \sqrt{n_\tau}(S + \frac{1}{3}\hat{\gamma}S^2 + \frac{1}{6n_\tau}\hat{\gamma})$, where $S = \frac{BHAR_\tau}{\sigma(BHR_{i,\tau} - BHR_{p_i,\tau})}$, $\hat{\gamma} = \frac{\sum_{i=1}^{n_\tau}((BHR_{i,\tau} - BHR_{p_i,\tau}) - BHAR_\tau)^3}{n_\tau \sigma(BHR_{i,\tau} - BHR_{p_i,\tau})^3}$, and $\sigma(BHR_{i,\tau} - BHR_{p_i,\tau})$ is the standard deviation of abnormal returns for the sample of n_τ event firms.

Figure 4 plots the mean BHARs of acquirers during the three-year post-merger horizon. The mean BHARs of successful acquirers over the three-year post-merger window shrinks from -12.1% to -9.8% after matching on investment-to-assets. The mean BHARs of failed acquirers displays similar pattern, reducing the underperformance from -14.1% to -10.7% over the three-year post-merger window. The evidence here shows that investment-to-assets provides incremental explanatory power for post-merger underperformance.

Chapter 8
CONCLUSIONS

In this paper, I show that the post-merger underperformance is explained by a key variable, investment, in ways consistent with the predictions of q theory of investment. The extant literature typically values acquirers using standard asset pricing models, such as the CAPM and the Fama-French three-factor model, which fail to take into account the negative relation between investment and expected returns, and hence, result in a post-merger performance puzzle. Upon documenting that a disproportionately high fraction of acquirers are high Tobin's q firms, a group that is sensitive to investment shocks and is characterized by high investment ratio and low discount rate, I use an investment-augmented Fama French model and a q theory based model to examine acquirers' long-term performances. By linking the acquirers' expected returns to investment, my work rationalizes the empirical observations that stock acquirers and glamour acquirers experience long-term low returns after acquisitions. Their underperformance shrinks in magnitude and even becomes indistinguishable from zero once the investment factor is considered. I also examine the unconsummated deals and document that the poor returns of failed stock acquirers can be traced to high q firms. Moreover, the negative abnormal returns are only found when using the CAPM and the Fama-French three-factor specification. Adding the investment factor, I do not find the substantial underperformance for failed glamour stock acquirers or persistent performance difference between successful and failed glamour stock acquirers claimed in the literature.

This paper brings the insights from the investment-based asset pricing theory to solve the empirical post-merger underperformance puzzle. Acquirers are largely high

q firms. As pointed out in the literature, high q firms are difficult to price using the CAPM or Fama-French three factor model. Explicitly accounting for the negative investment-expected returns relation significantly improves the ability to value shares of high q firms and explain acquirers' long term performance.

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Table 1

Predictions of the investment-based & behavioral hypotheses for post-merger performance of acquirers

	Investment-based	Behavioral
High *q* acquirers (Glamour acquirers)	Insignificant abnormal returns once investment is included in the asset pricing model. Negative loadings on the investment factor.	Negative abnormal returns in any asset pricing model.
Stock-financed acquirers	Negative abnormal returns of high *q* stock acquirers under the CAPM and the Fama-French three-factor model. Insignificant abnormal returns once investment is included in the asset pricing model. Negative loadings on the investment factor.	Negative abnormal returns in any asset pricing model.
Failed high *q* stock acquirers (Failed glamour stock acquirers)	Insignificant abnormal returns once investment is included in the asset pricing model. Negative loadings on the investment factor. Insignificant performance differential between successful and failed glamour stock acquirers.	Negative abnormal returns in any asset pricing model. Significant performance differential between successful and failed glamour stock acquirers.

Table 2

Consummated sample and unconsummated sample by year and type of payment

This table reports the number of merger and acquisition events each year. Acquirers must be U.S. public firm covered by Compustat and the Center for Research in Security Prices (CRSP) with usable returns during the event window (i.e. three-year post-merger period). The deal value must be at least $1 million. The consummated sample (Panel A) consists of completed deals announced and completed between 1984 and 2007. The unconsummated sample (Panel B) consists of failed deals announced between 1984 and 2007 and listed as withdrawn in SDC Platinum U.S. Mergers & Acquisitions database. In each panel, the column labeled "ALL" reports the total number of sample observations. The columns labeled "CASH" and "STOCK" report the numbers of deals that are financed solely by cash and by stocks, respectively. The column labeled "MIXED" reports the numbers of deals that are financed by mixed payments.

Panel A: Consummated Deals

Year	ALL	CASH	STOCK	MIXED
1984	282	5	0	277
1985	213	61	33	119
1986	179	102	66	11
1987	234	89	76	69
1988	221	105	65	51
1989	196	84	68	44
1990	212	78	77	57
1991	217	72	76	69
1992	329	90	160	79
1993	454	104	214	136
1994	596	176	297	123
1995	700	177	363	160
1996	806	196	411	199
1997	836	207	407	222
1998	955	190	490	275
1999	794	169	409	216
2000	824	170	392	262
2001	547	146	206	195
2002	370	141	92	137
2003	358	160	77	121
2004	477	205	79	193
2005	462	213	53	196
2006	435	224	52	159
2007	476	232	41	203
Total	11,173	3,396	4,204	3,573
In %	100%	30.4%	37.6%	32.0%

Panel B: Unconsummated Deals

Year	ALL	CASH	STOCK	MIXED
1984	62	4	3	55
1985	43	16	16	11
1986	49	19	13	17
1987	51	12	12	27
1988	76	28	20	28
1989	63	15	24	24
1990	40	8	13	19
1991	46	4	32	10
1992	41	7	23	11
1993	45	5	23	17
1994	80	15	36	29
1995	81	16	40	25
1996	77	6	42	29
1997	95	14	43	38
1998	83	14	41	28
1999	76	16	32	28
2000	71	18	35	18
2001	45	8	22	15
2002	27	2	14	11
2003	20	6	9	5
2004	27	6	12	9
2005	23	7	9	7
2006	19	5	4	10
2007	26	8	6	12
Total	1,266	259	524	483
In %	100%	20.5%	41.4%	38.1%

Table 3

Consummated deals by size and Tobin's *q* ratio

This table reports the frequency distribution (in percent) over size and Tobin's *q* quintiles for the consummated sample (Panel A), the sample of successful cash-financed deals (Panel B), and the sample of successful stock-financed deals (Panel C). The size is defined as the price per share at the end of June times the number of shares outstanding. Tobin's *q* ratio is measured at the most recent fiscal year-end prior to the deal announcement date. For firms that announce acquisitions in the period from July of year *t* to June of year *t+1*, I calculate the Tobin's *q* at the fiscal year-end of calendar year *t*. Tobin's *q* is market value of assets divided by the book value of total assets, where market value of assets is calculated as the book value of assets (AT) plus the market value of common stock (PRCC_F*CSHO) less the sum of book value of common equity (CEQ) and balance sheet deferred taxes (TXDB). The NYSE breakpoints of size are from Kenneth French's Web site. The breakpoints of *q* are calculated using all stocks listed on NYSE, AMEX, and NASDAQ. I test each size (*q*) category whether the proportion is smaller than or equal to 20% using z-test. The symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: All consummated Sample

	Size					
	Small	2	3	4	Large	All
Low *q*	6.12	1.80	0.82	0.66	0.85	10.25
2	6.10	3.16	2.65	2.21	1.53	15.65
3	6.27	3.81	4.08	3.31	2.74	20.21
4	5.93	4.73	3.59	3.49	4.08	21.82***
High *q*	7.83	5.16	5.57	4.81	8.71	32.08***
All	32.25***	18.66	16.71	14.48	17.91	100.00

Panel B: Cash-financed Sample

	Size					
	Small	2	3	4	Large	All
Low *q*	6.62	2.30	1.47	0.99	1.13	12.51
2	6.14	3.33	3.12	2.40	2.06	17.05
3	5.62	3.50	3.84	2.81	3.22	18.99
4	5.21	5.08	3.74	4.46	5.01	23.50***
High *q*	5.35	4.39	4.15	3.91	10.15	27.95***
All	28.97***	18.60	16.32	14.57	21.57**	100.00

Panel C: Stock-financed Sample

	Size					
	Small	2	3	4	Large	All
Low *q*	4.17	1.21	0.37	0.34	0.58	6.67
2	4.51	2.73	2.88	1.86	1.47	13.45
3	5.38	4.20	4.56	3.99	2.86	20.99*
4	5.40	3.96	3.65	3.38	4.72	21.11**
High *q*	7.68	6.35	7.00	6.40	10.36	37.79***
All	27.14***	18.45	18.46	15.97	19.99	100.00

Table 4

Unconsummated deals by size and Tobin's *q* ratio

This table reports the frequency distribution (in percent) in given size and Tobin's *q* quintiles for the unconsummated sample (Panel A), the sample of failed cash-financed deals (Panel B), and the sample of failed stock-financed deals (Panel C). The size is defined as the price per share at the end of June times the number of shares outstanding. Tobin's *q* ratio is measured at the most recent fiscal year-end prior to the deal announcement date. For firms that announce acquisitions in the period from July of year *t* to June of year *t+1*, I calculate the Tobin's *q* at the fiscal year-end of calendar year *t*. Tobin's *q* is market value of assets divided by the book value of total assets, where market value of assets is calculated as the book value of assets (AT) plus the market value of common stock (PRCC_F*CSHO) less the sum of book value of common equity (CEQ) and balance sheet deferred taxes (TXDB). The NYSE breakpoints of size are from Kenneth French's Web site. The breakpoints of *q* are calculated using all stocks listed on NYSE, AMEX, and NASDAQ. I test each size (*q*) category whether the proportion is smaller than or equal to 20% using z-test. The symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: All Unconsummated Sample

	Size					
	Small	2	3	4	Large	All
Low *q*	9.95	2.42	1.25	1.16	0.99	15.77
2	6.36	2.96	2.24	1.97	1.97	15.50
3	6.99	2.96	3.67	3.67	3.14	20.43
4	7.17	2.96	2.96	3.32	2.78	19.19
High *q*	11.02	4.57	5.11	3.76	4.66	29.12***
All	41.49***	15.87	15.23	13.88	13.54	100.00

Panel B: Failed Cash-financed Sample

	Size					
	Small	2	3	4	Large	All
Low *q*	7.66	2.70	1.35	1.35	0.90	13.96
2	4.95	5.41	2.70	1.80	3.15	18.01
3	5.41	2.70	2.25	5.41	3.60	19.37
4	3.60	3.60	3.15	5.41	2.70	18.46
High *q*	8.11	6.31	5.86	3.60	6.31	30.19***
All	29.73***	20.72	15.31	17.57	16.66	100.00

Panel C: Failed Stock-financed Sample

	Size					
	Small	2	3	4	Large	All
Low *q*	9.62	1.46	1.46	0.63	0.63	13.80
2	7.53	1.67	1.88	2.09	0.84	14.01
3	9.00	3.14	4.60	2.72	2.09	21.55
4	9.21	2.93	2.30	2.51	2.30	19.25
High *q*	12.76	4.39	6.07	4.18	3.97	31.37***
All	48.12***	13.59	16.31	12.13	9.83	100.00

Table 5

Calendar-time factor regressions for consummated sample

This table reports calendar-time abnormal returns and the coefficients under the CAPM, the Fama-French three-factor model (1993), the investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang's (2011) *q* theory based model (CNMZ). The portfolios consist of firms that have completed acquisitions during the 12/24/36 months prior to the month of portfolio formation. Portfolio returns are equally weighted (Panel A) and value weighted (Panel B). In the CAPM and the Fama and French three-factor model (1993), I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site. In the *q* theory based model, the factor returns IA and ROE are obtained from Lu Zhang. In the investment-augmented Fama-French model (FF+INV), I add an investment factor, denoted INV, into the Fama and French three-factor model. The investment factor is the zero-cost portfolio return from buying stocks with the bottom 30% investment-to-assets ratios and shorting stocks with the top 30% investment-to-asset ratios, while controlling the size and book-to-market ratio. The investment-to-asset ratio is measured as the annual change in plant, property and equipment plus the annual change in inventories divided by the lagged book value of assets. In each June, all NYSE, Amex, and NASDAQ stocks are sorted into three book-to-market groups and three investment-to-assets groups based on the breakpoints for the low 30%, medium 40% and high 30% of the ranked values. The median NYSE market equity is also used to split NYSE, Amex and NASDAQ stocks into two size groups. By performing a triple sort, stocks are classified into eighteen portfolios. Monthly value-weighted returns on the eighteen portfolios are calculated from July of year *t* to June of *t+1*. The investment factor (INV) is then defined as the average returns on the six low investment-to-assets portfolios minus the average returns on the six high investment-to-assets portfolios. The regressions are estimated using weighted least squares, and the *t*-statistics (in parentheses) are computed using the White (1980) heteroskedasticity-consistent standard errors. The symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Adj *R*-Sqr denotes the adjusted *R*-square.

Panel A: Equal-Weighted Portfolio							
12 months							
CAPM		Fama-French		FF+INV		CNMZ	
α	-0.0063	α	-0.0046	α	-0.0036	α	-0.0001
	(-3.73***)		(-3.24***)		(-2.53**)		(-0.08)
MKT	1.2453	*MKT*	1.1795	*MKT*	1.1517	*MKT*	1.0298
	(35.54***)		(35.99***)		(34.98***)		(30.92***)
		SMB	0.4534	*SMB*	0.4672	*IA*	-0.0024
			(11.30***)		(11.84***)		(-3.42***)
		HML	-0.0155	*HML*	0.0358	*ROE*	-0.0042
			(-0.33)		(0.75)		(-12.55***)
				INV	-0.2725		
					(-3.74***)		
Adj *R*-Sqr	79.36%		86.52%		87.08%		86.63%

Panel B: Value-Weighted Portfolio							
12 months							
CAPM		Fama-French		FF+INV		CNMZ	
α	-0.0051	α	-0.0026	α	-0.0021	α	-0.0013
	(-3.37***)		(1.82*)		(-1.44)		(-0.90)
MKT	1.2663	*MKT*	1.1515	*MKT*	1.1378	*MKT*	1.1331
	(39.01***)		(35.34***)		(34.15***)		(32.71***)
		SMB	-0.1853	*SMB*	-0.1784	*IA*	-0.0023
			(-4.64***)		(-4.47***)		(-3.15***)
		HML	-0.417	*HML*	-0.3916	*ROE*	-0.0022
			(-8.95***)		(-8.08***)		(-6.30***)
				INV	-0.1352		
					(-1.84*)		
Adj R-Sqr	83.07%		86.53%		86.63%		85.32%

24 months							
CAPM		Fama-French		FF+INV		CNMZ	
α	-0.0051	α	-0.0044	α	-0.0030	α	0.0007
	(-3.10***)		(-3.18***)		(-2.20***)		(0.50)
MKT	1.2146	*MKT*	1.1832	*MKT*	1.1438	*MKT*	0.9996
	(34.62***)		(37.54***)		(37.00***)		(30.58***)
		SMB	0.4781	*SMB*	0.4962	*IA*	-0.0024
			(12.28***)		(13.30***)		(-3.51***)
		HML	0.0958	*HML*	0.1665	*ROE*	-0.0040
			(2.12***)		(3.70***)		(-12.16***)
				INV	-0.3774		
					(-5.52***)		
Adj *R*-Sqr	79.44%		86.54%		87.74%		86.49%

24 months							
CAPM		Fama-French		FF+INV		CNMZ	
α	-0.0048	α	-0.0029	α	-0.0017	α	-0.0002
	(-3.00***)		(-1.86**)		(-1.12)		(-0.12)
MKT	1.2741	*MKT*	1.1894	*MKT*	1.1576	*MKT*	1.0987
	(37.52***)		(33.44***)		(32.39***)		(31.70***)
		SMB	-0.1336	*SMB*	-0.119	*IA*	-0.0028
			(-3.04***)		(-2.76***)		(-3.87***)
		HML	-0.3277	*HML*	-0.2706	*ROE*	-0.0028
			(-6.43***)		(-5.21***)		(-8.22***)
				INV	-0.3046		
					(-3.85***)		
Adj *R*-Sqr	81.95%		84.00%		84.71%		85.71%

36 months							
CAPM		Fama-French		FF+INV		CNMZ	
α	-0.0033	α	-0.0033	α	-0.0020	α	0.0017
	(-2.00**)		(-2.34**)		(-1.47)		(1.17)
MKT	1.2001	*MKT*	1.1946	*MKT*	1.1595	*MKT*	1.0006
	(34.32***)		(38.19***)		(37.46***)		(29.95***)
		SMB	0.4936	*SMB*	0.5113	*IA*	-0.0013
			(12.71***)		(13.60***)		(-1.81*)
		HML	0.1883	*HML*	0.2517	*ROE*	-0.0039
			(4.19***)		(5.58***)		(-11.69***)
				INV	-0.3402		
					(-4.94***)		
Adj *R*-Sqr	79.15%		86.35%		87.34%		85.68%

36 months							
CAPM		Fama-French		FF+INV		CNMZ	
α	-0.0039	α	-0.0020	α	-0.0009	α	0.0009
	(-2.22**)		(-1.16)		(-0.50)		(0.54)
MKT	1.2848	*MKT*	1.2072	*MKT*	1.1753	*MKT*	1.0885
	(35.12***)		(31.13***)		(30.06***)		(29.68***)
		SMB	-0.12	*SMB*	-0.1039	*IA*	-0.0020
			(-2.49**)		(-2.19**)		(-2.66***)
		HML	-0.3109	*HML*	-0.2532	*ROE*	-0.0035
			(-5.58***)		(-4.44***)		(-9.49***)
				INV	-0.3094		
					(-3.56***)		
Adj *R*-Sqr	81.95%		81.62%		82.30%		84.71%

Table 6

Calendar-time factor regressions for successful high *q* and low *q* acquirers

This table reports calendar-time abnormal returns and the coefficients under the CAPM, the Fama-French three-factor model (1993), the investment-augmented Fama-French model (FF+INV), and Chen, Novy-Marx, and Zhang's (2011) *q* theory based model (CNMZ) for successful high *q* and low *q* acquirers, respectively. The acquirers are categorized as high *q* -firms if their Tobin's *q* ratio (measured at the most recent fiscal year-end prior to deal announcement) is greater than top 30% *q* ratio breakpoint of measurement year and categorized as low *q* firms if Tobin's *q* is less than bottom 30% *q* ratio breakpoint of measurement year. Tobin's *q* = [book value of assets (AT) + market value of common stock (PRCC_F*CSHO) - book value of common equity (CEQ) - balance sheet deferred taxes (TXDB)]/ book value of assets (AT). The portfolios consist of firms that have completed acquisitions during the 12/24/36 months prior to the month of portfolio formation. A long-short portfolio is also formed by buying stocks of low *q* acquirers and shorting stocks of high *q* acquirers. The regressions are estimated using weighted least squares on equal-weighted portfolios, and the *t*-statistics (in parentheses) are computed using the White (1980) heteroskedasticity-consistent standard errors. Abnormal returns of long-short portfolio (Diff.) are given by the intercept when excess portfolio returns are regressed on the aforementioned models. The symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Adj *R*-Sqr denotes the adjusted *R*-square.

Panel A: 12 months

	CAPM			Fama-French			FF+INV			CNMZ	
	Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*
α	0.0012	-0.0110	α	-0.0016	-0.0068	α	-0.0020	-0.0034	α	0.0033	-0.0005
	(0.66)	(-5.00***)		(-1.08)	(-3.40***)		(-1.31)	(-1.79*)		(1.82*)	(-0.27)
MKT	1.0008	1.4943	*MKT*	1.1312	1.3216	*MKT*	1.1425	1.2188	*MKT*	0.9232	1.1400
	(24.97***)	(31.05***)		(30.68***)	(26.54***)		(29.89***)	(25.41***)		(20.85***)	(25.52***)
			SMB	0.5264	0.3162	*SMB*	0.5260	0.3368	*IA*	0.0020	-0.0067
				(12.48***)	(5.95***)		(12.47***)	(6.87***)		(2.21**)	(-7.16***)
			HML	0.5148	-0.2730	*HML*	0.5028	-0.1907	*ROE*	-0.0027	-0.0047
				(9.77***)	(-4.06***)		(9.35***)	(-3.03***)		(-6.28***)	(-12.06***)
						INV	0.0866	-0.6777			
							(1.12)	(-7.25***)			
Adj *R*-Sqr	68.52%	77.10%		80.52%	83.17%		80.53%	85.76%		72.54%	86.65%
Diff.	0.0107			0.0043			0.0022			0.0051	
Low *q*-High *q*	(5.15***)			(2.46**)			(1.31)			(2.46**)	

Panel B: 24 months

	CAPM		Fama-French			FF+INV			CNMZ		
	Low q	High q		Low q	High q		Low q	High q		Low q	High q
α	0.0007	-0.0095	α	-0.0019	-0.0068	α	-0.0018	-0.0035	α	0.0022	0.0005
	(0.44)	(-4.60***)		(-1.60)	(-3.60***)		(-1.52)	(-1.91*)		(1.34)	(0.31)
MKT	0.9893	1.4588	*MKT*	1.1154	1.3358	*MKT*	1.1137	1.2299	*MKT*	0.9325	1.1052
	(27.53***)	(32.34***)		(37.66***)	(28.75***)		(36.43***)	(28.03***)		(23.09***)	(27.02***)
			SMB	0.5480	0.3604	*SMB*	0.5481	0.3750	*IA*	0.0015	-0.0060
				(15.98***)	(7.07***)		(15.95***)	(8.13***)		(1.78*)	(-7.21***)
			HML	0.5232	-0.1697	*HML*	0.5252	-0.0814	*ROE*	-0.0019	-0.0048
				(12.17***)	(-2.66***)		(11.91***)	(-1.39)		(-4.94***)	(-13.21***)
						INV	-0.0135	-0.7028			
							(-0.22)	(-8.23***)			
Adj R-Sqr	71.75%	77.80%		85.60%	83.24%		85.55%	86.33%		73.95%	87.66%
Diff.	0.0086			0.0036			0.0023			0.0025	
Low q-High q	(4.46***)			(2.17**)			(1.45)			(1.38)	

Panel C: 36 months

	CAPM		Fama-French			FF+INV			CNMZ		
	Low q	High q		Low q	High q		Low q	High q		Low q	High q
α	0.0005	-0.0067	α	-0.0020	-0.0050	α	-0.0018	-0.0026	α	0.0018	0.0020
	(0.32)	(-3.18***)		(-1.62)	(-2.54**)		(-1.46)	(-1.37)		(1.06)	(1.16)
MKT	1.0235	1.4286	*MKT*	1.1377	1.3423	*MKT*	1.1311	1.2665	*MKT*	0.9693	1.0911
	(28.73***)	(31.72***)		(40.96***)	(29.08***)		(39.70***)	(28.01***)		(24.12***)	(26.14***)
			SMB	0.5544	0.3972	*SMB*	0.5563	0.4161	*IA*	0.0017	-0.0039
				(16.40***)	(7.48***)		(16.43***)	(8.29***)		(2.09**)	(-4.62***)
			HML	0.5634	-0.0843	*HML*	0.5745	0.0006	*ROE*	-0.0019	-0.0053
				(13.88***)	(-1.31)		(13.69***)	(0.01)		(-4.72***)	(-13.94***)
						INV	-0.0641	-0.5736			
							(-1.04)	(-6.21***)			
Adj R-Sqr	72.67%	76.43%		86.91%	81.42%		86.92%	83.48%		73.92%	86.24%
Diff.	0.0063			0.0026			0.0020			0.0017	
Low q-High q	(3.16***)			(1.56)			(1.18)			(0.85)	

Table 7

Calendar-time factor regressions for successful stock acquirers: high *q* v.s. low *q*

This table reports calendar-time abnormal returns under the CAPM, the Fama-French three-factor model (1993), the investment-augmented Fama-French model (FF+INV), and Chen, Novy-Marx, and Zhang's (2011) *q* theory based model (CNMZ) for successful high *q* and low *q* stock acquirers, respectively. It also shows the coefficients under CAPM, Fama-French three-factor model, investment-augmented Fama-French model, and the *q* theory based model. The stock-financed acquirers are categorized as high *q* firms if their *q* ratio (measured at the most recent fiscal year-end prior to deal announcement) is greater than top 30% *q* ratio breakpoint of measurement year and categorized as low *q* firms if *q* is less than bottom 30% *q* ratio breakpoint of measurement year. The regressions are estimated using weighted least squares on equal-weighted portfolios, and the *t*-statistics (in parentheses) are computed using the White (1980) heteroskedasticity-consistent standard errors. The symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Adj *R*-Sqr denotes the adjusted *R*-square.

Panel A: 12 months

	CAPM			Fama-French			FF+INV			CNMZ	
	Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*
α	-0.0121	-0.0137	α	-0.0079	-0.0071	α	-0.0078	-0.0019	α	-0.0071	0.0028
	(-1.72*)	(-4.04***)		(-1.18)	(-2.22**)		(-1.16)	(-0.59)		(-0.99)	(0.97)
MKT	1.4438	1.7164	*MKT*	1.4476	1.4527	*MKT*	1.4455	1.3225	*MKT*	1.1678	1.1769
	(8.75***)	(23.59***)		(8.65***)	(18.13***)		(8.42***)	(16.47***)		(6.46***)	(17.39***)
			SMB	0.7137	0.2990	*SMB*	0.7149	0.3201	*IA*	0.0088	-0.0092
				(3.91***)	(3.66***)		(3.88***)	(4.10***)		(2.55**)	(-6.27***)
			HML	0.2831	-0.4605	*HML*	0.2860	-0.3741	*ROE*	-0.0084	-0.0074
				(1.29)	(-4.32***)		(1.26)	(-3.63***)		(-5.23***)	(-13.03***)
						INV	-0.0190	-0.8238			
							(-0.06)	(-5.33***)			
Adj *R*-Sqr	34.27%	66.01%		39.85%	73.08%		39.57%	75.46%		43.05%	80.70%

Panel B: 24 months

	CAPM			Fama-French			FF+INV			CNMZ	
	Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*
α	-0.0033	-0.0141	α	-0.0056	-0.0094	α	-0.0057	-0.0034	α	0.0031	0.0029
	(-0.57)	(-4.40***)		(-0.96)	(-3.06***)		(-0.97)	(-1.16)		(0.51)	(1.14)
MKT	1.4278	1.6381	*MKT*	1.4551	1.4441	*MKT*	1.4604	1.2798	*MKT*	1.1037	1.0519
	(10.62***)	(24.40***)		(9.94***)	(19.55***)		(9.65***)	(17.74***)		(7.18***)	(17.55***)
			SMB	0.84797	0.3709	*SMB*	0.8456	0.3849	*IA*	0.0048	-0.0093
				(5.30***)	(4.74***)		(5.25***)	(5.32***)		(1.65*)	(-7.40***)
			HML	0.4145	-0.3157	*HML*	0.4083	-0.2086	*ROE*	-0.0074	-0.0075
				(2.13**)	(-3.17***)		(2.05**)	(-2.24**)		(-5.49***)	(-14.74***)
						INV	0.0420	-0.9884			
							(0.14)	(-7.08***)			
Adj *R*-Sqr	39.74%	66.61%		46.28%	72.92%		46.04%	76.86%		46.93%	83.02%

Panel C: 36 months

	CAPM			Fama-French			FF+INV			CNMZ	
	Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*
α	-0.0028	-0.0097	α	-0.0054	-0.0068	α	-0.0059	-0.0020	α	0.0040	0.0049
	(-0.54)	(-3.01***)		(-1.10)	(-2.21**)		(-1.16)	(-0.64)		(0.76)	(1.89*)
MKT	1.3715	1.6499	*MKT*	1.3995	1.5182	*MKT*	1.4151	1.3787	*MKT*	1.0474	1.0799
	(11.59***)	(24.62***)		(11.05***)	(20.68***)		(10.78***)	(18.76***)		(7.74***)	(17.61***)
			SMB	0.9558	0.4294	*SMB*	0.9533	0.4414	*IA*	0.0044	-0.0060
				(6.90***)	(5.42***)		(6.87***)	(5.88***)		(1.76*)	(-4.84***)
			HML	0.4334	-0.1710	*HML*	0.4179	-0.0769	*ROE*	-0.0071	-0.0081
				(2.58**)	(-1.71*)		(2.43**)	(-0.80)		(-5.92***)	(-15.62***)
						INV	0.1118	-0.8432			
							(0.46)	(-5.89***)			
Adj *R*-Sqr	42.34%	66.13%		52.90%	72.28%		52.73%	75.14%		49.88%	82.03%

Table 8

Calendar-time factor regressions for failed stock acquirers: high *q* v.s. low *q*

This table reports calendar-time abnormal returns under the CAPM, the Fama-French three-factor model (1993), the investment-augmented Fama-French model (FF+INV), and Chen, Novy-Marx, and Zhang's (2011) *q* theory based model (CNMZ) for failed high *q* and low *q* stock acquirers, respectively. It also shows the coefficients under CAPM, Fama-French three-factor model, investment-augmented Fama-French model, and the *q* theory based model. The failed stock acquirers are categorized as high *q* firms if their *q* ratio (measured at the most recent fiscal year-end prior to deal announcement) is greater than top 30% *q* ratio breakpoint of measurement year and categorized as low *q* firms if *q* is less than bottom 30% *q* ratio breakpoint of measurement year. The regressions are estimated using weighted least squares on equal-weighted portfolios, and the *t*-statistics (in parentheses) are computed using the White (1980) heteroskedasticity-consistent standard errors. The symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Adj *R*-Sqr denotes the adjusted *R*-square.

Panel A: 12 months

	CAPM			Fama-French			FF+INV			CNMZ	
	Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*
α	0.0027	-0.0224	α	0.0036	-0.0135	α	0.0044	-0.0084	α	0.0107	0.0014
	(0.34)	(-3.09***)		(0.43)	(-1.90*)		(0.51)	(-1.14)		(1.21)	(0.19)
MKT	0.5916	1.3517	*MKT*	0.5713	0.9693	*MKT*	0.5441	0.8351	*MKT*	0.3828	0.6503
	(3.24***)	(8.66***)		(2.70***)	(5.55***)		(2.47**)	(4.57***)		(1.86*)	(4.00***)
			SMB	0.3559	0.5778	*SMB*	0.3564	0.5727	*IA*	-0.0012	-0.0103
				(1.49)	(2.89***)		(1.49)	(2.89***)		(-0.25)	(-2.73***)
			HML	0.0796	-0.7770	*HML*	0.1152	-0.6600	*ROE*	-0.0060	-0.0134
				(0.27)	(-3.08***)		(0.37)	(-2.59**)		(-2.88***)	(-8.64***)
						INV	-0.2118	-0.8886			
							(-0.46)	(-2.31**)			
Adj *R*-Sqr	13.84%	22.03%		13.98%	30.37%		14.86%	32.56%		16.37%	40.89%

Panel B: 24 months

	CAPM			Fama-French			FF+INV			CNMZ	
	Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*
α	0.0040	-0.0126	α	0.0048	-0.0057	α	0.0051	-0.0024	α	0.0137	0.0080
	(0.67)	(-2.15**)		(0.79)	(-1.00)		(0.81)	(-0.41)		(1.80*)	(1.44)
MKT	0.7671	1.4939	*MKT*	0.7495	1.2086	*MKT*	0.7416	1.1242	*MKT*	0.4964	0.8597
	(5.54***)	(11.79***)		(4.77***)	(8.60***)		(4.53***)	(7.68***)		(3.26***)	(6.71***)
			SMB	0.6240	0.5906	*SMB*	0.6250	0.5905	*IA*	-0.0009	-0.0071
				(3.63***)	(3.68***)		(3.63***)	(3.70***)		(-0.27)	(-2.51**)
			HML	0.1825	-0.5398	*HML*	0.1926	-0.4548	*ROE*	-0.0079	-0.0121
				(0.84)	(-2.70***)		(0.86)	(-2.23**)		(-5.32***)	(-10.08***)
						INV	-0.0587	-0.5952			
							(-0.18)	(-1.94*)			
Adj *R*-Sqr	20.25%	33.41%		24.16%	41.11%		23.84%	42.55%		28.59%	52.27%

Panel C: 36 months

	CAPM			Fama-French			FF+INV			CNMZ	
	Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*		Low *q*	High *q*
α	0.0085	-0.0109	α	0.0071	-0.0067	α	0.0079	-0.0046	α	0.0151	0.0045
	(1.70*)	(-2.21**)		(1.42)	(-1.39)		(1.56)	(-0.92)		(2.34**)	(0.96)
MKT	0.7647	1.4658	*MKT*	0.8341	1.2842	*MKT*	0.8057	1.2282	*MKT*	0.5617	0.9567
	(6.73***)	(13.68***)		(6.58***)	(10.97***)		(6.12***)	(10.10***)		(4.38***)	(8.78***)
			SMB	0.6859	0.6414	*SMB*	0.6910	0.6468	*IA*	-0.0012	-0.0042
				(5.00***)	(4.78***)		(5.03***)	(4.83***)		(-0.42)	(-1.76*)
			HML	0.4006	-0.2610	*HML*	0.4339	-0.2005	*ROE*	-0.0050	-0.0102
				(2.33**)	(-1.55)		(2.45**)	(-1.16)		(-4.12***)	(-10.04***)
						INV	-0.2146	-0.4163			
							(-0.79)	(-1.64)			
Adj *R*-Sqr	24.33%	39.34%		30.74%	46.58%		30.63%	47.63%		28.57%	55.43%

Table 9

Long-run performance difference

This table reports calendar-time abnormal returns under the CAPM, the Fama-French three-factor model (1993), the investment-augmented Fama-French model (FF+INV), and Chen, Novy-Marx, and Zhang's (2011) *q* theory based model (CNMZ) for successful and failed glamour stock acquirers, respectively. The stock acquirers are categorized as glamour firms if their book-to-market ratio (measured at the most recent fiscal year-end prior to deal announcement) is less than bottom 30% breakpoint of measurement year. The book-to-market ratio is defined as book value over size. The size is measured as the price per share at the end of June times the number of shares outstanding. The book value is defined as the book value of stockholders' equity, less book value of preferred stock, plus balance sheet deferred taxes and investment tax credit (when available). The regressions are estimated using weighted least squares on equal-weighted portfolios, and the *t*-statistics (in parentheses) are computed using the White (1980) heteroskedasticity-consistent standard errors. The symbols *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

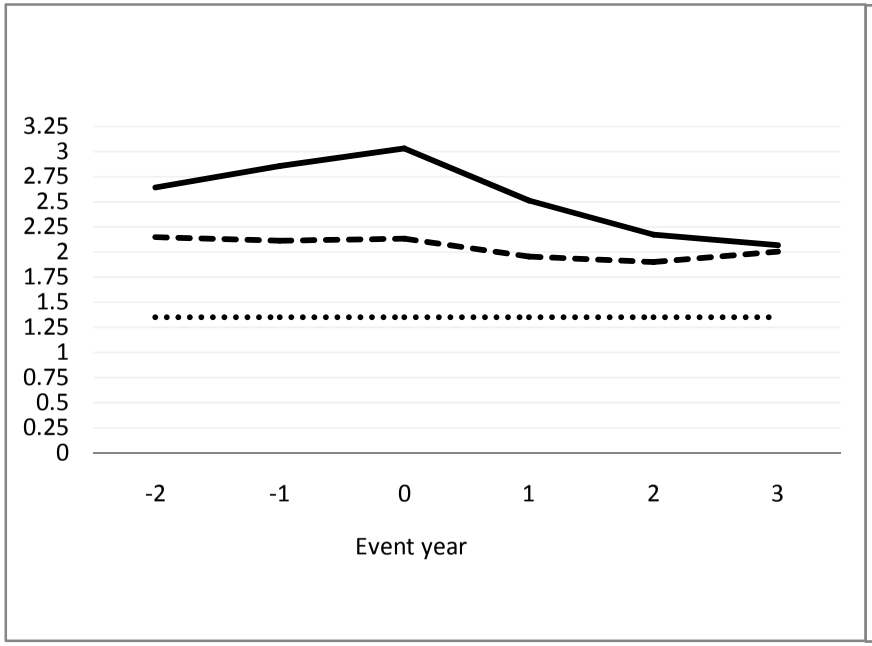
CAPM			
	1-Year	2-Year	3-Year
Successful Glamour Stock Acquirers	-0.0156	-0.0137	-0.0093
	(-5.72***)	(-5.31***)	(-3.45***)
Failed Glamour Stock Acquirers	-0.0260	-0.0114	-0.0125
	(-3.87***)	(-2.36**)	(-2.41**)
Successful-Failed	0.0106	-0.0018	0.0038
	(3.51***)	(-0.64)	(1.98**)
Fama-French			
	1-Year	2-Year	3-Year
Successful Glamour Stock Acquirers	-0.0069	-0.0057	-0.0044
	(-2.32**)	(-2.84***)	(-2.07**)
Failed Glamour Stock Acquirers	-0.0163	-0.0059	-0.0070
	(-2.80***)	(-1.24)	(-1.70*)
Successful-Failed	0.0105	0.0004	0.0033
	(3.42***)	(0.25)	(1.89*)
FF+INV			
	1-Year	2-Year	3-Year
Successful Glamour Stock Acquirers	-0.0023	-0.0038	-0.0023
	(-0.67)	(-1.28)	(-0.89)
Failed Glamour Stock Acquirers	-0.0117	-0.0030	-0.0052
	(-1.95*)	(-0.61)	(-1.24)
Successful-Failed	0.0095	-0.0006	0.0029
	(3.12***)	(-0.45)	(1.76*)
CNMZ			
	1-Year	2-Year	3-Year
Successful Glamour Stock Acquirers	0.0026	0.0030	0.0037
	(1.32)	(1.44)	(1.70*)
Failed Glamour Stock Acquirers	-0.0032	0.0057	0.0029
	(-0.56)	(1.23)	(0.72)
Successful-Failed	0.0061	-0.0023	0.0007
	(2.04**)	(-0.79)	(0.11)

Figure 1

Evolution of Tobin's *q* and capital expenditure plus R&D-to-asset ratio of acquirers

This figure plots successful and failed acquirers' median Tobin's *q* (Panel A) and capital expenditure plus R&D-to-asset ratios (Panel B) from two years before the deal announcement to three years after the deal announcement. Tobin's *q* is market value of assets divided by the book value of total assets, where market value of assets is calculated as the book value of assets plus the market value of common stock less the sum of book value of common equity and balance sheet deferred taxes. The CAPEX plus R&D-to-asset ratio is measured as the sum of the capital expenditures and research and development expense divided by the book value of total assets. The solid lines are for consummated sample, and the dash lines are for unconsummated sample. The dot lines plot the market median value calculated using all stocks listed on NYSE, AMEX, and NASDAQ.

Panel A: Tobin's *q*



Panel B: CAPEX plus R&D to asset

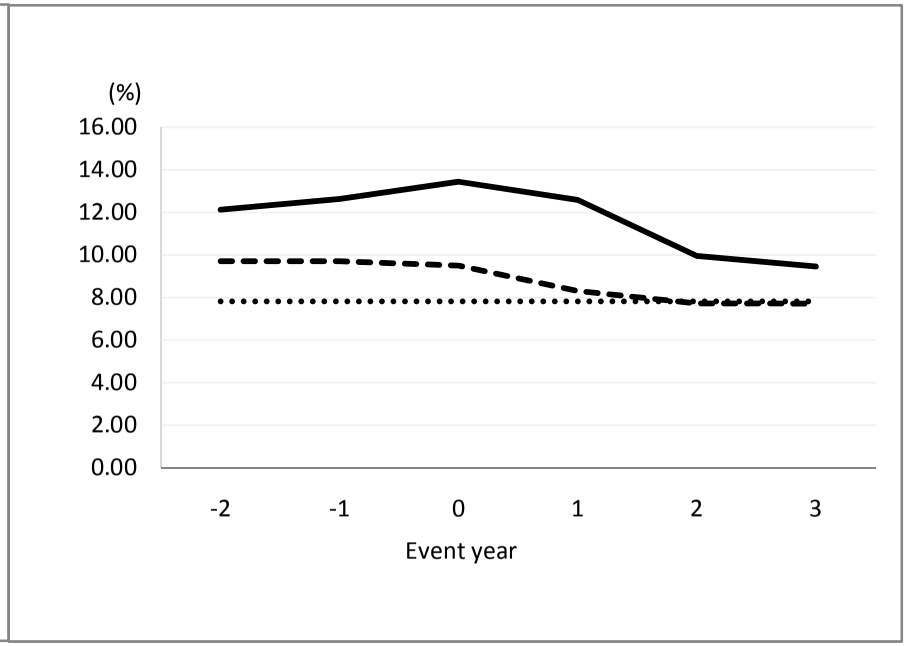
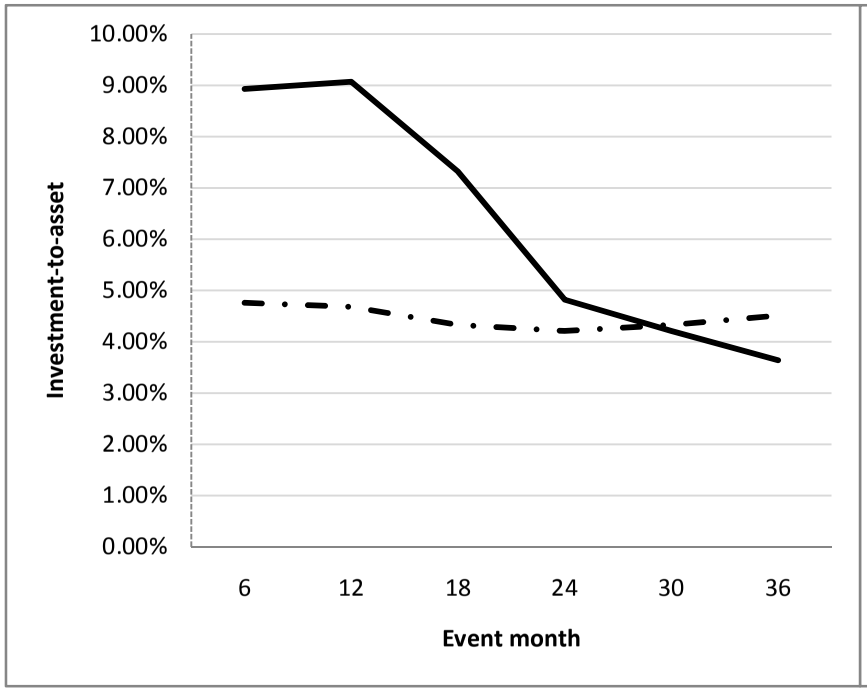


Figure 2

Evolution of invest-to-assets and return-on-equity of acquirers and matching nonacquirers

This figure plots successful acquirers' and matching nonacquirers' median invest-to-assets and return-on-equity during the 36 months after mergers and acquisitions. The investment-to-asset ratio is measured as the annual change in plant, property and equipment plus the annual change in inventories divided by the lagged book value of assets. The return-on-equity is measured as income before extraordinary items divided by one-quarter-lagged book equity. Book equity is measured as shareholders' equity, plus balance sheet deferred taxes and investment tax credit if available, minus the book value of preferred stock. The solid lines are for acquirers. The dash dot lines are for industry-, size-, and book-to-market-matched nonacquirers.

Panel A: Investment-to-asset



Panel B: Return-on-equity

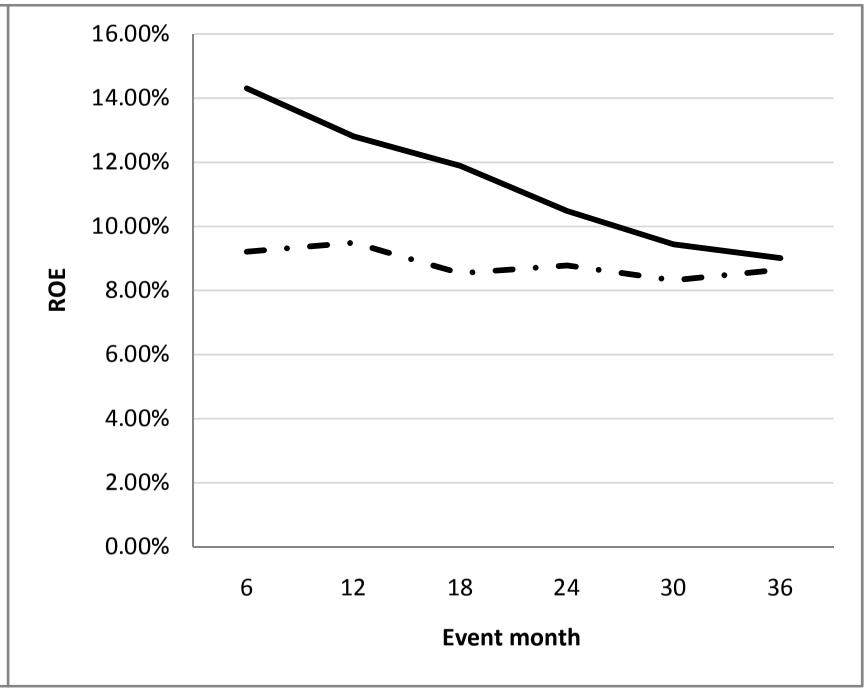
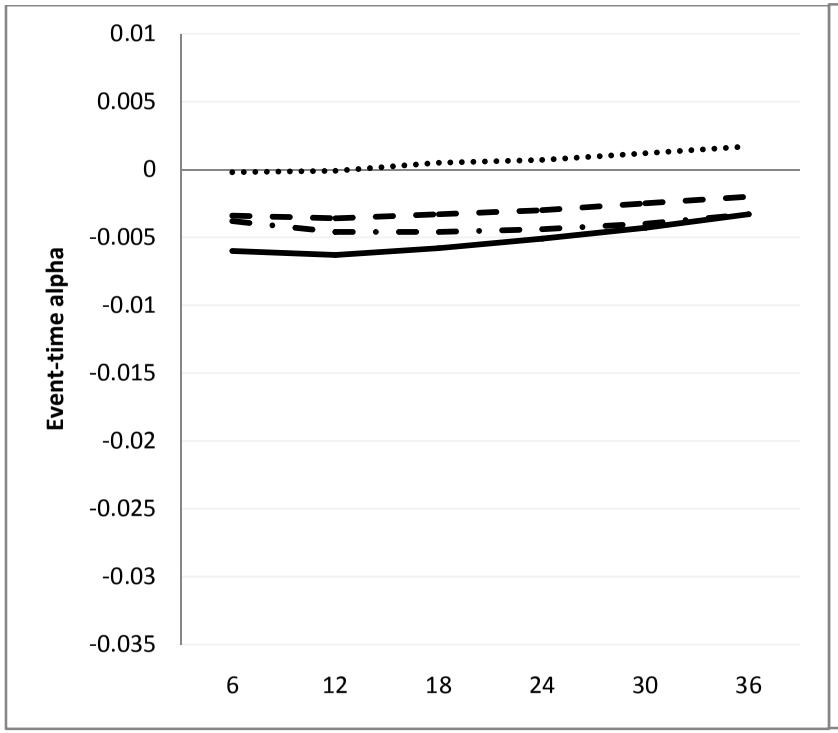


Figure 3

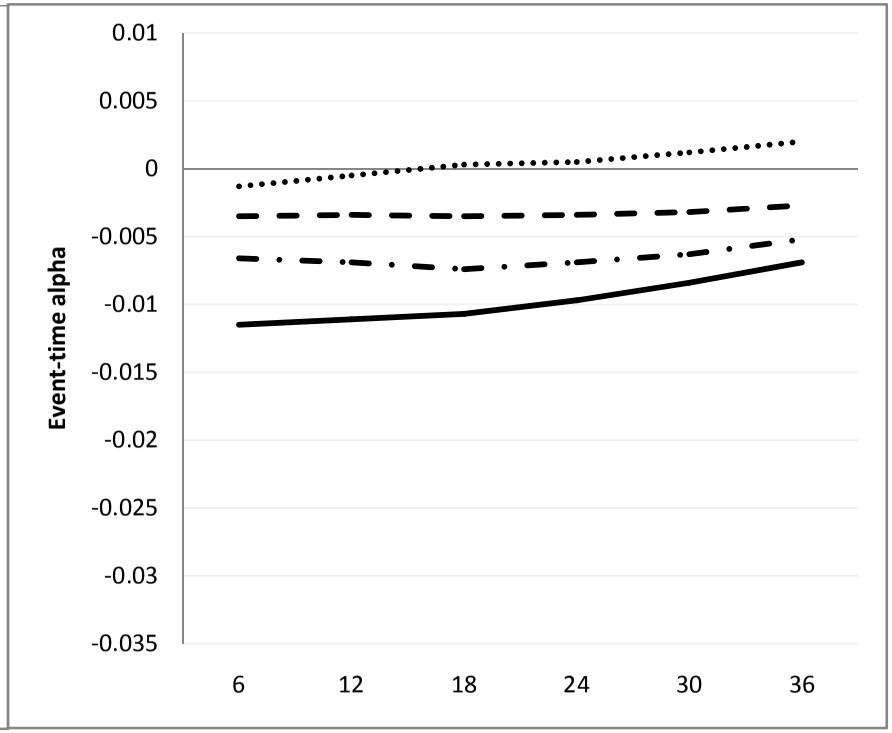
Abnormal returns from event-time regression

This figure reports the alphas from event-time regressions of all successful acquirers (Panel A), successful high *q* acquirers (Panel B), successful stock acquirers (Panel C), and failed high *q* stock acquirers (Panel D). Six portfolios are formed for each group. The first portfolio is composed by firms that initiated merger bids in the prior six months, the second portfolio is composed by firms that initiated merger bids between seven and twelve months ago, and so on. The sixth portfolio is composed by firms that initiated merger bids between thirty and thirty-six months ago. For each group, four sets of event-time regressions are performed: the CAPM, the Fama-French (1993) three factor model, the investment-augmented Fama-French model, and the *q* theory based model. The portfolio returns are equal-weighted and the regressions are estimated using weighted least square. The solid lines plot the alphas from the event-time CAPM regressions. The dash dot lines plot the alphas from event-time Fama-French three factor regressions. The dash lines plot the alphas from investment-augmented Fama-French regressions. The dot lines plot the alphas from *q* theory based model.

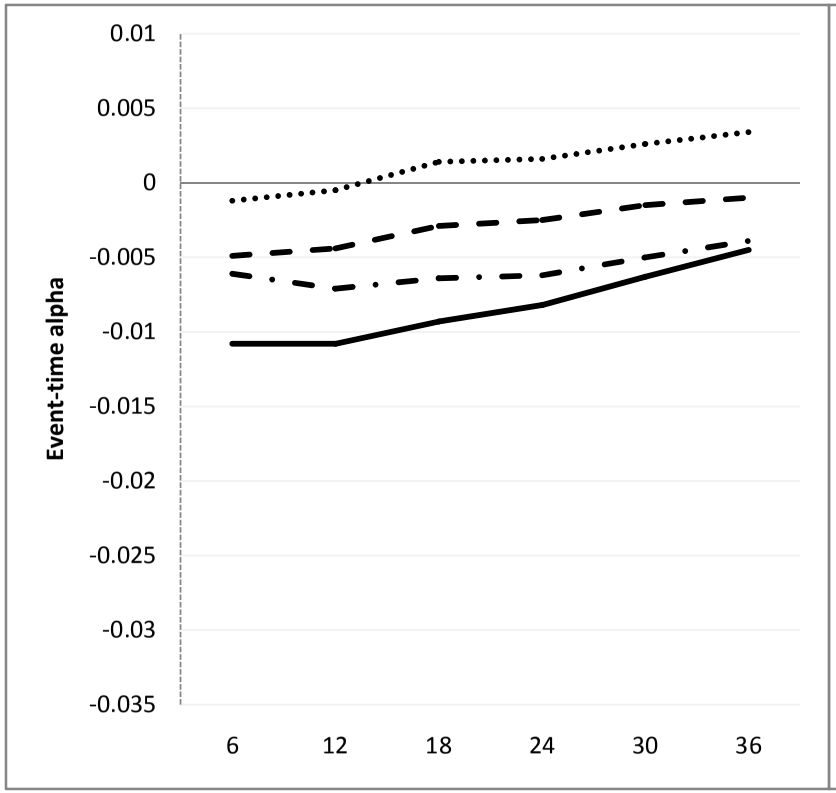
Panel A: all successful acquirers



Panel B: successful high *q* acquirers



Panel C: successful stock acquirers



Panel D: failed high *q* stock acquirers

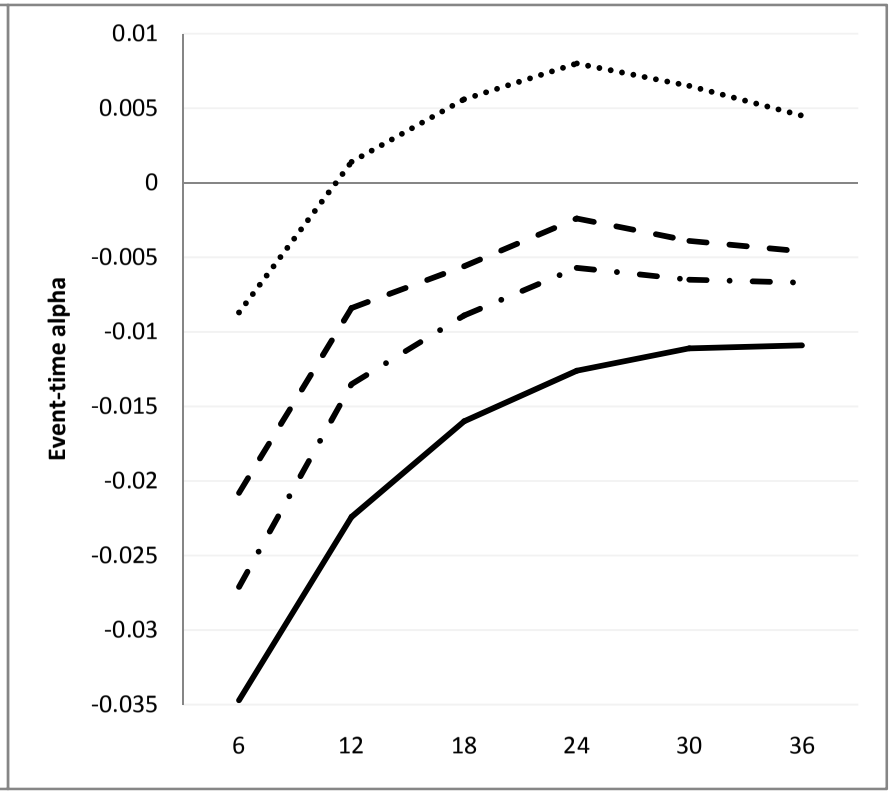
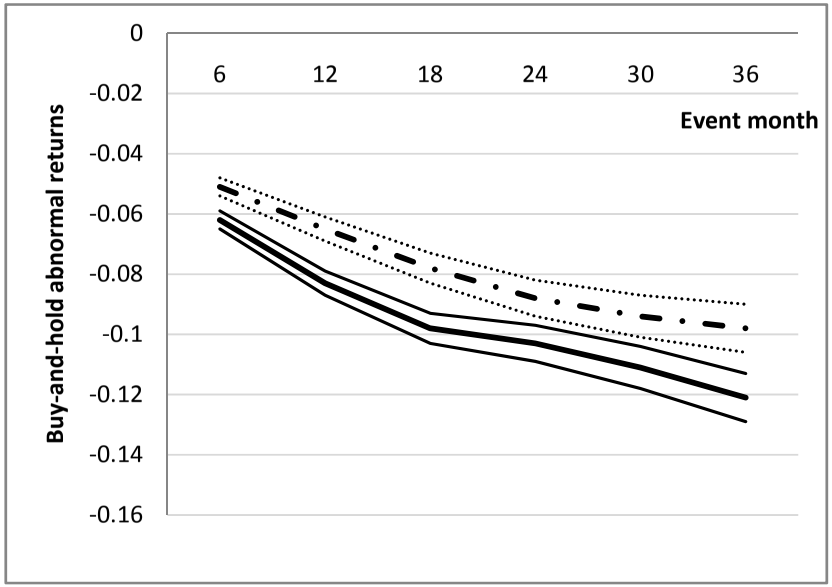


Figure 4

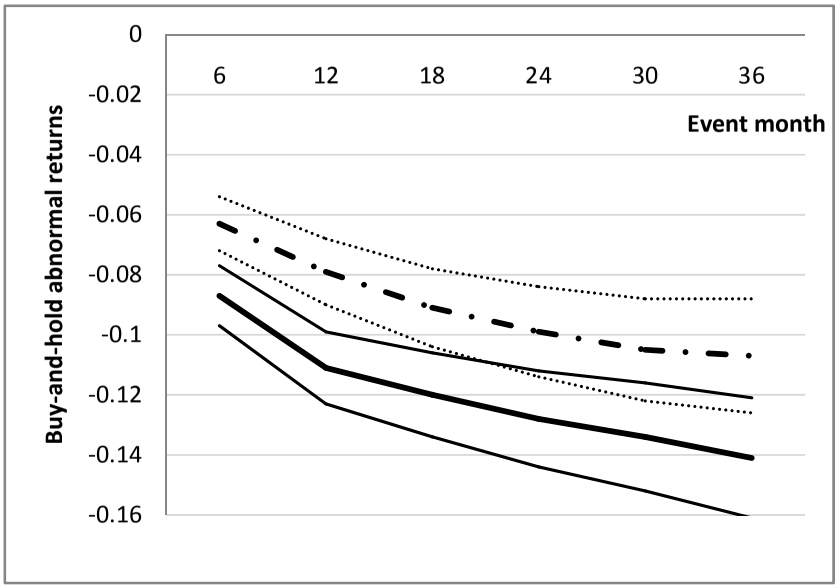
Acquirers' long-term buy-and-hold abnormal returns

This figure reports the long-term buy-and-hold abnormal returns (BHARs) for successful acquirers (Panel A) and failed acquirers (Panel B) during the three-year post-merger horizon. The thick solid line reports the mean BHAR relative to the reference portfolio constructed by matching on industry, size, and book-to-market. The two thin solid lines above and below the thick solid line are the two-standard-error bounds. The dash dot line reports the mean BHAR relative to the reference portfolio constructed by matching on industry, size, book-to-market, and investment-to-assets. The two dot lines above and below the dash dot line are the two-standard-error bounds. The BHAR for acquirer *i* is calculated as $BHAR_{i,\tau} = BHR_{i,\tau} - BHR_{p_i,\tau}$, where $BHR_{i,\tau}$ is the buy-and-hold returns over horizon τ, and $BHR_{p_i,\tau}$ is the buy-and-hold returns of the corresponding reference portfolio. Then mean BHAR is calculated as $BHAR_\tau = \frac{\sum_{k=1}^{n_\tau} BHR_{k,\tau} - BHR_{p_k,\tau}}{n_\tau}$, where n_τ is the number of event firms that have BHRs over horizon τ. The Lyon, Barber, and Tsai (1999)'s skewness-adjusted *t* statistic is $t_{sa,\tau} = \sqrt{n_\tau}(S + \frac{1}{3}\hat{\gamma}S^2 + \frac{1}{6n_\tau}\hat{\gamma})$, where $S = \frac{BHAR_\tau}{\sigma(BHR_{i,\tau} - BHR_{p_i,\tau})}$ and $\hat{\gamma} = \frac{\sum_{i=1}^{n_\tau}\left((BHR_{i,\tau} - BHR_{p_i,\tau}) - BHAR_\tau\right)^3}{n_\tau \sigma(BHR_{i,\tau} - BHR_{p_i,\tau})^3}$.

Panel A: Successful acquirers



Panel B: Failed acquirers



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