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

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Abstract

This paper proposes an investment-based explanation and resolves the post-merger performance puzzle. Traditional asset pricing models fail to take into account the link between investment and performance, and hence, resulting in post-merger performance puzzle. Upon observing that disproportionately high fraction of acquirers are high Tobin's Q firms, a group characterized with high investment ratio and low discount rate, I use an investment-augmented Fama French model and a Q-theory based model to examine acquirer's long-term performance and find the puzzle disappears. Empirical results show that stock-financed acquirers and glamour acquirers do not underperform once the investment factor is controlled.

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I Introduction

Over the past decades, intense research has focused on the long-run post-merger returns. Several studies report strong evidence of long-term underperformance of the acquirers.[1] Nonetheless, there is no consensus as to why acquirers underperform in the long run. Most of the prevailing explanations stem from the behavioral literature, arguing that the acquirers are overvalued before the mergers or as a result of the mergers. I propose an investment-based explanation from neoclassical reasoning that links the performance with acquirer's investment rate. Specifically, I ask whether acquirer's long-run poor performance can be explained by an investment factor, long in low investment-to-assets stocks and short in high investment-to-assets stocks.

The study of acquirer's long-run performance is intriguing because large post-merger excess returns are inconsistent with market efficiency. These large negative abnormal returns are often viewed as evidence that wealth gains from acquisitions are overstated during the pre-acquisition period. For example, Loughran and Vijh (1997) propose the means of payment hypothesis, arguing that the managers tend to pay for the acquisitions with shares when they believe the stocks are overvalued and pay with cash otherwise. Consequently, the long-run abnormal returns will be negative for stock-financed acquirers and positive for cash-financed acquirers. A number of theoretical works formally model the link between mergers and mis-valuation. 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's management overestimate synergies during market valuation peaks and accept offers from overvalued acquirers. Empirical evidence by Savor and Lu (2009) supports the hypothesis that overvalued acquirers use their equity as currency to create value for long-term shareholders. Rau and Vermaelen (1998) propose the performance extrapolation hypothesis. They argue that the market and the acquirer's management assess the value of acquisition based on acquirer's past stock returns and earnings growth record. Consequently, "glamour" acquirers[2] are overvalued around the announcement of acquisition, and in turn, their long run performance reverses. This explanation

[1] See, for example, Agrawal et al. (1992), Anderson and Mendelker (1993), Rau and Vermaelen (1998), and Mitchell and Stafford (2000).

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

is also consistent with market mis-valuation argument, with richly valued acquirers performing substantially worse than those that are conservatively priced.

Different from the existing behavioral literature, this paper aims at providing an underlying cause, unifying both Loughran and Vijh (1997) and Rau and Vermaelen (1998), by asking whether the long-run performance is tied to acquirer's future investment opportunities. Specifically, I argue that acquirers tend to have high Tobin's Q.[3] High Q-firms generally have more growth opportunities, invest more (see, e.g. Martin (1996)), and thus, as suggested by the Q-theory, are expected to earn lower average return than low Q-firms. Most stock-financed acquirers and the glamour acquirers are high Q-firms. This explains their long-run underperformance. Stock-financed acquirers and glamour acquirers receive low expected returns due to negative investment exposure. Once the investment factor is employed to evaluate the post-merger performance, the long-run underperformance should decrease in magnitude.

The Q-theory of investment is initiated by Tobin (1969) and advanced by Cochrane (1991). It suggests that a firm's investment rate rises with its Q and falls with the discount rate. Liu et al. (2009) demonstrate the negative investment-expected return relation under constant return to scale. They argue that investment rate increases with the net present value of capital (NPV), and the NPV decreases with the cost of capital or the expected return. Li et al. (2007) demonstrate the negative investment-expected return relation under decreasing returns to scale. They show that higher investment decreases the marginal product of capital, and consequently, lower the expected returns. Carlson et al. (2004)'s real options model also predicts the negative investment-expected return relation. Investment converts riskier expansion options into less risky assets in place. Therefore, firms with high investment rates are less risky and should earn lower expected returns.

The Q-theory of investment has been applied to relevant areas. For example, motivated by Q-theory, Jovanovic and Rousseau (2002) model the merger waves. Merger waves occur because of profitable reallocation opportunities. Accordingly, high Q-firms buy low Q-firms. Motivated from neoclassical reasoning, Chen et al. (2010) propose a new three-factor model that explains many anomalies, which I will term as Q-theory based model throughout the paper. The new factor model

[3]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)).

consists of the market factor and factor mimicking portfolios based on investment and productivity. They argue that investment predicts returns based on the intuition that low costs of capital are related to high NPV. Given expected cash flows, high NPVs lead to high investment and hence, firms that invest more are expected to earn lower returns. The return-on-asset (ROA) factor predicts returns because high discount rates are necessary to offset the high expected ROA to result in low NPV of projects and thus low investment.

This study proceeds by examining the long-term performance of 11,659 consummated deals with acquirers listed on both the Compustat and Center for Research in Security Prices (CRSP) with usable returns, and bids announced and completed over the period of 1984-2009. Using the Fama (1998) calendar-time approach, I examine the portfolio returns for all the firms that completed merger transactions in the previous 12, 24, or 36 calendar months over the 25-year sample period. I confirm the findings in literature that acquirers experience large negative abnormal returns when evaluated by CAPM and Fama and French (1993) three-factor model.

Following the first test, I employ two other asset pricing models, the investment-augmented Fama-French model and the Q-theory based model, to test my investment-based explanation. For my investment-based hypothesis to hold, the post-merger underperformance puzzle should be pronounced in the group of high Q-acquirers, but substantially shrink in magnitude and even disappears once the investment factor is controlled. To justify my claim, I classify my sample based on acquirer's pre-merger Tobin's Q, measured at two fiscal year-end prior to the deal announcement date. The two-year gap lessens the concern that Tobin's Q proxies for both investment opportunities and market mis-valuation. The acquirers with pre-merger Tobin's Q above the top 30% NYSE Q ratio breakpoint are classified as high Q-firms. Acquirers with pre-merger Tobin's Q below the bottom 30% NYSE Q ratio breakpoint are classified as low Q-firms. Consistent with my discussion earlier, the consummated sample is largely composed by high Q-firms, with 45% by high Q-firms in contrast to only 20% by low Q-firms. Using the calendar-time portfolio approach, I find that the post-merger underperformance of acquirers is primarily caused by poor returns of high Q-firms. Yet, the portfolio containing high Q-acquirers underperforms only in the traditional CAPM and Fama-French framework. This underperformance disappears once the investment factor is controlled.

For example, the portfolio containing high Q-acquirers earns an annualized CAPM abnormal return of -8.28%[4] and an annualized Fama-French abnormal return of -6.24% over three-year post-merger window. In contrast, the portfolio containing low Q-acquirers earns insignificant abnormal returns. Adding an investment factor in the Fama-French three-factor regression substantially reduces the magnitude of abnormal return to -3.24% per year and makes it indistinguishable from zero. The annual abnormal return under the Q-theory based model is 1.92%, a number that is also insignificant. Note that the investment appears to have a negative effect on the performance of high Q-acquirers while a positive (and sometimes insignificant) effect on the performance of low Q-acquirers. It provides evidence that high Q-acquirers are likely to invest more than low Q-acquirers, and that their increased investment is negatively related to long-term average returns. The contrasting loading suggests that the investment is correlated with the nature of the firms (i.e. Tobin's Q), and therefore explains the low returns of high Q-acquirers.

My investment-based hypothesis also helps explain why glamour acquirers earn relatively low returns compared to value acquirers. Rau and Vermaelen (1998) document poor post-merger performance of low book-to-market glamour firms and interpret it as evidence that both the market and the board of directors incorrectly extrapolate the acquirer's past earnings growth rates when assessing the acquisition. Instead of a mis-valuation story, I argue that the negative abnormal returns observed in the data can be explained by the investment factor. The explanation is intuitive: glamour acquirers are more productive and likely to invest more and grow faster than value acquirers. Zhang (2005) formally develops a model, in which glamour firms are more inclined to invest than value firms, especially in good times, while value firms tend to cut more capital than growth firms in bad times.[5] With high tendency to invest, glamour acquirers earn low average returns, as predicted by Q-theory of investment. Since Tobin's Q is highly correlated with the book-to-market ratio, the regression results that contrast glamour acquirers to value acquirers are quite similar to those contrasting high Q-acquirers to low Q-acquirers. As confirmed in empirical results, glamour acquirers underperform value acquirers in CAPM and Fama-French three-factor regressions. Nevertheless, the

[4] Abnormal returns are annualized by multiplying the intercepts from monthly regressions by 12.

[5] Zhang (2005) defined 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.

underperformance decreases in magnitude and becomes insignificant once the investment factor is controlled. The negative and significant investment factor loadings of the glamour acquirer portfolios suggest that increased investment impacts the post-merger returns.

I further examine the cash-financed and stock-financed acquirers separately. A number of papers relate the long-run underperformance of stock acquirers to market mis-valuation. Instead of viewing the negative long-term abnormal returns of stock acquirers as evidence of performance reverse of the overpriced stocks, I argue that the empirical link between the means of payment and the performance is driven by the acquirer's Tobin's Q and their corresponding investment rate. Martin (1996) finds that firms with more investment opportunities (measured by Tobin's Q) are more willing to finance the merger with stocks. In the consummated sample, 41% of stock acquirers are high Q-firms as opposed to only 11% are low Q-firms. Thus, I argue that the long-term underperformance of stock-financed acquirers can be explained by the excessively high fraction of high Q-firms, a group characterized by high investment-to-assets and low discount rates. If, indeed, firms engage in acquisitions as a way of issuing overvalued equity, I would expect stock acquirers to continue underperforming no matter which asset pricing model is employed. On the other hand, for my investment-based hypothesis to hold, I expect that high Q-stock acquirers experience greater underperformance than low Q-stock acquirers. Yet, the observed poor post-merger returns should decrease substantially in magnitude and even become insignificant once the investment factor is controlled. Since equity issuers are typically high Q-firms, my argument is also coherent with Li et al. (2007), who argue that equity issuance leads to high investment and thereby low returns.

Empirical results support the investment-based explanation. Specifically, stock acquirers, on average, experience long-term negative abnormal returns post-merger when measured using CAPM or Fama-French three-factor model. Among them, high Q-stock acquirers perform much worse than low Q-stock acquirers. The annualized CAPM abnormal return of high Q-stock acquirers is -11.76% over the three-year post-merger window, in contrast to -3.84% for low Q-stock acquirers. Adding the investment factor to Fama-French three-factor model reduces the annualized abnormal returns of high Q-stock acquirers to -2.28%. Under the Q-theory based model, high Q-stock acquirers even earn weakly positive abnormal returns. Moreover, the investment factor carries significant

explanatory power for long-term performance of high Q-stock acquirers. High Q-stock acquirers are associated with higher post-merger investment, which in turn leads to lower average 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 more than the successful ones in the long run and view the disparity as value created for acquirer's long-term shareholders. They even find more pronounced result for failed glamour stock acquirers and interpret it as evidence that failure is more costly for richly valued stocks. Instead of mis-valuation story, I argue the investment is the key factor that explains their low average returns. The documented poor returns for both successful stock acquirers and failed stock acquirers result from inadequate risk adjustment in traditional asset pricing models. Consequently, the fact that stock acquirers tend to be high Q-firms, have high investment rate and low returns is ignored. Once the investment factor is controlled, the underperformance should be minimal. I collect a sample of 1,334 unconsummated deals, of which 36% is classified as high Q-acquirers and 23% as low Q-acquirers. In my empirical examination, I find that the poor performance of failed stock acquirers can be traced to high Q-group. But this underperformance goes away once the investment factor is controlled. In fact, I find no long-term negative abnormal return for failed glamour stock acquirers once the investment factor is adjusted.

This paper brings the insights from the investment-based asset pricing theory to the empirical post-merger underperformance puzzle. I document evidence that, because both stock-financed acquirers and glamour acquirers have disproportionately high fraction of high Q-firms, which are characterized by high investment rate, investment is likely to be the key factor that links to their underperformance. This paper not only provides an underlying explanation to the post-merger underperformance phenomenon but also unifies the empirical observations in both Loughran and Vijh (1997) and Rau and Vermaelen (1998) into a general framework. Rather than interpret negative abnormal returns as per se evidence of overprice of glamour acquirers and stock-financed acquirers, I conclude that the underperformance in the data are endogenously determined by the post-merger investment, which differs across firms.

The remainder of the paper is organized as follows. Section II briefly reviews the literature and establishes the testable hypothesis. Section III describes the data. Section IV presents the empirical

tests and results, and Section V concludes the paper.

II Literature review and hypothesis development

It is well known that acquirers underperform in the long run (see, e.g., Asquith (1983),Agrawal et al. (1992), Loderer and Martin (1992), Anderson and Mendelker (1993), and Mitchell and Stafford (2000)). Several explanations have been proposed such as the relative size of acquisition (e.g. Loughran and Vijh (1997)), the delayed adjustment to merger news (e.g., Asquith (1983)), the overoptimistic EPS forecast (e.g. Block (2000)), and etc.. Among them, the two prevailing explanations for post-merger underperformance stem from the behavioral literature, arguing that the market slowly corrects its mis-valuation of the acquirers. First, the method of payment hypothesis (Loughran and Vijh (1997)) argues that acquirers tend to pay with stocks when they are overvalued. Second, the performance extrapolation hypothesis (Rau and Vermaelen (1998)) argues that market and acquirers with low book-to-market tend to overestimate their gains from merger. These two hypotheses are widely adopted because of the support of empirical evidence. In section A and B, I give a brief introduction of them. I introduce my investment-based hypothesis in section C.

A Method of payment hypothesis

Method of payment hypothesis of merger is based on market mis-valuation theory. From the acquirer's perspective, stock-financed mergers involve two simultaneous transactions: a merger and an equity issue. Under information asymmetry assumption, Myers and Majluf (1984) show that firms will issue equity only when it is overpriced. It follows that the equity issuance is associated with negative abnormal returns. 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)). Loughran and Vijh (1997) tie the long-term negative abnormal returns to the method of payments and find that stock-financed firms have post-merger abnormal returns of -24.2% over the five-year period, whereas the post-merger abnormal return is 18.5% for cash-financed acquirers. Their results suggest that the long-term underperformance is predominantly caused by the poor post-merger performance of stock-financed acquirers. Gregory (1997) finds that stock-financed acquirers

experience worse performance than cash-financed acquirers, a result consistent with asymmetry information theory as well. Savor and Lu (2009) test whether stock-financed mergers benefit the acquirer's long-term shareholders. They use the long-term post-merger performance of the failed acquirers as a proxy for how the successful ones would have experienced had they not completed the merger transactions. Using calendar-time portfolio regression with the Fama-French three-factor model, they document annualized abnormal return of -7.0% for successful stock acquirers over the 2-year holding period whereas -16.6% for failed stock acquirers. In contrast, failed cash acquirers experience no underperformance compared to successful ones. Thus, they 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.

B Performance extrapolation hypothesis

The performance extrapolation hypothesis ascribes the long-term negative abnormal return to the low book-to-market glamour acquirers. Fama and French (1992) argue that the value firms earn relatively high returns because they are exposed to higher distress risk. In contrast, Lakonishok et al. (1994) argue that the value premium is not associated to risk, but instead arises because the market extrapolates the past performance of the firms when evaluating their future performance. Building on these theoretical work, Rau and Vermaelen (1998) develop the performance extrapolation hypothesis which asserts that both the market and the top management of the acquirers extrapolate the past performance when assessing the value of new acquisitions. Glamour acquirers have high past stock returns and high past earnings growth, and thus, are 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 post-merger abnormal returns of -17.3% for glamour acquirers and 7.6% 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 richly valued stocks.

C Investment-based hypothesis

The theoretical motivation of my investment-based hypothesis is from the Q-theory of investment. Cochrane (1991) launches a production-based asset pricing model and is the first to derive the negative relation between investment and expected returns. Intuitively, firms invest more when the 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 costs of capital lead to low NPVs and low investments, and low costs of capital lead to high NPVs and high investments. More recently, Carlson et al. (2004) build a real options model that also shows the negative investment-expected return relation. Investment converts firm's risky growth options to less risky assets in place, and in turn lowers expected returns. Chen et al. (2010) develop the Q-theory based model, in which they also motivate the investment as a firm characteristic related to risk. Unlike these partial equilibrium models, general equilibrium models view investment as a risk factor. For example, Gala (2006) develops a general equilibrium production economy with heterogeneous firms and irreversible investment. In his model, a firm can supply valuable consumption insurance and reduce the riskiness of firm's equity if it can mitigate the effect of aggregate productivity shocks through investment in order to smooth dividends. Motivated by general equilibrium models, I augment Fama-French three-factor model with a zero-cost portfolio sorted on investment in empirical design. Taken together, the Q-theory of investment suggests that a firm's investment rate rises with its Q and falls with the expected return.

Building on the Q-theory, my investment-based hypothesis suggests that high Q-firms are likely to have plentiful growth opportunities, invest more, and earn lower expected return than low Q-firms. The post-merger underperformance of acquirers can be predominately caused by poor returns of high Q-acquirers. The underperformance puzzle arises because of inadequate risk adjustment in traditional asset pricing models, such as CAPM and Fama-French three-factor model. To solve the misspecification problem, investment factor should be controlled in empirical tests.

The investment-based hypothesis is also expected to explain the performance disparity between glamour and value acquirers. Theoretical works (see, e.g., Abel and Blanchard (1983), Abel and Eberly (1994)) in neoclassical investment literature suggest that the 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. In bad times, value firms are less flexible than glamour counterparts. The value firms are likely to cut more capital than glamour firms because of the asymmetric adjustment costs and countercyclical price of risk. His empirical evidence supports the theoretical predictions that glamour firms invest more than value firms. It follows that the post-merger underperformance of glamour acquirers can result from the missing investment factor in empirical asset pricing models.

The 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. The investment-based argument is 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 the sources of funds equal the uses of funds, and implies that equity issuing firms are disproportionately high investment firms and cash-distributing firms are disproportionately low investment firms. The resulting testable implication is that firms raising capital are associated with high investment and low expected returns. Lyandres et al. (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 result consistent with Li et al. (2007).

To summarize, the investment-based hypothesis suggests that a high fraction of acquirers is characterized with high Tobin's Q, a proxy for investment opportunities. The negative relation between investment and expected return explains acquirer's post-merger underperformance. Empirical expected return models are mis-specified and thereby lead to post-merger underperformance puzzle.

III Data and descriptive Statistics

The sample is drawn from Thomson Financial's Securities Data Company (SDC) Platinum U.S. Mergers & Acquisitions database. I start with all transactions that are classified either as a merger

or an acquisition of majority interest between 1984 and 2009.[6] To be included in the sample, the transaction must be listed as completed with deal value of at least $1 million, and the acquirer must be a public firm listed on the Compustat and Center for Research in Security Prices (CRSP) with usable returns during the event window (i.e. three-year post-merger period).

The processed sample is composed of 11,659 mergers. To investigate the method of payments used by acquirers in the sample, I classify the event as follows. For each transaction, 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. If so, I classify the event as 100% stock-financed or 100% cash-financed respectively. The rest is categorized as mixed payments. The resulting sample consists of 3,611 (31.0%) cash payments, 4,273 (36.7%) stock payments, and 3,775 (32.3%) mixed payments. Panel A of Table 1 reports the number of consummated deals for each year, the number of deals financed by cash, and the number of deals financed by stocks.

The frequency distributions of sizes and book-to-market ratios of the bidding firms relative to the universe of all NYSE stocks are presented in Table 2. The breakpoints are from Kenneth French's Web site. For firms that have merger and acquisition transactions in the period from July of year t to June of year t+1, I determine the size and book-to-market quintiles at the fiscal year-end of calendar year t-1. Following Fama and French (1993), 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). To estimate the book value of preferred stock, I use the redemption, liquidation, or par value of preferred stock (in this order), depending on availability. Note that the percentage of low book-to-market acquirers is much higher for equity-financed sample, measuring 37.95% on average for firms in the bottom book-to-market quintile. By contrast, 27.27% of cash-financed acquirers fall into the bottom book-to-market quintile.

A sample of failed bids is also collected using SDC Platinum U.S. Mergers & Acquisitions database. To be included in the sample, the acquirers must be U.S. public firms. The announcement date falls within 1984 to 2009 with 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 bid to be the first offer

[6] In untabulated robustness check, I limit my sample to deals announced and completed between 1984 to 2006 in order to provide at least 3 years of data for each firm after deal completion. The results are quantitatively similar.

by a given acquirer for a given target to avoid overweighting contested deals from competitors or regulators. Specifically, I use the Challenged Deal Flag as a filter to screen for challenged deals and then manually sort the data based on Date Announced to determine the first bidder. The final sample consists of 1,334 failed acquisitions grouped into three financing categories: 282 (21.1%) cash payments, 539 (40.4%) stock payments, and 513 (38.6%) mixed payments. Panel B of Table 1 reports the number of unconsummated deals for each year, the number of failed deals financed by cash, and the number of failed deals financed by stocks. Table 3 shows the frequency distributions of sizes and book-to-market ratios of the failed acquirers relative to the universe of all NYSE stocks. Similar to the sample of consummated deals, the sample of failed acquirers tilts towards small and low book-to-market acquirers. This bias toward small cap firms is phenomenal for failed stock-financed sample - 48.59% of the failed stock acquirers are in the smallest quintile. The distribution of failed stock acquirers across book-to-market quintiles is similar to that of failed cash acquirers, with approximately 30% fall into the bottom book-to-market quintile.

To study whether the post-merger performance is tied to acquirer's Tobin's Q and the corresponding investment rate, I measure acquirer's pre-merger Q ratio at two 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 pre-merger Tobin's Q at the fiscal year-end of calendar year t-2. The Tobin's Q ratio is argued to proxy for both investment opportunities (see, eg. Martin (1996)) and market mis-valuation. (See, e.g. Dong et al. (2006)). The two-year gap alleviates the concern that stock acquirers may have high Tobins' Q due to overpricing around the merger. Following Kaplan and Zingales (1997) and Gompers et al. (2003), I compute Tobin's Q as 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. In untabulated results, I find that median value of the pre-merger Q ratio for the successful acquirers is 1.54, with 1.79 for successful stock acquirers and 1.50 for successful cash acquirers. For failed acquirers, the median pre-merger Q ratio is 1.32, with 1.51 for failed stock acquirers and 1.30 for failed cash acquirers. Compared to the contemporaneous median Q ratio of 1.18 for NYSE stocks, the sample of acquirers are skewed towards high Tobin's

Q-firms.

Next, I use the top 30% and bottom 30% NYSE Q ratio breakpoints to categorize the acquirers into high Q- and low Q- firms. Panel A of Table 4 shows the fraction of consummated acquisitions based on categories of acquirer's pre-merger Q ratio. The sample is partitioned into groups according to method of payment. While 33% of cash-financed acquirers are high Q-firms and 21% low Q-firms, 41% of stock-financed acquirers are high-Q firms and only 11% low Q-firms. The disproportionately high fraction of high Q-firms in stock-financed sample implies that the potential growth opportunities may influence the financing of acquisitions. Panel B of Table 4 documents the fraction of unconsummated deals according to the Q ratio and financing type. Similar to consummated sample, the sample of failed stock acquirers are mainly composed by the high Q- acquirers, with 39% of failed stock acquirers categorized as high Q-firms and 21% low Q-firms. Among failed cash acquirers, 36% are classified as high Q-firms while 20% are low Q-firms. Altogether, acquirers are largely composed by high Q-firms.

IV Results

I investigate the role of investment in explaining the post-merger underperformance using calendar-time portfolio regressions.

A Evidence on post-merger underperformance puzzle.

A number of papers, e.g. Kothari and Warner (1997), Barber and Lyon (1997), Lyon et al. (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. I adopt the calendar-time portfolio approach proposed by Fama (1998) in measuring long-run abnormal returns to avoid the bad model problem and to develop better statistical inferences.

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. For each calendar month, I calculate both the equal-weighted and value-weighted returns on a portfolio consisting of all firms that have completed merger transaction during the k months ($k = 12, 24, 36$)

prior to the month of portfolio formation ($t = 1$ to T). The following regressions are then estimated:

$$R_{pt} - R_{ft} = \alpha_{CAPM} + \beta_{CAPM} MKT_t + \epsilon_{pt} \tag{1}$$

$$R_{pt} - R_{ft} = \alpha_{FF} + \beta_{FF} MKT_t + s_{FF} SMB_t + h_{FF} HML_t + \epsilon_{pt} \tag{2}$$

The dependent variable is the monthly excess return of the portfolios. The risk-free rate is the one-month Treasury bill rate. The risk factors are: the monthly return of the CRSP value-weighted index less the risk-free rate (MKT), monthly premium of the size factor (SMB), and the monthly premium of the book-to-market factor (HML). The monthly premiums of the Fama and French (1993) factors are obtained from Kenneth French's website. β, s, h denote the factor loadings and α stands for the monthly average abnormal return of the event firms. Note that alpha can include the unexplained part of the portfolio returns if the model is mis-specified, a problem noted by Fama (1998). Following Loughran and Ritter (2000), I estimate calendar-time portfolio regression 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. I focus my discussion on results obtained using WLS regressions, but the results are comparable when using OLS regressions.

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-, 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-, three-year post-merger horizon, respectively. In Panel B, the wealth effect is examined using the value-weighted schemes. 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. Since percentage mis-valuations are usually greater among small firms than among big firms, value-weighting portfolio returns tend to reduce abnormal returns. In the subsequent analysis, I focus my findings from

equal-weighted portfolios.

B The investment-augmented model and the Q-theory based asset pricing model

The previous section documents that acquirers significantly underperform over the three-year post-merger period. In this section, I investigate whether the post-merger performance can be explained by the investment factor. I adopt two different factor models:a Fama-French three-factor model augmented with an investment factor, and a Q-theory based model proposed by Chen et al. (2010).

First, I augment Fama-French three-factor models with an investment factor. Similar to Lyandres et al. (2008), the investment factor is constructed using 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 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 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. Put it formally, denote r_{ijk} the value-weighted returns of portfolios composed by firms in the ith group of size, the jth group of book-to-market, and kth group of investment-to-assets for i =1, 2 and j, k = 1, 2, 3. The investment factor is defined as:

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

To document the extent to which post-merger performance is determined by the investment factor, I use the calendar-time portfolio returns to estimate the following regressions:

$$R_{pt} - R_{ft} = \alpha_{INV} + \beta_{INV} MKT_t + s_{INV} SMB_t + h_{INV} HML_t + \lambda INV_t + \epsilon_{pt} \quad (3)$$

The third column of Table 5 presents my results. The magnitude of post-merger abnormal returns are reduced when the investment factor is controlled. 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 significantly negative sign of investment factor is coherent to my conjecture that increased investment of the acquiring firms impacts the long-term average returns.

Second, I apply the Q-theory based model proposed by Chen et al. (2010), in which they replace Fama and French's (1993) size and book-to-market ratio with two neoclassical factors-an investment factor (IA) and an ROA factor. In a similar fashion to Fama and French (1993), they construct portfolios using a two-by-three sort on size and investment-to-assets. Their investment factor (IA) is then defined as the difference between the portfolio return of low-investment stocks and the portfolio return of high-investment stocks. The ROA factor is constructed from a two-by-three sort on size and return on assets (ROA), measured as income before extraordinary items divided by one-quarter lagged total assets. The ROA factor is then defined as the difference between the portfolio returns of high-ROA stocks and portfolio returns of low-ROA stocks. To investigate the extent to which post-merger performance is determined by the investment factor, I use the calendar-time portfolio returns to estimate the following regressions:

$$R_{pt} - R_{ft} = \alpha_Q + \beta_Q MKT_t + s_Q IA_t + h_Q ROA_t + \epsilon_{pt} \quad (4)$$

The fourth column of Table 5 presents my finding that the equal-weighted and value-weighted post-merger abnormal returns become insignificant. For example, the equal-weighted portfolio has abnormal return of -0.05% (t-statistic= -0.33), 0.01% (t-statistic = 0.04), and 0.11% (t-statistic = 0.72) per month over one-, two-, and three-year post-merger horizons, respectively. Note that the loadings on the investment factors are negative and highly significant, suggesting that increases in

investment, all else being equal, are associated with a reduction in post-merger performance. Taken together, the results presented in Table 5 suggest strongly that investment influences and explains the post-merger performance. The abnormal returns are negative statistically significant under the CAPM and Fama-French three-factor specifications. Adding an investment factor into Fama-French specification substantially reduces the magnitude of underperformance. Using the Q-theory based model, the alphas even becomes insignificant. Furthermore, the negative and significant coefficients of investment factor support my conjecture that investment is the key variable that explains the acquirer's post-merger performance.

C Evidence on acquirer's 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 the acquirers to invest more and in turn earn lower average returns than non-acquirers, and I have shown that investment is negatively related to acquirer's long-term performance, as predicted by the Q-theory. To provide more detailed evidence on the role of investment factor in explaining the performance heterogeneity of high Q-acquirers and low Q-acquirers., I perform calendar-time portfolio regression on these two subsamples: 1) high Q-acquirers (i.e. the acquirers with pre-merger Tobin's Q ratio higher than the NYSE 70% Tobin's Q breakpoint), and 2) low Q-acquirers (i.e. the acquirers with pre-merger Tobin's Q ratio lower than the NYSE 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 -1.11% (t-statistic= -4.98), -0.97% (t-statistic= -4.61), and -0.69% (t-statistic=-3.25), respectively, while the portfolio of low Q-acquirers earn insignificant abnormal returns. In untabulated results, I 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 CAPM and Fama-French three-factor model for the three horizons, suggesting that the difference in performance between the high Q- and low Q- acquirers is striking when using the traditional asset pricing model.

Turning next to the investment-augmented Fama-French model for post-merger performance in Table 6, I show the long-term underperformance can be explained by the investment factor. Adding an investment factor in the Fama-French framework reduces the magnitude of underperformance of high Q-acquirers; for example, the equal-weighted alpha from Fama-French model decreases in magnitude from -0.69% (t-statistic = -3.39) to -0.34% (t-statistic = -1.74) and from -0.69% (t-statistic= -3.61) to -0.34% (t-statistic = -1.91) per month over the one- and two-year post-merger horizon, respectively. The abnormal return even becomes insignificant, from -0.52% (t-statistic= -2.65) to -0.27% (t-statistic = -1.40) per month over the three-year post-merger window. The untabulated results from the long-short portfolio show that the differential in long-term performance between high Q- and low Q- acquirers is negligible. Noteworthy, the loadings on the investment factor for the portfolio formed by high Q-acquirers range from -0.72 to -0.59, results significant at 0.1% level. The negative effect of investment factor on post-merger performance is only traced to high Q-acquirers, corroborating my theoretical prior that high Q- acquirers are exposed to more investment opportunities and thus are likely to invest more than low Q- firms, and that their increased investment is negatively related to long-term average returns.

Employing the Q-theory based model yields similar results. High Q-acquirers earn insignificant abnormal returns of -0.08% (t-statistic = -0.41), 0.01% (t-statistic = 0.05), and 0.16% (t-statistic = 0.86) per month over the one-, two-, and three-year post-merger window, while low Q-acquirers earn insignificant abnormal returns. 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 investment is highly correlated with the nature of the acquiring firms and that the investment is the underlying driving force for the observed difference in post-merger performance. Distinct from results of the CAPM and Fama-French three-factor regressions, the high Q-acquirers are no longer outperformed by low Q-acquirers over three-year post-merger horizon when I utilize the Q-theory based model to measure the disparity in performance between the two groups.

Taken together, the results presented in Table 6 suggest strongly that the nature of the acquiring firms influence post-merger performance. The investment factor explains the underperformance of

high Q-acquirers, thereby resolves the post-merger underperformance puzzle.

D Evidence on performance extrapolation hypothesis and investment-based explanation.

Previous studies decry the post-merger underperformance for the valuation of acquiring firms, with value acquirers performing significantly better than glamour acquirers (Rau and Vermaelen (1998)). I argue that the observed disparity in long-term performance between glamour acquirers and value acquirers are determined by the investment rates, rather than the mispricing. The glamour firms undertake more investment opportunities than value firms, and the increased investment is negatively related to discount rates.

To examine the performance extrapolation hypothesis, I use the book-to-market breakpoints from Kenneth French's Web site to categorize the acquirers into value group and glamour group at the most recent fiscal year-end prior to their acquisition transaction. The acquirers with top 30% NYSE book-to-market ratio are classified as value firms, and those with bottom 30% are classified as glamour firms. I perform calendar-time portfolio regression to the two groups. Since Tobin's Q is highly correlated with the book-to-market ratio, not surprisingly, the results for glamour v.s. value acquirers are quite similar to those for high Q- v.s. low Q-acquirers.

Using CAPM and Fama-French (1993) specifications in calendar-time portfolio regressions, I find results in Table 7 consistent with those of Rau and Vermaelen (1998). Portfolio of glamour acquirers experiences negative equal-weighted CAPM alphas of -0.94% (t-statistic = -4.52), -0.82% (t-statistic = -4.08), and -0.59% (t-statistic = -2.83) per month over one-, two- and three-year post-merger period, respectively, whereas portfolio of value acquirers obtains insignificant abnormal returns. Once the investment factor is added to Fama-French (1993) model, the magnitude of the underperformance of glamour acquirers decreases from -0.58% (t-statistic = -3.16) to -0.35% (t-statistic=-2.08), from -0.56% (t-statistic = -3.15) to -0.32% (t-statistic = -1.91), and from -0.42% (t-statistic= -2.19) to -0.22% (t-statistic = -1.19) per month over one-, two-, and three-year post-merger window, respectively. Under the Q-theory based model, the glamour acquirers earn insignificant returns over all three post-merger horizons. The investment factors load negatively for glamour acquirers as

predicted. Value acquirers have higher loadings to the investment factor than glamour acquirers, suggesting that glamour acquirers invest more than value acquirers after the acquisitions complete. In untabulated results, the long-short strategy produces significant abnormal returns under CAPM and Fama-French model, whereas these results are weakened when investment factor is employed. Using Q-theory based model, glamour acquirers no longer underperforms the value acquirers.

E Evidence on method of payments hypothesis and 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 in explaining the performance heterogeneity of cash-financed acquirers and stock-financed acquirers. Previous studies establish that mode of payments impacts post-merger returns, with stock-financed acquirers experience greater underperformance than cash-financed acquirers (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 is caused by poor performance of high Q-stock acquirers, a group that is characterized by high investment-to-asset ratio and low discount rates.

To start with, I reexamine the empirical link between means of payments and post-merger returns. I split the sample according to the means of payments and perform calendar-time factor regressions to the mergers solely financed by cash and those solely financed by equity. Turning first to the CAPM and Fama-French specifications in the first two columns of Table 8, I note that the equal-weighted alphas are negative and statistically significant for the stock-financed acquirers, a result consistent with method of payment hypothesis. For example, over one-, two-, and three-year horizons, the portfolio containing stock acquirers has an equal-weighted abnormal return of -1.08% (t-statistic=-4.75), -0.82% (t-statistic=-3.84), and -0.43% (t-statistic=-2.02) per month from market regression. 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. The evidence presented here confirms the predominant literature that stock-financed acquirers underperform cash-financed acquirers in the long run.

Next, I show that such performance heterogeneity disappears once the investment factor is controlled. In the third column of Table 8, I begin the examination using the investment-augmented Fama-French model. The underperformance of stock acquirers shrinks in magnitude from -0.71% (t-statistic=-3.44) to -0.44% (t-statistic=-2.12), from -0.62% (t-statistic=-3.21) to -0.25% (t-statistic = -1.33), and from -0.39% (t-statistic=-2.06) to -0.10% (t-statistic = -0.53) per month over the one-, two-, and three-year post-merger window, respectively. On the other hand, the cash acquirers portfolio never earns a significant abnormal return. The investment factor loads negatively on the performance of stock acquirers, indicating that increased investment impacts stock acquirer's performance.

Turning next to the Q-theory based model in the fourth column of Table 8, the stock-financed acquirers earn an insignificant equal-weighted alpha of -0.05% (t-statistic=-0.29) and 0.13% (t-statistic=0.70) per month over one- and two-year post-merger horizon, respectively. Over the three-year post-merger period, the portfolio of stock acquirers earns a positive abnormal return of 0.33% (t-statistic = 1.71), a result significant at 10% level. This means that stock acquirers even outperform market in the long run. On the other hand, cash-financed acquirers earn insignificant abnormal returns over all three windows. As predicted, the loadings on the investment factors are all negative and highly significant for stock-financed acquirers, while insignificant for cash-financed counterparts. In untabulated results, the disparity in performance between cash- and stock-financed acquirers becomes insignificant for all three horizons after the Q-theory based model is employed. In other words, stock acquirers are not outperformed by cash acquirers. Altogether, the evidence here supports my prediction that investment is the key factor that explains the well-known post-merger underperformance of equity-financed acquirers.

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 pre-merger Tobin's Q

higher than the NYSE 70% Q ratio breakpoint), and 2) low Q-stock acquirers (i.e. the stock-financed acquirers with pre-merger Tobin's Q lower than the NYSE 30% Q ratio breakpoint).

Table 9 reports the calendar-time portfolio regression results for high Q- and low Q- stock acquirers, respectively. In the CAPM and 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 window. 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 underperformance of high Q-stock acquirers and makes it insignificant. In Table 9, the equal-weighted abnormal return from Fama-French model decreases from -0.70% (t-statistic = -2.22) to -0.19% (t-statistic= -0.61), from -0.93% (t-statistic=-3.05) to -0.34% (t-statistic= -1.17), and from -0.68% (t-statistic= -2.19) to -0.19% (t-statistic= -0.63) per month over one-, two-, and three-year post-merger horizon, respectively. Noteworthy, the investment factor has substantial negative effects on the performance of high Q-stock acquirers, suggesting that high Q-stock acquirers invest more and face lower discount rates than other types of firms.

Turning next to the Q-theory based model presenting in the fourth column of Table 9, the portfolio of high Q-stock acquirers has insignificant returns over one- and two-year post-merger window and even earns a positive abnormal return of 0.50% (t-statistic =1.95) per month over three-year horizon. As predicted, strong and persistent negative loadings on investment factor bring the low returns on high Q-stock acquirer portfolio, while the low Q-stock acquirer portfolio has a positive exposure to 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 influence the returns. To check the robustness of my results, I partition the sample of cash-financed acquirers and perform the same study on high Q- and low Q- cash acquirers. Table 10 shows the results. 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 that high Q-firms invest more than low Q-firms and thus

earn lower average returns.

To sum up, the stock-financed acquirers are largely composed by 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.

F 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 the performance, and I have presented results from successful acquirers. In this section, the failed sample 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 substantial difference between successful and failed stock acquirers in contrast to ignorable difference between successful and failed cash acquirers, which therefore supports the market-timing theory that overvalued firms create value by converting their overpriced equity into hard assets. Besides, they document more pronounced results for glamour stock acquirers and interpret these as evidence that failure is more costly for richly valued acquirers. Instead of viewing low average returns of failed stock acquirers as per se evidence of failure to take advantage of mispricing in the market, I link the low returns to firm's investment opportunities. Specifically, I argue that firms making offers share the same characteristics: high Tobin's Q, plentiful investment opportunities, and low discount rates. Like the underperformance of successful stock acquirers, 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 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 a 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.

As previously mentioned, 39% of failed stock sample is composed by high Q-firms and only 21% by low Q-firms. Therefore, I argue this underperformance is predominately caused by low average returns of high Q-group. The calendar-time portfolio regressions are estimated using weighted least square for failed high Q-stock acquirers and failed low Q-stock acquirers. Table 11 presents the results. Turning first to the CAPM and Fama-French three-factor specifications in Table 11, failed high Q-stock acquirers underperform, especially over the one-year post-announcement window, while failed low Q-stock acquirers earns insignificant abnormal returns over all three post-announcement horizons. Turning next to the investment-augmented Fama-French model and Q-theory based model, the portfolio of both failed high Q- and low Q-stock acquirers experience no underperformance 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 performance. In a robustness check, I run calendar-time portfolio regressions for failed high Q- and low Q-cash acquirers. Table 12 reports the results. As hypothesized , the negative effect of investment factor on performance is traced only to high Q-group, consistent with my earlier interpretation that high Q-firms are exposed to more investment opportunities than low Q-firms, which in turn lowers the average returns of high Q-group.

Having shown that the underperformance of failed stock acquirers can be explained by the investment factor, I then examine whether investment is the driving force for poor returns of failed glamour stock acquirers. Table 13 shows the results of calendar-time portfolio regressions. In the CAPM and Fama-French three-factor specifications, the portfolio of failed glamour stock acquirers experiences significantly negative returns. For example, the portfolio of failed glamour stock acquirers earns a significantly negative CAPM alpha of -2.30% (t-statistic = -3.87), -1.14%

(t-statistic= -2.36), and -1.01% (t-statistic= -2.41) per month over one-, two-, and three-year post-announcement horizon, respectively. In contrast, the portfolio of the failed value stock acquirers earns insignificant abnormal returns over all three windows. Adding the investment factor in the Fama and French (1993) model reduces the magnitude of underperformance from -1.63% (t-statistic = -2.80) to -1.17% (t-statistic = -1.95), from -0.59% (t-statistic = -1.24) to -0.30% (t-statistic = -0.61), and from -0.70% (t-statistic = -1.70) to -0.52% (t-statistic = -1.24) per month over the one-, two-, and three-year post-announcement window, respectively. In the Q-theory based model, the portfolio containing failed glamour stock acquirers earns insignificant abnormal returns over all three horizons. Noteworthy, the failed high Q- stock acquirer performance loads negatively on the investment factor, confirming my conjecture that investment factor explains the poor performance. The increase in investment impacts the post-announcement performance.

Taken together, the poor performance of failed stock acquirers can be traced to the high Q-firms. High Q-firms are exposed to more investment opportunities. High investment rates lead to low discount rates. Traditional asset pricing models fail to take into account the link between investment and performance, and hence, produce negative and significant abnormal returns. Once the investment factor is controlled, I do not observe pronounced underperformance for failed glamour stock acquirers.

G 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 by firms that have completed merger transaction between 7 and 12 months ago, and so on. The last portfolio is composed by firms that have completed merger transaction between 31 and 36 months ago.

Figure 1 reports the event-time equal-weighted alphas of the portfolios from CAPM, Fama-French three-factor model, investment-augmented Fama-French model, and 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-acquistion. 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 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 substantially shrinks when 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. The underperformance even disappears under the Q-theory based model. The model even yields positive abnormal return, 0.33% per month, during month 31-36. The result suggests that when the investment factor is controlled, the stock acquirers no longer underperform. Panel D examines the portfolio abnormal returns of failed high Q-stock acquirers. The worst performance, -3.51% per month, appears in the first six month. This underperformance decreases in magnitude when investment factor is added in Fama-French model. Under the Q-theory based model, the poor performance is only pronounced in the first six months, and the magnitude shrinks to -1.09% per month.

V Conclusions

The merger literature has paid little attention to the link between investment and performance. 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. Traditional asset pricing models, such as CAPM and Fama-French three-factor model, fail to take into account the negative relation between investment and expected returns, and hence, resulting in a post-merger performance puzzle. Upon observing that disproportionately high fraction of acquirers are high Tobin's Q firms, a group characterized with high investment ratio and low discount rate, I use an investment-augmented

Fama French model and a Q-theory based model to examine acquirer's 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. The unconsummated deals are also examined. The poor returns of failed stock acquirers can be traced to high Q-firms. Nevertheless, the negative abnormal returns are only documented when using CAPM and Fama-French three-factor specification. Controlling the investment factor, I do not find the substantial underperformance for 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. If researchers do not take into account the negative relation between investment and expected returns, their analysis might mistakenly over ascribe the poor performance to the mis-valuation of the market.

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Table 1

Time-series distribution of consummated sample and unconsummated sample

This table reports the number of merger and acquisition events each year. Acquirers must be U.S. public firm listed on the Compustat and 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 2009. The unconsummated sample (panel B) consists of failed deals announced between 1984 and 2009 and listed as withdrawn in SDC Platinum U.S. Mergers & Acquisitions database. 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.

Panel A: Consummated Deals				Panel B: Unconsummated Deals		
Year	ALL	CASH	STOCK	ALL	CASH	STOCK
1984	282	5	0	62	4	3
1985	213	61	33	43	16	16
1986	179	102	66	49	19	13
1987	234	89	76	51	12	12
1988	221	105	65	76	28	20
1989	196	84	68	63	15	24
1990	212	78	77	40	8	13
1991	217	72	76	46	4	32
1992	329	90	160	41	7	23
1993	454	104	214	45	5	23
1994	596	176	297	80	15	36
1995	700	177	363	81	16	40
1996	806	196	411	77	6	42
1997	836	207	407	95	14	43
1998	955	190	490	83	14	41
1999	794	169	409	76	16	32
2000	824	170	392	71	18	35
2001	547	146	206	45	8	22
2002	370	141	92	27	2	14
2003	358	160	77	20	6	9
2004	477	205	79	27	6	12
2005	462	213	53	23	7	9
2006	435	224	52	19	5	4
2007	476	232	41	26	8	6
2008	317	159	36	47	19	7
2009	169	56	33	21	4	8
Total	11659	3611	4273	1334	282	539

Table 2

The frequency distribution of consummated deals in size and book-to-market quintiles

This table reports the frequency distribution (in percent) in given size and book-to-market 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. 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). To estimate the book value of preferred stock, I use the redemption, liquidation, or par value of preferred stock (in this order), depending on availability. To calculate the book-to-market ratio, I use the market size at the end of the fiscal year times the number of shares outstanding. The breakpoints of size and book-to-market quintiles are from Kenneth French's Web site.

Panel A: All consummated Sample

	Small Cap.	2	3	4	Big Cap.	All
Low BM	7.94	5.20	5.44	4.75	8.59	31.92
2	5.98	4.72	3.63	3.52	4.03	21.88
3	6.34	3.83	4.04	3.24	2.81	20.26
4	6.20	3.17	2.65	2.20	1.54	15.76
High BM	6.12	1.74	0.82	0.66	0.84	10.18
All	32.58	18.66	16.58	14.37	17.81	100

Panel B: Cash-financed Sample

	Small Cap.	2	3	4	Big Cap.	All
Low BM	5.17	4.29	3.84	3.84	10.13	27.27
2	5.14	5.00	3.76	4.61	4.93	23.44
3	5.88	3.52	4.08	2.74	3.24	19.46
4	6.33	3.31	2.96	2.46	1.90	16.96
High BM	6.79	2.43	1.48	1.02	1.16	12.88
All	29.31	18.55	16.12	14.67	21.36	100

Panel C: Equity-financed Sample

	Small Cap.	2	3	4	Big Cap.	All
Low BM	8.35	6.08	6.96	6.45	10.11	37.95
2	5.54	4.26	3.72	3.35	3.92	20.79
3	5.68	4.12	4.74	3.89	2.56	20.99
4	4.60	2.75	2.87	1.99	1.25	13.46
High BM	4.20	1.22	0.43	0.40	0.60	6.85
All	28.37	18.43	18.72	16.08	18.44	100

Table 3

The frequency distribution of unconsummated deals in size and book-to-market quintiles

This table reports the frequency distribution (in percent) in given size and book-to-market 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. 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). To estimate the book value of preferred stock, I use the redemption, liquidation, or par value of preferred stock (in this order), depending on availability. To calculate the book-to-market ratio, I use the market size at the end of the fiscal year times the number of shares outstanding. The breakpoints of size and book-to-market quintiles are from Kenneth French's Web site.

Panel A: All Unconsummated Sample

	Small Cap.	2	3	4	Big Cap.	All
Low BM	10.90	4.60	4.86	3.66	4.86	28.88
2	7.24	2.90	2.90	3.32	3.15	19.51
3	7.07	3.24	3.49	3.49	2.98	20.27
4	6.64	2.81	2.13	2.04	1.96	15.58
High BM	9.97	2.39	1.36	1.11	0.94	15.77
All	41.82	15.94	14.74	13.62	13.89	100

Panel B: Failed Cash-financed Sample

	Small Cap.	2	3	4	Big Cap.	All
Low BM	8.20	5.74	5.33	3.69	6.56	29.52
2	3.28	3.69	3.28	5.74	4.10	20.09
3	5.74	3.28	2.05	4.92	3.28	19.27
4	4.51	4.92	2.46	2.05	2.87	16.81
High BM	7.38	2.87	2.05	1.23	0.82	14.35
All	29.11	20.50	15.17	17.63	17.63	100

Panel C: Failed Equity-financed Sample

	Small Cap.	2	3	4	Big Cap.	All
Low BM	12.40	4.67	5.89	4.07	3.86	30.89
2	9.15	2.85	2.24	2.44	2.44	19.12
3	8.74	3.05	4.47	2.64	2.03	20.93
4	8.54	1.63	1.83	2.24	1.02	15.26
High BM	9.76	1.42	1.42	0.61	0.61	13.82
All	48.59	13.62	15.85	12.00	9.96	100

Table 4

Percentage of deals by financing type and pre-merger Q-ratio

This table reports the percentage of consummated deals (panel A) and percentage of unconsummated deals (panel B) by financing type and pre-merger Q-ratio. The financing category STOCK includes payments made solely in common stock, CASH includes payments made solely in cash, ALL includes all three financing types (stock, cash and mixed). The pre-merger Q ratio is measured at two 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 pre-merger Tobin's Q at the fiscal year-end of calendar year t-2. 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 Q-ratio is categorized as high if Q is greater than top 30% NYSE Q-ratio breakpoint of measurement year and categorized as low if Q is less than bottom 30% NYSE Q-ratio breakpoint of measurement year.

Panel A: Consummated Sample

Financing Type	Pre-merger Q-ratio	
STOCK	High Q	41%
	Low Q	11%
CASH	High Q	33%
	Low Q	21%
ALL	High Q	45%
	Low Q	20%

Panel B: Unconsummated Sample

Financing Type	Pre-merger Q-ratio	
STOCK	High Q	39%
	Low Q	21%
CASH	High Q	36%
	Low Q	20%
ALL	High Q	36%
	Low Q	23%

Table 5

Calendar-time factor regressions for consummated sample

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model, as well as the coefficients on investment factor (INV) under Investment-augmented Fama-French model and the coefficients on investment factor (IA) under the Q-theory based model. 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 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 Q-theory based model, the factor returns IA and ROA are obtained from Long Chen. In investment-augmented Fama-French model, 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. The adjusted R squares are also reported.

Panel A: Equal-Weighted Portfolio					Panel B: Value-Weighted Portfolio			
	12 months				12 months			
	CAPM	Fama-French	Investment-Augmented	Q-theory Based	CAPM	Fama-French	Investment-Augmented	Q-theory Based
Alpha	-0.0063	-0.0046	-0.0036	-0.0005	-0.0051	-0.0026	-0.0021	-0.0009
	(-3.73***)	(-3.24***)	(-2.53**)	(-0.33)	(-3.37***)	(1.82*)	(-1.44)	(-0.64)
INV			-0.2725				-0.1352	
			(-3.74***)				(-1.84*)	
IA				-0.1761				-0.2430
				(-2.36**)				(-3.22***)
Adj R-Sqr	79.36%	86.52%	87.08%	86.58%	83.07%	86.53%	86.63%	86.18%

	24 months			
	CAPM	Fama-French	Investment-Augmented	Q-theory Based
Alpha	-0.0051	-0.0044	-0.0030	0.0001
	(-3.10***)	(-3.18***)	(-2.20***)	(0.04)
INV			-0.3774	
			(-5.52***)	
IA				-0.1939
				(-2.56**)
Adj R-Sqr	79.44%	86.54%	87.74%	85.43%

	24 months			
	CAPM	Fama-French	Investment-Augmented	Q-theory Based
Alpha	-0.0048	-0.0029	-0.0017	-0.0000
	(-3.00***)	(-1.86**)	(-1.12)	(-0.03)
INV			-0.3046	
			(-3.85***)	
IA				-0.3013
				(-3.94***)
Adj R-Sqr	81.95%	84.00%	84.71%	86.12%

	36 months			
	CAPM	Fama-French	Investment-Augmented	Q-theory Based
Alpha	-0.0033	-0.0033	-0.0020	0.0011
	(-2.00**)	(-2.34**)	(-1.47)	(0.72)
INV			-0.3402	
			(-4.94***)	
IA				-0.1142
				(-1.45)
Adj R-Sqr	79.15%	86.35%	87.34%	83.99%

	36 months			
	CAPM	Fama-French	Investment-Augmented	Q-theory Based
Alpha	-0.0039	-0.0020	-0.0009	0.0011
	(-2.22**)	(-1.16)	(-0.50)	(0.69)
INV			-0.3094	
			(-3.56***)	
IA				-0.2793
				(-3.36***)
Adj R-Sqr	81.95%	81.62%	82.30%	84.49%

Table 6 Calendar-time factor regressions for successful high Q- and low Q-acquirers

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model, as well as the coefficients on investment factor (INV) under Investment-augmented Fama-French model and the coefficients on investment factor (IA) under the Q-theory based model for successful high Q- and low Q-acquirers, respectively. The acquirers are categorized as high Q-firms if their per-merger Q ratio (measured at two fiscal year-end prior to deal announcement) is greater than top 30% NYSE Q-ratio breakpoint of measurement year and categorized as low Q-firms if pre-merger Q is less than bottom 30% NYSE 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. I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site and the factor returns of IA and ROA from Long Chen. In investment-augmented Fama-French model, I add an investment factor, denoted INV, into the Fama and French three-factor model. INV is 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 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. The adjusted R squares are also reported.

Panel A: 12 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0015	-0.0111	-0.0014	-0.0069	-0.0018	-0.0034	0.0030	-0.0008
	(0.85)	(-4.98***)	(-0.94)	(-3.39***)	(-1.19)	(-1.74*)	(1.63)	(-0.41)
INV					0.0881	-0.6812		
					(1.12)	(-7.18***)		
IA							0.2612	-0.6792
							(2.66***)	(-7.07***)
Adj R-Sqr	68.60%	77.18%	80.47%	83.20%	80.49%	85.79%	71.68%	86.89%
Panel B: 24 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0011	-0.0097	-0.0018	-0.0069	-0.0017	-0.0034	0.0022	0.0001
	(0.66)	(-4.61***)	(-1.45)	(-3.61***)	(-1.37)	(-1.91*)	(1.29)	(0.05)
INV					-0.0115	-0.7166		
					(-0.18)	(-8.24***)		
IA							0.1616	-0.6496
							(1.80*)	(-7.31***)
Adj R-Sqr	71.18%	77.72%	85.32%	83.14%	85.27%	86.31%	72.62%	87.32%
Panel C: 36 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0009	-0.0069	-0.0019	-0.0052	-0.0017	-0.0027	0.0017	0.0016
	(0.53)	(-3.25***)	(-1.62)	(-2.65***)	(-1.41)	(-1.40)	(1.02)	(0.86)
INV					-0.0559	-0.5856		
					(-0.91)	(-6.29***)		
IA							0.1770	-0.4663
							(1.99**)	(-5.03***)
Adj R-Sqr	71.97%	76.24%	86.44%	81.23%	86.43%	83.36%	73.09%	85.09%

Table 7

Calendar-time factor regressions for successful value and glamour acquirers

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model, as well as the coefficients on investment factor (INV) under Investment-augmented Fama-French model and the coefficients on investment factor (IA) under the Q-theory based model for successful value and glamour acquirers, respectively. The acquirers are categorized as value acquirers if their book-to-market ratio (measured at fiscal year-end prior to deal announcement) is greater than top 30% NYSE B/M breakpoint and categorized as glamour acquirers if book-to-market ratio is less than bottom 30% NYSE B/M breakpoint. The portfolios consist of firms that have completed acquisitions during the 12/24/36 months prior to the month of portfolio formation. I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site and the factor returns of IA and ROA from Long Chen. In investment-augmented Fama-French model, I add an investment factor, denoted INV, into the Fama and French three-factor model. INV is 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 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. The adjusted R squares are also reported.

Panel A: 12 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Value	Glamour	Value	Glamour	Value	Glamour	Value	Glamour
Alpha	0.0002	-0.0094	-0.0016	-0.0058	-0.0017	-0.0035	0.0015	-0.0007
	(0.11)	(-4.52***)	(-1.16)	(-3.16***)	(-1.21)	(-2.03**)	(0.87)	(-0.44)
INV					0.0309	-0.5955		
					(0.42)	(-6.78***)		
IA							0.3233	-0.5957
							(3.69***)	(-6.68***)
Adj R-Sqr	72.41%	77.41%	82.87%	83.86%	82.82%	85.95%	75.32%	86.92%
Panel B: 24 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Value	Glamour	Value	Glamour	Value	Glamour	Value	Glamour
Alpha	0.0001	-0.0082	-0.0015	-0.0056	-0.0013	-0.0032	0.0010	0.0001
	(0.08)	(-4.08***)	(-1.26)	(-3.15***)	(-1.07)	(-1.91*)	(0.62)	(0.08)
INV					-0.0644	-0.6449		
					(-1.04)	(-7.82***)		
IA							0.2201	-0.5699
							(2.68***)	(-6.92***)
Adj R-Sqr	75.14%	78.42%	86.69%	84.02%	86.69%	86.68%	76.54%	87.60%
Panel C: 36 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Value	Glamour	Value	Glamour	Value	Glamour	Value	Glamour
Alpha	0.0002	-0.0059	-0.0016	-0.0042	-0.0013	-0.0022	0.0009	0.0017
	(0.13)	(-2.83***)	(-1.37)	(-2.19**)	(-1.09)	(-1.19)	(0.53)	(0.97)
INV					-0.1006	-0.5431		
					(-1.62)	(-6.01***)		
IA							0.2286	-0.4163
							(2.70***)	(-4.71***)
Adj R-Sqr	75.46%	77.18%	87.73%	82.14%	87.80%	84.01%	76.49%	85.65%

Table 8

Calendar-time factor regressions for successful cash-financed and stock-financed acquirers

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model for successful cash-financed and stock-financed acquirers, respectively. It also shows the coefficients on investment factor (INV) under Investment-augmented Fama-French model and those on investment factor (IA) under the Q-theory based model. The acquirers are categorized as cash-/stock-financed acquirers if the total value of the transaction as reported by SDC is equal to the value paid through cash /common stocks. The portfolios consist of firms that have completed acquisitions during the 12/24/36 months prior to the month of portfolio formation. I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site and the factor returns of IA and ROA from Long Chen. In investment-augmented Fama-French model, I add an investment factor, denoted INV, into the Fama and French three-factor model. INV is 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 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. The adjusted R squares are also reported.

Panel A: 12 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Cash	Equity	Cash	Equity	Cash	Equity	Cash	Equity
Alpha	-0.0001	-0.0108	-0.0004	-0.0071	-0.0001	-0.0044	0.0009	-0.0005
	(-0.09)	(-4.75***)	(-0.38)	(-3.44***)	(-0.07)	(-2.12**)	(0.68)	(-0.29)
INV					-0.1349	-0.4527		
					(-2.41**)	(-4.34***)		
IA							0.0444	-0.4341
							(0.63)	(-4.45***)
Adj R-Sqr	82.28%	74.12%	89.35%	81.12%	89.52%	82.22%	82.83%	85.61%
Panel B: 24 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Cash	Equity	Cash	Equity	Cash	Equity	Cash	Equity
Alpha	-0.0006	-0.0082	-0.0011	-0.0062	-0.0007	-0.0025	0.0003	0.0013
	(-0.45)	(-3.84***)	(-1.10)	(-3.21***)	(-0.74)	(-1.33)	(0.19)	(0.70)
INV					-0.1412	-0.6385		
					(-2.78***)	(-7.00***)		
IA							0.0655	-0.5245
							(0.96)	(-5.57***)
Adj R-Sqr	82.88%	84.80%	90.69%	81.34%	90.89%	84.00%	83.33%	84.66%
Panel C: 36 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Cash	Equity	Cash	Equity	Cash	Equity	Cash	Equity
Alpha	-0.0003	-0.0043	-0.0011	-0.0039	-0.0008	-0.0010	0.0004	0.0033
	(-0.23)	(-2.02**)	(-1.12)	(-2.06**)	(-0.78)	(-0.53)	(0.29)	(1.71*)
INV					-0.1457	-0.5183		
					(-2.83***)	(-5.67***)		
IA							0.1042	-0.3617
							(1.49)	(-3.68***)
Adj R-Sqr	82.06%	74.81%	90.72%	81.06%	90.93%	82.90%	82.82%	82.37%

Table 9

Calendar-time factor regressions for successful high Q- and low Q- stock acquirers

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model for successful high Q- and low Q- stock acquirers, respectively. It also shows the coefficients on investment factor (INV) under Investment-augmented Fama-French model and those on investment factor (IA) under the Q-theory based model. The stock-financed acquirers are categorized as high Q-firms if their per-merger Q ratio (measured at two fiscal year-end prior to deal announcement) is greater than top 30% NYSE Q-ratio breakpoint of measurement year and categorized as low Q-firms if pre-merger Q is less than bottom 30% NYSE 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. I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site and the factor returns of IA and ROA from Long Chen. In investment-augmented Fama-French model, I add an investment factor, denoted INV, into the Fama and French three-factor model. INV is 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 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. The adjusted R squares are also reported.

Panel A: 12 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	-0.0125	-0.0133	-0.0159	-0.0070	-0.0169	-0.0019	-0.0077	0.0035
	(-1.81*)	(-4.01***)	(-2.28**)	(-2.22**)	(-2.39**)	(-0.61)	(-1.09)	(1.28)
INV					0.3076	-0.8237		
					(0.89)	(-5.41***)		
IA							0.7776	-0.9580
							(2.19**)	(-6.90***)
Adj R-Sqr	35.13%	66.04%	39.93%	73.15%	39.87%	75.54%	40.00%	81.73%
Panel B: 24 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	-0.0034	-0.0140	-0.0059	-0.0093	-0.0062	-0.0034	0.0010	0.0028
	(-0.59)	(-4.37***)	(-1.04)	(-3.05***)	(-1.06)	(-1.17)	(0.16)	(1.13)
INV					0.0636	-0.9880		
					(0.22)	(-7.12***)		
IA							0.4017	-0.9515
							(1.29)	(-7.54***)
Adj R-Sqr	40.83%	66.87%	47.53%	73.06%	47.30%	77.01%	43.91%	83.38%
Panel C: 36 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	-0.0032	-0.0098	-0.0057	-0.0068	-0.0062	-0.0019	0.0020	0.0050
	(-0.63)	(-3.04***)	(-1.17)	(-2.19**)	(-1.24)	(-0.63)	(0.38)	(1.95*)
INV					0.1267	-0.8453		
					(0.53)	(-5.89***)		
IA							0.3498	-0.7187
							(1.30)	(-5.53***)
Adj R-Sqr	43.91%	67.19%	54.02%	72.35%	53.86%	75.24%	47.57%	82.22%

Table 10

Calendar-time factor regressions for successful high Q- and low Q- cash acquirers

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model for successful high Q- and low Q- cash acquirers, respectively. It also shows the coefficients on investment factor (INV) under Investment-augmented Fama-French model and those on investment factor (IA) under the Q-theory based model. The cash-financed acquirers are categorized as high Q-firms if their per-merger Q ratio (measured at two fiscal year-end prior to deal announcement) is greater than top 30% NYSE Q-ratio breakpoint of measurement year and categorized as low Q-firms if pre-merger Q is less than bottom 30% NYSE 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. I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site and the factor returns of IA and ROA from Long Chen. In investment-augmented Fama-French model, I add an investment factor, denoted INV, into the Fama and French three-factor model. INV is 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 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. The adjusted R squares are also reported.

Panel A: 12 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0031	-0.0037	0.0026	-0.0012	0.0019	0.0002	0.0033	0.0011
	(1.06)	(-1.34)	(0.95)	(-0.44)	(0.70)	(0.06)	(0.74)	(0.40)
INV					0.2579	-0.5682		
					(1.70*)	(-4.09***)		
IA							0.6707	-0.3288
							(2.83***)	(-2.31**)
Adj R-Sqr	48.98%	62.70%	58.32%	66.63%	58.59%	68.36%	39.67%	64.92%
Panel B: 24 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0029	-0.0012	0.0021	0.0012	0.0022	0.0022	0.0067	0.0031
	(1.26)	(-0.53)	(0.99)	(0.53)	(1.04)	(1.02)	(1.95*)	(1.27)
INV					-0.0560	-0.4706		
					(-0.48)	(-4.13***)		
IA							0.2196	-0.2334
							(1.21)	(-1.95*)
Adj R-Sqr	61.94%	70.93%	69.44%	75.06%	69.36%	76.38%	47.82%	71.80%
Panel C: 36 months								
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0017	-0.0014	0.0000	0.0007	0.0002	0.0015	0.0035	0.0032
	(0.75)	(-0.64)	(0.02)	(0.36)	(0.08)	(0.76)	(1.13)	(1.50)
INV					-0.0680	-0.3694		
					(-0.62)	(-3.56***)		
IA							0.3529	-0.1957
							(2.17**)	(-1.89*)
Adj R-Sqr	64.77%	73.75%	74.30%	78.37%	74.25%	79.21%	52.06%	77.31%

Table 11

Calendar-time factor regressions for failed high Q- and low Q- stock acquirers

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model for failed high Q- and low Q- stock acquirers, respectively. It also shows the coefficients on investment factor (INV) under Investment-augmented Fama-French model and those on investment factor (IA) under the Q-theory based model. The failed stock acquirers are categorized as high Q-firms if their per-merger Q ratio (measured at two fiscal year-end prior to deal announcement) is greater than top 30% NYSE Q-ratio breakpoint of measurement year and categorized as low Q-firms if pre-merger Q is less than bottom 30% NYSE 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 failed stock-financed acquirers that have announced acquisitions during the 12/24/36 months prior to the month of portfolio formation. I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site and the factor returns of IA and ROA from Long Chen. In investment-augmented Fama-French model, I add an investment factor, denoted INV, into the Fama and French three-factor model. INV is 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 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. The adjusted R squares are also reported.

Panel A: 12 months

	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0013	-0.0227	-0.0013	-0.0136	-0.0020	-0.0085	0.0078	-0.0001
	(0.13)	(-3.13***)	(-0.13)	(-1.91*)	(-0.19)	(-1.15)	(0.72)	(-0.01)
INV					0.1726	-0.8951		
					(0.30)	(-2.31**)		
IA							0.3135	-1.0618
							(0.55)	(-2.78***)
Adj R-Sqr	15.62%	20.91%	17.21%	29.35%	16.86%	30.50%	17.46%	38.52%

Panel B: 24 months

	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0039	-0.0128	0.0021	-0.0058	0.0015	-0.0024	0.0122	0.0070
	(0.54)	(-2.19**)	(0.28)	(-1.00)	(0.20)	(-0.41)	(1.59)	(1.26)
INV					0.1429	-0.6012		
					(0.35)	(-1.95*)		
IA							0.1690	-0.7471
							(0.42)	(-2.53**)
Adj R-Sqr	20.10%	32.27%	23.71%	40.13%	23.43%	40.74%	25.65%	49.74%

Panel C: 36 months

	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0085	-0.0111	0.0051	-0.0067	0.0054	-0.0046	0.0140	0.0040
	(1.40)	(-2.24**)	(0.84)	(-1.38)	(0.86)	(-0.92)	(2.17**)	(0.84)
INV					-0.0678	-0.4214		
					(-0.20)	(-1.65*)		
IA							0.0634	-0.4425
							(0.18)	(-1.79*)
Adj R-Sqr	22.43%	38.24%	28.45%	45.60%	28.17%	45.93%	25.36%	53.31%

Table 12

Calendar-time factor regressions for failed high Q- and low Q- cash acquirers

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model for failed high Q- and low Q- cash acquirers, respectively. It also shows the coefficients on investment factor (INV) under Investment-augmented Fama-French model and those on investment factor (IA) under the Q-theory based model. The failed cash acquirers are categorized as high Q-firms if their per-merger Q ratio (measured at two fiscal year-end prior to deal announcement) is greater than top 30% NYSE Q-ratio breakpoint of measurement year and categorized as low Q-firms if pre-merger Q is less than bottom 30% NYSE 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 failed cash-financed acquirers that have announced acquisitions during the 12/24/36 months prior to the month of portfolio formation. I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site and the factor returns of IA and ROA from Long Chen. In investment-augmented Fama-French model, I add an investment factor, denoted INV, into the Fama and French three-factor model. INV is 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 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. The adjusted R squares are also reported.

Panel A: 12 months

	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0024	-0.0034	0.0011	-0.0029	-0.0011	-0.0003	-0.0034	0.0010
	(0.46)	(-0.83)	(0.22)	(-0.69)	(-0.23)	(-0.07)	(-0.53)	(0.18)
INV					0.5321	-0.5868		
					(2.12**)	(-2.28**)		
IA							0.9545	-0.3729
							(2.88***)	(-1.20)
Adj R-Sqr	29.51%	43.64%	41.05%	44.28%	41.80%	45.10%	31.41%	37.15%

Panel B: 24 months

	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0031	-0.0009	-0.0012	-0.0001	-0.0025	0.0011	-0.0060	0.0040
	(0.76)	(-0.28)	(-0.35)	(-0.02)	(-0.68)	(0.33)	(-1.20)	(0.98)
INV					0.3363	-0.2897		
					(1.70*)	(-1.56)		
IA							0.8583	-0.0998
							(3.14***)	(-0.45)
Adj R-Sqr	31.89%	52.80%	46.89%	55.51%	47.23%	55.72%	32.69%	46.23%

Panel C: 36 months

	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Low Q	High Q	Low Q	High Q	Low Q	High Q	Low Q	High Q
Alpha	0.0034	-0.0013	-0.0021	-0.0005	-0.0025	0.0009	-0.0018	0.0039
	(1.00)	(-0.48)	(-0.72)	(-0.18)	(-0.84)	(0.31)	(-0.40)	(1.14)
INV					0.1110	-0.4246		
					(0.72)	(-2.68***)		
IA							0.6821	-0.2185
							(2.88***)	(-1.18)
Adj R-Sqr	39.62%	58.20%	56.01%	61.28%	55.94%	62.07%	34.66%	53.91%

Table 13

Calendar-time factor regressions for failed glamour and value stock acquirers

This table reports calendar-time abnormal returns under CAPM, Fama-French three-factor model (1993), Investment-augmented Fama-French model, and Chen, Novy-Marx, and Zhang (2010) Q-theory based model for failed glamour and value stock acquirers, respectively. It also shows the coefficients on investment factor (INV) under Investment-augmented Fama-French model and those on investment factor (IA) under the Q-theory based model. The acquirers are categorized as value acquirers if their book-to-market ratio (measured at fiscal year-end prior to deal announcement) is greater than top 30% NYSE B/M breakpoint and categorized as glamour acquirers if book-to-market ratio is less than bottom 30% NYSE B/M breakpoint. The portfolios consist of failed stock-financed acquirers that have announced acquisitions during the 12/24/36 months prior to the month of portfolio formation. I obtain the factor returns of market, SMB, and HML from Kenneth French's Web site and the factor returns of IA and ROA from Long Chen. In investment-augmented Fama-French model, I add an investment factor, denoted INV, into the Fama and French three-factor model. INV is 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 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. The adjusted R squares are also reported.

Panel A: 12 months

	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Value	Glamour	Value	Glamour	Value	Glamour	Value	Glamour
Alpha	-0.0056	-0.0230	-0.0064	-0.0163	-0.0086	-0.0117	0.0004	-0.0032
	(-0.82)	(-3.87***)	(-0.92)	(-2.80***)	(-1.20)	(-1.95*)	(0.06)	(-0.56)
INV					0.5167	-0.8311		
					(1.35)	(-2.63***)		
IA							0.7655	-0.8825
							(2.07**)	(-2.88***)
Adj R-Sqr	16.53%	25.56%	19.55%	33.96%	19.79%	35.26%	23.50%	43.28%

Panel B: 24 months

	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Value	Glamour	Value	Glamour	Value	Glamour	Value	Glamour
Alpha	-0.0004	-0.0114	-0.0008	-0.0059	-0.0026	-0.0030	0.0058	0.0057
	(-0.07)	(-2.36**)	(-0.16)	(-1.24)	(-0.49)	(-0.61)	(1.08)	(1.23)
INV					0.4590	-0.5522		
					(1.60)	(-2.14**)		
IA							0.5388	-0.8269
							(1.91*)	(-9.85***)
Adj R-Sqr	21.97%	36.54%	28.20%	44.13%	28.58%	44.79%	30.87%	52.61%

Panel C: 36 months

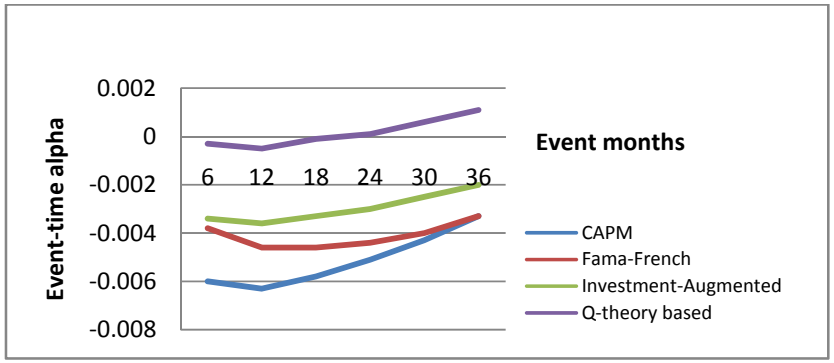
	CAPM		Fama-French		Investment-Augmented		Q-theory Based	
	Value	Glamour	Value	Glamour	Value	Glamour	Value	Glamour
Alpha	0.0035	-0.0101	0.0018	-0.0070	0.0010	-0.0052	0.0085	0.0029
	(0.78)	(-2.41**)	(0.41)	(-1.70*)	(0.23)	(-1.24)	(1.85*)	(0.72)
INV					0.1842	-0.3576		
					(0.79)	(-1.64)		
IA							0.3499	-0.7197
							(1.45)	(-10.03***)
Adj R-Sqr	27.06%	42.90%	35.64%	50.20:%	35.56%	50.48%	33.30%	57.28%

Figure 1

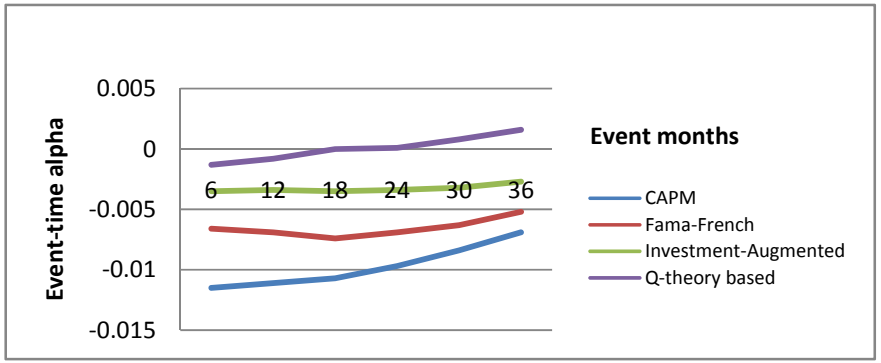
Abnormal returns from even-time regression

This figure reports the alphas from even-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: CAPM, Fama-French (1993) three factor model, investment-augmented Fama-French model, and Q-theory based model. The portfolio returns are equal-weighted and the regressions are estimated using weighted least square.

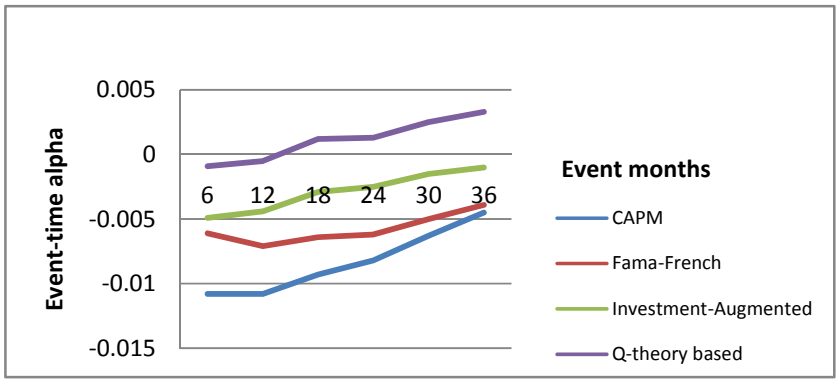
Panel A: all successful acquirers



Panel B: successful high Q-acquirers



Panel C: successful stock acquirers



Panel D: failed high Q-stock acquirers