THREE ESSAYS IN CORPORATE FINANCE

by

HONGCHAO ZENG

DOUGLAS O. COOK, COMMITTEE CHAIR
JAMES A. LIGON
SHANE UNDERWOOD
B. MICHAEL ADAMS
JUNSOO LEE

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ABSTRACT

This dissertation contains three essays in corporate finance.

In the first essay, using the presence of business combination (BC) laws to proxy for the monitoring strength of the takeover market, we examine how an active takeover market affects the level and valuation of corporate cash holdings. After accounting for potential endogeneity of state incorporation, we find that firms incorporated in states without BC laws hold significantly more cash than those incorporated in states with BC laws. We also find that the value of cash holdings used by firms to defend themselves against unwanted takeovers in the presence of an active takeover market is not discounted by investors. Our findings suggest a substitution effect between legal antitakeover protection and firms' use of cash protection. However, there is no evidence that these cash holdings lead to value destruction. Firms may use corporate payouts to signal internal governance quality and avoid a market discount placed on cash holdings.

In the second essay, using the Herfindahl-Hirschman Index (HHI), the industry price-cost margin, the number of firms within an industry, and the level of import penetration to gauge the intensity of product market competition, we find that the speed of capital structure adjustment for firms in competitive industries is significantly faster than for firms in non-competitive industries. Further analysis reveals that this effect is driven solely by the capital structure movements of over-levered firms. While over-levered firms in competitive industries face higher levels of investment needs relative to those in non-competitive industries, they are significantly less likely to use debt financing and to deliberately deviate from target.

In the third essay, we find that cash has a negative impact on the future market share growth of the old firms, evidence that can better explain the unwillingness of such firms to hold precautionary cash as they face increasingly more volatile cash flows in an imperfect capital market. Furthermore, we show that the relational strength between cash and product market performance evolves in a way that reflects a changing composition of manufacturing firms which progressively tilts toward young firms.

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CHAPTER 1

THE TAKEOVER MARKET AND CORPORATE CASH HOLDINGS

1.1. Introduction

The literature on corporate governance and corporate cash policies can be traced to the agency costs of free cash flow theory developed by Jensen (1986), which focuses on the conflicts of interest between managers and shareholders over cash payouts. The conflict occurs as a result of entrenched managers wishing to hold excess cash and engage in value-decreasing activities at the expense of shareholders. Jensen stresses the importance of the compensating monitoring roles played by a firm's internal control system and the external market for corporate control as the disciplining power of the product and factor markets weakens.

While the effectiveness of any corporate governance mechanism is evaluated conventionally by its ability to force managers to disgorge excess cash, the empirical evidence is rather mixed not only on the relations between the levels of cash holdings and corporate governance, but also on the effects of large cash reserves on shareholder wealth. Regarding the levels of cash holdings, Dittmar, Mahrt-Smith, and Servaes (2003) and Pinkowitz, Stulz, and Williamson (2006) find international evidence that weaker shareholder rights are associated with higher cash holdings. In contrast, Harford, Mansi, and Maxwell (2008) show that U.S. firms with weaker corporate governance structures tend to have smaller cash reserves.[1] Mikkelson and Partch (2003) find no evidence that high cash firms have greater incentive problems. Regarding

the negative valuation effects of large cash reserves, Pinkowitz, Stulz, and Williamson (2006) find that cash is valued less in countries with poor investor protection and Dittmar and Mahrt-Smith (2007) show that the value of cash in poorly governed firms is significantly lower than in well- governed firms. Similarly, Harford (1999) and Harford, Mansi, and Maxwell (2003) find that firms with large cash reserves tend to make value-decreasing acquisitions. In contrast, Mikkelson and Partch (2003) find that persistently high cash holdings do not lead to worse firm performance and Bates, Kahle, and Stulz (2009) show that the continuing increase in U.S. firms' cash holdings from 1980 to 2006 does not destroy the value of cash.

Although there is a large amount of literature examining the relationship between cash holdings and corporate governance, there is little analysis of the impact of the market for corporate control on cash holdings.[2] Jensen's free cash flow theory (1986) argues that since firms with large amounts of free cash flow are likely to engage in value reducing mergers and other activities that reduce corporate value, these firms are also likely to be targeted by the takeover market. Harford (1999) finds consistent evidence that acquisitions by cash rich firms are value decreasing. However, Harford as well as Pinkowitz (2002) find that excess cash holdings actually lower the likelihood of an acquisition by reducing the probability that a firm will be targeted through channels like repurchases tender offers, employing the "Pac Man defense" or paying cash to shareholders. Thus, whether the takeover market monitors or promotes corporate cash holdings is an unresolved empirical issue.

In this paper, we analyze four interrelated issues. First, we examine the effect of an active takeover market on the level of corporate cash holdings. Since it has been shown that business combination (BC) laws are the most stringent second-generation antitakeover laws, we use the existence these laws to proxy for the monitoring strength of the takeover market. Thus, if a firm

is incorporated in a state without (with) BC laws, it is presumed to operate in an active (inactive) takeover market. We are using this proxy to test a substitution effect between legal antitakeover protection and firms' use of cash for protection.

After controlling for firm-specific characteristics and firm-level corporate governance through institutional ownership, we find support for the takeover-deterrence hypothesis, which predicts that an active takeover market incentivizes managers to hold more cash to protect against hostile takeover attempts. While our results are robust to different model specifications and subsample periods, the employment of additional control variables, and the exclusion of Delaware as the state of incorporation, there are two important concerns about our methodology. First, the state of incorporation could be endogenous due to selection bias. If firms holding excess cash self-select into states without BC laws, our results could be biased and inconsistent. We address this concern using the Heckman two-stage treatment effect model. After accounting for the potential endogeneity of state incorporation using lagged non-BC industry density and lagged non-BC state density as instruments,[3] we still find that non-BC firms hold significantly more cash than BC firms. Second, our results could be driven by possible permanent differences between non-BC and BC firms, and such differences could cause non-BC firms to hold higher levels of cash holdings even before the passage of BC laws. To address this concern, we use an earlier sample period in our analysis and find evidence that the levels of cash holdings in non-BC firms are lower relative to BC firms before the enactment of BC laws.

Second, we examine whether financial constraints affect how corporate cash policies respond to the monitoring of the takeover market. Although the agency costs of free cash flow might be expected to plague firms that generate large cash flows but have low growth prospects (Jensen (1986)), financially constrained firms might be less likely affected since managerial

slack would be mitigated by high levels of investment opportunities accompanied by low levels of cash flows.

Our premise finds support as follows: Stulz (1990) argues that the agency costs of managerial discretion are higher for low market-to-book firms than for high market-to-book firms and Opler et al. (1999) suggest that the agency costs of managerial discretion may be trivial for firms with valuable investment opportunities because the objectives of management and shareholders are more likely to align under such a context. Furthermore, Denis and Sibilkov (2009) find that large cash holdings of financially constrained firms with high hedging needs are associated with higher levels of investment, while low cash holdings in some constrained firms reflect persistently low cash flows. Therefore, we hypothesize that financially constrained firms should be less sensitive to the monitoring of the takeover market, and the threat of hostile takeovers should have a larger impact on the cash policies of financially unconstrained firms.

In our empirical analysis, we first use the SA index developed by Hadlock and Pierce (2010) to measure financial constraint levels but then also test four other conventional measures (payout ratio, firm size, bond rating, and commercial paper rating). In all of our analyses, we control for the potential endogeneity of state incorporation using the inverse Mill's ratio and find that firms' higher levels of cash holdings in non-BC states are more pronounced in financially unconstrained subsamples.

Third, we examine whether the excess cash held by non-BC firms as acquisition protection leads to value destruction. Specifically, we employ two methods to analyze the marginal value placed by shareholders on a firm's cash holdings. First, following Faulkender and Wang (2006), we use excess stock returns to proxy for the market valuation of a firm, and evaluate how a change in the firm's cash holdings affects the firm's market value. Second, we utilize the

methodology in Fama and French (1998) and use market-to-book ratios to proxy for market value and to assess the value of excess cash to shareholders. Both methods generate the result that shareholders do not appear to discount the value of cash held by firms for takeover-deterrence purposes in non-BC states.

Last, we investigate the reasons why shareholders are not concerned with excess cash holdings by firms in non-BC states. Tracing out the spending patterns of both non-BC and BC firms, we show that the payouts of non-BC firms are not lower than those in BC firms. Using multivariate analyses, we provide evidence that non-BC firms are associated with significantly higher dividend payout ratios, suggesting that the use of payouts may signal good internal governance quality, thereby avoiding a market discount placed on cash holdings.

Our paper contributes to the literature in the following ways. First, to the best of our knowledge, we are the first to directly test the effects of the takeover market on corporate cash holdings, finding evidence that the takeover market contributes to excess cash holdings. Second, we show that excess cash holdings are more pronounced in financially unconstrained firms, providing evidence that financial constraints have a differential impact on corporate cash policies. Third, we find that while firms in non-BC states hold more cash, the market does not appear to discount the value of cash, indicating that the excess cash holdings are not necessarily dissipated in destructive ways.

The remainder of this paper is organized as follows. Section 2 briefly discusses the state antitakeover laws, with a focus on business combination laws, and develops hypotheses. Section 3 describes data selection and sample construction, and presents summary statistics. Section 4 presents and discusses our findings. Section 5 conducts robustness tests. Section 6 concludes.

1.2. Brief description of state antitakeover laws and hypotheses development

1.2.1. Description of state antitakeover laws

The regulation of hostile takeovers has been a focus of U.S. corporate laws. The first generation antitakeover statutes were initially adopted in Virginia, and then followed in 36 other states during the 1970s. In 1982, the Supreme Court declared a first generation antitakeover statute, the Illinois antitakeover law, to be unconstitutional. In response, many states enacted second generation antitakeover laws, which embody five standard types: 1) control share acquisition statutes require a hostile bidder to put its offer to vote before proceeding with it. Failure to do so may cause the loss of control rights over the shares it purchases; 2) fair price statutes require a bidder who has succeeded in gaining control to pay the remaining minority shareholders the same price paid for shares acquired through its bid; 3) business combination statutes prevent a bidder who gains control from merging the target with its own assets;[4] 4) poison pills allow shareholders to purchase shares at a discount in the event that any acquirer obtains a significant block without the approval of the board; and 5) constituencies permit managers to take into account the interests of non-shareholders in defending against a takeover (Bebchuk and Cohen (2003)).

Among the second generation antitakeover statutes, business combination (BC) laws are considered to have the most stringent effect on hostile takeovers as sheltering from takeover market monitoring allows managers more freedom to pursue their own interest, thereby increasing agency costs.[5] Thus, the passage of BC laws generates an exogenous variation in corporate governance, and has been widely used by researchers in empirical testing (Bertrand and Mullainathan (2003), Qiu and Yu (2009), Giroud and Mueller (2010), Frésard and Salva (2010), and Francis et al. (2011)). In this paper, we use BC laws to measure the monitoring

strength of the takeover market. Non-BC states are considered to contain strong takeover markets while BC states are considered to have weak takeover markets.

1.2.2. Hypotheses development

Conventionally, the takeover market is considered to be an effective governance mechanism to monitor corporate cash holdings (Jensen (1986)). However, this conventional wisdom is challenged by Pinkowitz (2002) and Harford (1999) who find that cash-rich firms are less likely to be targeted in hostile takeover attempts. Faleye (2004) provides an overview of the reasons that explain the failure of the takeover market to prevent firms from holding excess cash.[6] If an active takeover market incentivizes managers to hold more cash, then we should observe higher levels of cash holdings in non-BC states, compared to BC states.

> Hypothesis 1: Ceteris paribus, firms incorporated in non-BC states prefer to hold more cash than firms incorporated in BC states.

The effects of financial constraints on corporate cash policies have been documented in prior research.[7] Financially constrained firms are usually small and young firms with rich growth opportunities, characteristics not generally associated with free cash flow problems. Thus, financial constraints may serve to mitigate the agency costs of discretional excess cash holdings, reducing firms' sensitivity to the monitoring of the takeover market.

> Hypothesis 2: Ceteris paribus, the results in Hypothesis 1 are more pronounced for financially unconstrained firms.

1.3. Data and summary statistics

1.3.1. Data selection and sample construction

We obtain our data from multiple sources. We begin with all U.S. publicly traded firms listed on merged CRSP/Compustat files from 1990 to 2000 and exclude all financial firms (SIC codes 6000-6999) and utilities (SIC codes 4900-4999). We then delete all firm-year observations where total assets or sales are either missing or non-positive. Details regarding variable construction are in APPENDIX A.

Our analyses use institutional ownership to proxy for the monitoring function played by the presence of large shareholders. We obtain data on institutional holdings from Thomson Financial, and calculate this measure as the sum of all shares owned by institutional investors as a percentage of the firm's total number of shares outstanding. Higher institutional ownership is expected to reflect better corporate governance.

To study the impact of the takeover market on cash holdings, we define the dummy variable non-BC as 1 if a firm is incorporated in a state without BC laws and 0 otherwise. Both states of incorporation and states of locations are from Compustat. We obtain the year in which a state adopted its business combination (BC) law from Bertrand and Mullainathan (2003), and list the years of BC law passage in APPENDIX B.

To gauge the effect of excess cash holdings on the value of cash, we follow the methodology in Faulkender and Wang (2006) and examine the variation in excess stock returns over the fiscal year. Data on stock returns are from CRSP while break points for the 25 portfolios formed on size and BE/ME are from Kenneth R. French's web page and the factor monthly returns are from the Fama French & Liquidity Factors on WRDS. We calculate the benchmark return using the value-weighted monthly return of the actual portfolio a firm belongs to each month.[8] The excess stock return is the annual realized stock return less the benchmark return.

We winsorize all variables at the top and bottom one percentile to mitigate the influence of outliers. To be included in our initial sample, a firm-year observation must have non-missing values for all variables. The above selection criteria results in 33,596 firm-year observations.

1.3.2. Descriptive statistics

We divide our sample into non-BC and BC subsamples based on whether BC laws were passed at the time in question in the state of incorporation. Table 1 presents the summary statistics of the most commonly used control variables in the cash holdings analyses. The number of firms incorporated in non-BC states is much smaller than those in BC states, consistent with the findings in Bebchuk and Cohen (2003) that states offering strong antitakeover laws are substantially more successful both in retaining in-state firms and in attracting out-of-state incorporations.

On average, firms incorporated in non-BC states not only have higher cash holdings, but are also larger than firms incorporated in BC states. The mean difference between the size of non-BC and BC firms is significant at the 5% significance level, suggesting that the non-BC subsample is not dominated by financially constrained firms, characterized as small, young firms with large cash holdings. The mean institutional holdings for non-BC firms is 28% but 34% for BC firms and this 6% difference is significant at the 1% level with a *t*-statistics of 16.45, suggesting weaker internal corporate governance in non-BC firms. In addition, the two subsamples differ significantly in the amount of net working capital, capital expenditures, leverage, industry sigma, and R&D. Since the marginal impact on cash holdings will need to be determined after controlling for all the above differences, we perform multivariate analyses in Section 4.

1.4. Empirical results

In this section, we first analyze how an active takeover market affects the levels of corporate cash holdings. We then examine the effects of financial constraints on firms' cash policies. Finally, we investigate whether shareholders value differently the excess cash held by firms incorporated in non-BC states. In our analyses, we account for the potential endogeneity of state incorporation caused by selection bias using the Heckman two-stage treatment effect model.

1.4.1. The takeover market and the levels of cash holdings

We test the impact of an active takeover market on corporate cash holdings using the following specification:

$$Cash_{i,t} = \beta_0 + \beta_1(Non\text{-}BC_{i,t}) + \beta_2(MB_{i,t}) + \beta_3(SIZE_{i,t}) + \beta_4(CF_{i,t}) + \beta_5(NWC_{i,t}) + \beta_6(CAPEX_{i,t}) + \beta_7(LEV_{i,t}) + \beta_8(SIGMA_{i,t}) + \beta_9(RD_{i,t}) + \beta_{10}(DIV_{i,t}) + \beta_{11}(HOLDING_{i,t}) + \bar{y}_{jt}^{(i)} + \bar{y}_{lt}^{(i)} + \epsilon_{i,t} \quad (1)$$

where the dependent variable is the natural log of cash holdings to total assets ratio. Non-BC is a dummy variable equal to 1 if a state passed a BC law and 0 otherwise. We follow Opler et al. (1999) and control for firm-specific characteristics that include the market-to-book ratio, firm size, cash flows, net working capital, capital expenditures, the book leverage ratio, industry sigma, R&D expense, and a dividend dummy equal to 1 if a firm pays a dividend in year t and 0 otherwise. Following the literature on cash holdings and corporate governance (e.g., Dittmar and Mahrt-Smith (2007) and Harford, Mansi, and Maxwell (2008)), we use the proportion of institutional ownership (HOLDING) to proxy for investor oversight over management's use of corporate resources. As in Qiu and Yu (2009), we use $\bar{y}_{jt}^{(i)}$ and $\bar{y}_{lt}^{(i)}$ to control for industry shocks and state shocks, respectively, where $\bar{y}_{jt}^{(i)}$ denotes the average logarithm of cash holdings

in year t across all firms in industry j, excluding firm i, based on the 48 Fama and French (1997) industry definition, while $\bar{y}_{lt}^{(i)}$ depicts the average logarithm of cash holdings in year t across all firms located in state l, excluding firm i.

One potential concern for our model specification in Equation (1) is that firms with higher cash holdings may self-select into non-BC states, thus biasing our estimates. We therefore endogenize firms' decisions of where to incorporate using a Heckman two-stage treatment effect model to correct for this potential endogeneity of state incorporation.

In the first stage, we estimate the following probit model predicting the probability of a firm incorporating in a state without BC laws:

$$Y_i^* = \alpha_0 + \alpha_1(MB_{i,t}) + \alpha_2(SIZE_{i,t}) + \alpha_3(CF_{i,t}) + \alpha_4(NWC_{i,t}) + \alpha_5(CAPEX_{i,t}) + \alpha_6(LEV_{i,t}) + \alpha_7(SIGMA_{i,t}) + \alpha_8(RD_{i,t}) + \alpha_9(DIV_{i,t}) + \alpha_{10}(HOLDING_{i,t}) + \alpha_{11}(\bar{y}_{jt}^{(i)}) + \alpha_{12}(\bar{y}_{lt}^{(i)}) + \alpha_{13}(\text{Non-BC State-density})_{t-1} + \alpha_{14}(\text{Non-BC Industry-density})_{t-1} + \epsilon_i$$

and

$$Y_i = \begin{cases} 1 \ \ if\ Y_i^* \geq 0 \\ 0 \ if\ Y_i^* < 0 \end{cases} \qquad (2)$$

where the dependent variable Y_i^* is a latent continuous variable reflecting the propensity of a firm to incorporate in a state without BC laws. Y_i is a binary indicator which equals 1 if the firm incorporates in a non-BC state and 0 otherwise. The firm-level control variables are the exogenous independent variables from Equation (1). We use lagged non-BC state-density and lagged non-BC industry-density as instrumental variables, computing non-BC state-density as the average annual value of the non-BC dummy for all firms headquartered in firm i's state, excluding firm i. Similarly, we calculate non-BC industry-density as the average annual value of the non-BC dummy for all firms in firm i's industry, excluding firm i, where industry is based on

the 48 Fama-French (1997) industry definition. We achieve identification with sufficient variations in non-BC density by state of location and industry.

Table 2 presents the estimated coefficients from Equation (2). The coefficients on the instrumental variables are highly significant, suggesting that the instruments strongly explain whether a firm chooses to incorporate in a state without BC laws. To control for potential selection bias, we obtain the inverse Mill's ratio and use it as an additional control variable in Equation (1), which becomes the second-stage estimation of the Heckman treatment effect model. We report the estimation results in Table 3.

Our variable of interest is non-BC, where a positive and statistically significant coefficient for this variable would provide direct support for Hypothesis 1, indicating that the takeover market incentivizes managers to hold more cash. Table 3 column 1 presents the coefficients estimated from a cross-sectional regression without controlling for firm and year fixed effects. We find that an active takeover market is associated with higher corporate cash holdings. In column 2, we use a panel data model to control for both firm and year fixed effects and find, consistent with the cross-sectional result, that the coefficient on non-BC is positive and significant. Although all firm-level control variables are significant at the 1% level in the pooled OLS regression, we note that the coefficients on institutional ownership and the inverse Mill's ratio become insignificant after we control for the firm and year fixed effects. These results suggest that firm-level corporate governance as proxied by institutional ownership does not affect the level of corporate cash holdings and self-selection bias is unimportant.

In columns 3 and 4 we report robustness tests, examining the impact of the takeover market on cash holdings during different sample periods (1990-1996 and 1997-2000), as Subramanian (2004) argues that the effect of the state antitakeover law disappeared in Delaware from 1996.

We find that the positive and significant association between the takeover market and the corporate cash holdings still holds in the second subsample period. In column 5, we exclude firms incorporated in Delaware as they account for more than half of the full sample. This resulting positive and significant association between the takeover market and corporate cash holdings demonstrates that our findings are not driven by the Delaware effect.

1.4.2. The level of cash holdings before the passage of the BC laws

While our findings in the previous section indicate that an active takeover market incentivizes managers to hold more cash, it is possible that there are significant permanent differences between non-BC and BC firms, and such differences may cause non-BC firms to hold higher levels of cash even before the passage of BC laws. To address this concern, we examine the level of cash holdings in non-BC firms relative to BC firms before the passage of the BC laws. Since firms get reincorporated infrequently, our analyses are not likely to be affected by the changes in the state of incorporation.[9]

In Table 4 Column 1, we present the estimation results for the sample period 1980 – 1984, which is a 5-year period before the first adoption of the BC laws by New York in 1985. The coefficient on non-BC is significantly negative at the 1% level, indicating that non-BC firms hold significantly less excess cash before the passage of the BC laws. Column 2 shows that during the passage of the BC laws, non-BC firms no longer have lower levels of cash holdings relative to BC firms due to the impact of the BC laws. Column 3 reports the estimation results for the period 1980 – 1989 and shows that the level of cash holdings is significantly lower for non-BC firms compared to BC firms 10 years before 1990, suggesting that the permanent differences between non-BC and BC firms, if there are any, could not drive our results.

1.4.3. Differential impact of the takeover market on financially constrained and unconstrained firms

In this subsection, we test Hypothesis 2 which suggests that an active takeover market impacts the cash holdings of financially unconstrained firms greater than it does with constrained firms. We adopt the SA index developed by Hadlock and Pierce (2010) as our primary measure of financial constraints. For a robustness check, we also use four alternative approaches for sorting firms to obtain a sample of financially constrained firms. These four approaches include as measures the payout ratio, firm size, long-term bond rating, and commercial paper rating and are the most commonly used measures of financial constraints in recent literature (e.g., Almeida et al. (2004), Faulkender and Wang (2006), and Denis and Sibilkov (2009)).

Measure 1: SA index

Hadlock and Pierce (2010) assert that the KZ index is flawed and unlikely to be a valid measure of financial constraints. Instead, they recommend the SA index, which relies on firm size and age alone to predict financial constraints, calculated using the following way:

$$\text{SA index} = (-0.737*\text{Size}) + (0.043*\text{Size}^2) - (0.040*\text{Age}) \quad (3)$$

where size is the natural log of book assets, and age is the number of years the firm has been on Compustat with a non-missing stock price. In calculating this index, we follow Hadlock and Pierce and replace size by the natural log of $4.5 billion and age by thirty-seven years if the actual values exceed these thresholds. A higher SA index corresponds to a greater probability that a firm is financially constrained. We assign firms with an SA index above (below) the median to the financially constrained (unconstrained) sample.

Measure 2: Firm size

It is argued that since small firms are typically young and less well known, they are more vulnerable to capital market imperfections (Almeida et al. (2004)). We use total book assets as our measure of firm size. We assign firms below (above) the median to the financially constrained (unconstrained) sample.

Measure 3: Payout ratio

Fazzari et al. (1998) find that financially constrained firms have significantly lower payout ratios. We measure the payout ratio as the ratio of total shareholder distributions (total common dividends plus repurchases) to total assets. We assign firms with a non-positive (positive) payout ratio to the financially constrained (unconstrained) sample.

Measure 4: Long-term bond rating

Firms with access to public debt markets face less difficulty in raising funds for their investment opportunities than those without such access. Data on bond ratings is from Compustat S&P domestic long-term issuer credit rating. We assign firms that report positive debt but have never had their debt rated during our sample period to the financially constrained sample and firms that have had their long-term debt rated at some point during our sample period to the financially unconstrained sample.

Measure 5: Commercial paper rating

Firms with a commercial paper rating are considered to be among the safest group of publicly traded firms (Faulkender and Wang (2007)). Following Denis and Sibilkov (2009), we use the Compustat S&P domestic short-term issuer credit rating as the commercial paper rating.

We assign to the financially constrained sample those firm-years in which the firm does not have a short-term credit rating but reports positive debt, while assigning firm-years in which the firm has a short-term credit rating to the financially unconstrained sample.

The results in Table 5 support Hypothesis 2. Across all five measures of financial constraints, the coefficient on non-BC for the financially unconstrained sample is much larger in magnitude and statistically more significant compared with the coefficient in the financially constrained sample. For example, under the SA index, financially unconstrained firms incorporated in non-BC states hold 29.5% more cash than their counterparts incorporated in BC states. In contrast, financially constrained firms incorporated in non-BC states hold only 5.7% more cash than their counterparts incorporated in BC states. Although the sample size of financially unconstrained firms decreases dramatically for the measures of long-term debt and commercial paper rating, there is the same differential pattern and the results are much stronger. For example, financially unconstrained firms as determined by the commercial paper rating hold 80.9% more cash when incorporated in on-BC states. In all regressions, the estimated coefficients on the inverse Mills ratios are not significant, suggesting that there is no self-selection.

1.4.4. The impact of the takeover market on the value of cash

The empirical evidence in the previous subsections suggests that the presence of an active takeover market induces firms to hold more cash. In this subsection, we investigate whether excess cash holdings for takeover-deterrence purposes lead to value destruction. We adopt the Faulkender and Wang (2006) method to evaluate the marginal value of cash from the shareholders' perspective:

$$r_{i,t} - R^{B}_{i,t} = \lambda_0 + \lambda_1 * \text{Non-BC}_{i,t} + \lambda_{2*}\text{non-BC}_{i,t} * \frac{\Delta C_{i,t}}{M_{i,t-1}} + \lambda_3 \frac{\Delta C_{i,t}}{M_{i,t-1}} + \lambda_4 \frac{\Delta E_{i,t}}{M_{i,t-1}} + \lambda_5 \frac{\Delta NA_{i,t}}{M_{i,t-1}} +$$

$$\lambda_6 \frac{\Delta RD_{i,t}}{M_{i,t-1}} + \lambda_7 \frac{\Delta I_{i,t}}{M_{i,t-1}} + \lambda_8 \frac{\Delta D_{i,t}}{M_{i,t-1}} + \lambda_9 \frac{C_{i,t-1}}{M_{i,t-1}} + \lambda_{10} \frac{NF_{i,t}}{M_{i,t-1}} + \lambda_{11} LEV_{i,t} + \lambda_{12} \frac{C_{i,t-1}}{M_{i,t-1}} * \frac{\Delta C_{i,t}}{M_{i,t-1}} +$$

$$\lambda_{13} LEV_{i,t} * \frac{\Delta C_{i,t}}{M_{i,t-1}} + \lambda_{14} * \text{HOLDING}_{i,t} + \bar{y}^{(i)}_{jt} + \bar{y}^{(i)}_{lt} + \epsilon_{i,t} \quad (4)$$

The excess stock return, $r_{i,t} - R^{B}_{i,t}$, is the dependent variable, where $r_{i,t}$ is the stock return for firm i during fiscal year t and $R^{B}_{i,t}$ is firm i's benchmark return during year t. The dummy variable non-BC captures the effects of the takeover market on the value of cash. Institutional ownership (Institutional holdings) controls for the monitoring of large shareholders. The remaining independent variables are firm specific characteristics that control for potential sources of value that are correlated with cash holdings, including the cash holdings of firm i in year t ($C_{i,t}$), earnings before interest and extraordinary items ($E_{i,t}$), total assets net of cash ($NA_{i,t}$), R&D expenditures ($RD_{i,t}$), interest expenses ($I_{i,t}$), total dividends ($D_{i,t}$), the firm's net financing during year t ($NF_{i,t}$), and market leverage ($L_{i,t}$). ΔX represents a one year change in variable X. Following Qiu and Yu (2009), we use $\bar{y}^{(i)}_{jt}$ and $\bar{y}^{(i)}_{lt}$ to control for industry shocks and state shocks, respectively. $\bar{y}^{(i)}_{jt}$ denotes the average excess stock return in year t across all firms in industry j, excluding firm i and $\bar{y}^{(i)}_{lt}$ depicts the average excess stock return in year t across all firms located in state l, excluding firm i.

Table 6 contains the results based on Equation (4). Column 1 uses pooled OLS regressions while column 2 presents results from panel data regressions controlling for both firm and year fixed effects. For the takeover market to have a negative impact on the value of cash, we would expect the coefficient on the interaction between non-BC and the change in cash to be negative and significantly related to the excess stock return. However, the results in both columns 1 and 2

show that the value placed by shareholders on a dollar of cash for firms incorporated in non-BC states is not lower than for firms incorporated in BC states. In columns 3 and 4, we test the impact of the takeover market on the value of cash for two time periods using the same split as before. For the time period from 1997 to 2000, the coefficient on the interaction term between non-BC and change in cash becomes negative but is insignificant. Column 5 shows that our findings still hold after we exclude firms incorporated in Delaware. Again, the estimated coefficients on the inverse Mills ratios are insignificant across all model specifications, indicating that self-selection is unimportant. Taken together, our results are consistent with a takeover market that does not negatively impact the value of cash holdings.

For a robustness check, we also employ the Fama and French (1998) methodology to determine the impact of the takeover market on the value of cash. To avoid losing too many observations, our control variables include only the current levels and second lags of firm-specific characteristics. The primary specification is as follows:

$$\frac{MV_{i,t}}{NA_{i,t-1}} = \beta_0 + \beta_1 * Excash_{i,t} + \beta_{2*} Non\text{-}BC_{i,t} * \frac{Excash_{i,t}}{NA_{i,t}} + \beta_3 * Non\text{-}BC_{i,t} + \beta_4 \frac{E_{i,t}}{NA_{i,t}} + \beta_5 \frac{E_{i,t-2}}{NA_{i,t}} +$$

$$B_6 \frac{RD_{i,t}}{NA_{i,t}} + B_7 \frac{RD_{i,t-2}}{NA_{i,t}} + B_8 \frac{I_{i,t}}{NA_{i,t}} + B_9 \frac{I_{i,t-2}}{NA_{i,t}} + \beta_{10} \frac{D_{i,t}}{NA_{i,t}} + \beta_{11} \frac{D_{i,t-2}}{NA_{i,t}} + \beta_{12} * HOLDING_{i,t} +$$

$$\bar{y}_{jt}^{(i)} + \bar{y}_{lt}^{(i)} + \epsilon_{i,t} \qquad (5)$$

The dependent variable is the market-to-book ratio ($\frac{MV_{i,t}}{NA_{i,t-1}}$). The control variables include earnings before interest and extraordinary items (E_t), R&D expenditures (RD_t), interest expense (I_t), total dividends paid (D_t), institutional ownership (HOLDING), industry effects ($\bar{y}_{jt}^{(i)}$), and state effects ($\bar{y}_{lt}^{(i)}$). Excess cash at year t is defined as the residual of the following cash holding regression:

$$\text{Ln}\left(\frac{\text{Cash}_{i,t}}{\text{Assets}_{i,t}}\right) = \gamma_0 + \gamma_1(\text{Market-to-book}_{i,t}) + \gamma_2\,(\text{Firm size}_{i,t}) + \gamma_3\left(\frac{\text{Cash flow}_{i,t}}{\text{Assets}_{i,t}}\right) + \gamma_4\left(\frac{\text{NWC}_{i,t}}{\text{Assets}_{i,t}}\right) + \gamma_5\left(\frac{\text{Capex}_{i,t}}{\text{Assets}_{i,t}}\right) + \gamma_6\,(\text{IndustrySigma}_{l,t}) + \gamma_7\,(\text{Book leverage}_{i,t}) + \gamma_8\frac{\text{RD}_{i,t}}{\text{Sales}_{i,t}} + \gamma_9\,(\text{Dividend dummy}_{i,t}) + \alpha_i + \rho_t + \epsilon_{i,t} \quad (6)$$

Table 7 displays the results based on Equation (5). The estimated coefficients on the inverse Mills ratios are significantly negative, indicating the presence of a self-selection bias. To be specific, the variables that cause firms to get incorporated in non-BC states are negatively correlated with the market-to-book ratio. However, the presence of the active takeover market does not have a negative impact on the value of cash holdings: the coefficient on the interaction term between non-BC and excess cash is consistently positive and insignificant.

1.4.5. Investment and payout decisions for non-BC and BC firms

We have examined the relation between the takeover market and corporate cash holdings and have found direct evidence that the takeover-deterrence function of cash motivates firms incorporated in states with low hostile takeover protections to hold more cash. But do the high levels of cash holdings necessarily lead to value destruction? We investigated this question but found no evidence supporting a value discount charged for cash held by firms incorporated in non-BC states. How do we interpret these results? The mixed evidence on the relationship between the levels of cash holdings and the value of cash in prior studies suggests that the value of cash may be determined by firms' spending rather than saving patterns.

To investigate this further, we conduct our cash spending analysis in a multivariate context with a focus on acquisitions and dividend payouts. The sample used in this analysis spans the same time period of 1990-2000 as before but the sample size is different because we only require

the availability of the variables included in this test. We select variables that are consistent with Grullon and Michaely (2007), thereby, controlling for the following firm characteristics:

Ln(MV) and Ln(Age): Market value of equity and firm age are proxies for firm maturity.

Ln(MB) and sales growth: The market-to-book ratio and one-year sales growth rate are proxies for investment opportunities.

Return volatility: The one-year stock return volatility is as a proxy for risk.

Profitability: Return on assets (ROA) is a proxy for firm's profitability.

Leverage: Book leverage.

Institutional holdings: The proportion of institutional ownership is a proxy for corporate governance.

Although the above firm-level variables are mostly used in the literature on corporate payout policy, we adopt them in our analysis of investment decisions since they are close to those variables used by Harford (1999) in a study of acquisitions and by Harford, Mansi, and Maxwell (2008) in their study of firms' investment and payout decisions.

We estimate the model using a seemingly unrelated regression (SUR) of firms' capital expenditures, R&D expenditures and acquisitions on various explanatory variables because it is realistic to expect that the errors of the three regression equations would be correlated to some degree. All dependent variables are industry adjusted. Columns 2, 4, and 6 of Table 8 present the results after we correct for potential self-selection biases by including the inverse Mills ratio from Equation (2) as an additional control variable. In columns 1 and 2, we show that non-BC firms spend more on capital expenditures, found by Harford et al. (2008) to be one of the channels through which entrenched managers dissipate cash. However, in Tables 6 and 7 we find no evidence that such spending has a negative impact on the marginal value of cash. In

column 4, the sign of the coefficient on the non-BC dummy is reversed after we control for self-selection bias, suggesting that non-BC firms actually have higher R&D expenditures. Eberhart et al. (2004) find that R&D increases contribute to positive long-term abnormal operating performance. Thus, higher spending on value-enhancing R&D may in part explain why excess cash holdings in non-BC firms are not discounted by shareholders. The results in columns 5 and 6 show that the coefficient on the non-BC dummy remains negative and significant at the 1% level, suggesting that firms in non-BC states spend significantly less on acquisitions than in BC states. This evidence is not only consistent with our findings indicating that firms in non-BC states hold more cash and successfully protect themselves against takeovers but also provides an additional explanation for the result in Tables 6 and 7 that shareholders do not discount the value of cash held in non-BC firms.[10]

We now examine the effects of the takeover market on corporate dividend payouts and share repurchases. An active takeover market is expected to mitigate managerial slack and resolve the conflict between managers and shareholders over cash payouts by incentivizing managers to distribute cash to shareholders. However, our resulting higher levels of cash holdings corresponding to lower levels of acquisitions in non-BC firms suggest that managers in non-BC firms may use cash to suppress the effect of the external takeover market. This may allow managers to exercise more discretion over cash, resulting in a lower level of payouts to non-BC firms compared to BC firms. On the other hand, payouts may be higher as managers in these firms utilize dividend payouts to signal the quality of internal corporate governance and divert shareholders' attention from large cash reserves. We test these possibilities by estimating the effects of the takeover market on firms' dividend payouts and share repurchases using three measures ($Div_t/Sales_{t-1}$, Div_t/MV_{t-1}, and Div_t/AT_{t-1} for dividend payouts, and $Rep_t/Sales_{t-1}$,

Rep_t/MV_{t-1}, and Rep_t/AT_{t-1} for share repurchases). Table 9 displays the results that are robust to different measures of dividend payouts and potential self-selection bias, and indicate that non-BC firms have significantly higher dividend payouts than BC firms. Table 10 presents the results for share repurchases. In Column 2, the insignificant coefficient on the inverse Mills ratio suggests that self-selection is not important for this measure of share repurchases. In addition, the coefficient on non-BC is not significant either, indicating that the active takeover market has no impact on share repurchases. Although the signs of the coefficients on non-BC in columns 4 and 6 remain negative after correcting for potential self-selection biases, they are insignificant. Overall, the results in Table 9 and 10 support our second conjecture about payouts.

1.5. Robustness

We have used the natural log of cash and marketable securities to total assets ratio as the primary measure of cash holdings. For robustness, we also employ two alternatives measures of cash holdings. First, we use net assets, i.e., total assets less cash and marketable securities, to scale cash and then use the natural log of this ratio to measure cash holdings.[11] Second, we follow Harford et al. (2008) and use an industry-adjusted measure of cash holdings in our analyses, calculated as the difference between a firm's cash holdings and the median cash holdings in the firm's industry (Fama and French 48 industries). We obtain similar results using these alternative measures.

1.6. Conclusions

Using business combination (BC) laws to proxy for the monitoring strength of the takeover market, we directly test for the relation between the takeover market and corporate cash holdings and find that the takeover market incentivizes managers to hold more cash.

Are these higher levels of cash held by firms incorporated in non-BC states a cause of concern to shareholders? The answer is to this question appears to be no. We investigate the marginal value of cash holdings and find that although firms incorporated in states with a strong takeover market hold more cash for takeover-deterrence purpose, the value of the cash reserves is not discounted by the market. A possible reason for this is our finding that firms in non-BC states do not spend more on acquisitions, which are generally considered as value-decreasing, but instead pay higher levels of dividends compared to firms in BC states.

If large cash reserves decrease the potential success of a takeover, as indicated by the lower levels of acquisitions, why do non-BC firms still have higher dividend payouts if managers are relatively more entrenched? One possible explanation is that managers are using payouts to signal good internal governance quality because as Faleye (2004) points out, shareholders could always use the proxy contest as a last resort to address excessive liquidity concerns.[12]

APPENDIX A: Variable definitions

Variables	
Cash / assets	Cash and equivalents (CHE) / total assets (AT)
Total debt	Short-term debt (DLC) + long-term debt (DLTT)
Market equity	Stock's closing price at the fiscal year-end (PRCC_F) * number of shares (CSHO)
Market-to-book	[Market equity + total debt + preferred stock liquidating value (PSTKL) – deferred taxes and investment tax credits (TXDITC)] / total assets (AT)
Cash flow / assets	[Operating income (OIBDP) – interest expense (XINT) – taxes (TXT)] / total assets (AT)
NWC / assets	[Current assets (ACT) – current liabilities (LCT) – cash and equivalents (CHE)] / total assets (AT)
Firm size	Ln(total assets (AT)), where total assets are measured in 1983 dollars
Book leverage	[Short-term debt (DLC) + long-term debt (DLTT)] / total assets (AT)
Market leverage	Total debt / [total debt + Stock price (PRCC_F) * common shares outstanding (CSHO)]
Capex / assets	Capital expenditure (CAPEX) / total assets (AT)
R&D / sales	R&D expenditure (XRD) / sales (SALE) Missing values are set to zero.
Dividend dummy	Equal to 1 if a firm paid a positive dividend and 0 otherwise
Industry sigma	Average of prior 10 year standard deviations of cash flow ratios (CF / assets) for firms in the same industry defined by 2 digit SIC codes
Net assets	Total assets (AT) – Cash and equivalents (CHE)
Institutional ownership	Sum of all institutional ownership / total shares outstanding
Excess return	Stock return – benchmark stock return
Non-BC	Dummy variable set equal to 1 if a firm is incorporated in a state without BC laws and 0 otherwise
Earnings	Income before extraordinary items (IB) + Interest expense (XINT) + Deferred tax (TXDI) + Investment tax credits (ITCI)
Net financing	Equity issuance (SSTK) – Equity repurchases (PRSTKC) + Long-term debt issuance (DLTIS) – Long-term debt reduction (DLTR)
Sales growth	$Sales_t – sales_{t-1} / sales_{t-1}$
Age	The number of years from the date that a firm has the first non-missing stock price in Compustat.
Return volatility	The standard deviation of 1-year monthly stock returns
ROA	Operating income before depreciation (OIBDP) / total assets (AT)

APPENDIX B: State antitakeover legislation

APPENDIX B describes business combination (BC) law passage years in various states. (Source: Bertrand and Mullainathan (2003))

State	Year	State	Year
Arizona	1987	Nebraska	1988
Connecticut	1989	Nevada	1991
Delaware	1988	New Jersey	1986
Georgia	1988	New York	1985
Idaho	1988	Oklahoma	1991
Illinois	1989	Ohio	1990
Indiana	1986	Pennsylvania	1989
Kansas	1989	Rhode Island	1990
Kentucky	1987	South Carolina	1988
Maine	1988	South Dakota	1990
Maryland	1989	Tennessee	1988
Massachusetts	1989	Virginia	1988
Michigan	1989	Washington	1987
Minnesota	1987	Wisconsin	1987
Missouri	1986	Wyoming	1989

FOOTNOTES

[1] The positive relationship between governance and cash reserves is supported by the spending hypothesis, which predicts that poorly governed managers will quickly spend excess generated cash flows (Jensen and Meckling (1976)), leading to lower levels of observed cash reserves for firms with weaker corporate governance structures.

[2] Pinkowitz (2002) and Francis, Hasan, John, and Song (2011) use the passage of BC laws as a natural experiment to examine changes in the levels of corporate cash holdings and they report contrasting results.

[3] To study how the presence of IDB (an independent director who is a blockholder) affects corporate financial and investment policies, Agrawal and Nasser (2011) use lagged IDB-industry density and lagged IDB-state density to instrument for IDB presence.

[4] This is done by imposing a moratorium on certain kinds of transactions, including merges and asset sales for a period of up to five years. This moratorium hinders corporate raiders from gaining access to the target firm's assets for the purpose of paying down acquisition debt, thus making hostile takeovers more difficult and often impossible (Betrand and Mullainathan (2003)).

[5] Event study evidence shows that business combination laws result in the biggest stock price drop. In contrast, fair price laws result in negative but insignificant stock price changes, while control share acquisition laws cause some movements in stock prices (Karpoff and Malatesta 1989).

[6] Excess cash allows a hostile target to initiate several defensive strategies including purchasing stock, acquiring a competitor of the bidder, filing private antitrust litigation, and making a reverse bid for an unwanted suitor. In addition, excess cash makes it harder for the bidder to value the target since the cash can be used to launch value-decreasing activities.

[7] Almeida, Campello, and Weisbach (2004) find that constrained firms tend to save cash from firm-generated cash flows. Han and Qiu (2007) provide theoretical and empirical evidence suggesting that constrained firms increase cash holdings in response to higher cash flow volatility.

[8] Given that the Fama and French 25 portfolios are formed at the end of each June while the fiscal year-end of a firm could be any month during the year, a firm could belong to two portfolios in any year *t*. Therefore, following Faulkender and Wang (2006), we adjust the benchmark return by annualizing the monthly returns of the portfolio the firm belongs to each month.

[9] In a detailed literature review conducted by Qiu and Yu (2009), researchers have concluded that changes in the state of incorporation have a minimal impact on their empirical results.

[10] Examples of papers that demonstrate a negative relationship between spending on acquisitions and firm value include Harford (1999) who shows that firms with large cash holdings are more

likely to engage in value-decreasing acquisitions and Harford et al. (2008) who find that firms with poor governance dissipate cash quickly through acquisitions and capital expenditures.

[11] This measure is also used by Opler et al. (1999), Dittmar Mahrt-Smith (2007), and Harford et al. (2008).

[12] Pinkowitz (2002) comments that there might be no other device to control excessive cash holdings if the takeover market fails to prevent managers from holding cash.

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Table 1.1.
Descriptive statistics

This table presents summary statistics for the sample. The data set includes 7,281firms and 33,596 firm-year observations over the period 1990-2000. All variables are winsorized at the 1st and 99th percentiles to avoid the influence of extreme values. Variable definitions are in Appendix A. We proxy excess cash by the residuals from the following regression equation:

$$\text{Ln}\left(\frac{\text{Cash}_{i,t}}{\text{Assets}_{i,t}}\right) = \gamma_0 + \gamma_1(\text{Market-to-book}_{i,t}) + \gamma_2(\text{Firm size}_{i,t}) + \gamma_3\left(\frac{\text{Cash flow}_{i,t}}{\text{Assets}_{i,t}}\right) + \gamma_4\left(\frac{\text{NWC}_{i,t}}{\text{Assets}_{i,t}}\right) + \gamma_5\left(\frac{\text{Capex}_{i,t}}{\text{Assets}_{i,t}}\right) + \gamma_6(\text{IndustrySigma}_{l,t}) + \gamma_7(\text{Book leverage}_{i,t}) + \gamma_8\frac{\text{RD}_{i,t}}{\text{Sales}_{i,t}} + \gamma_9(\text{Dividend dummy}_{i,t}) + \alpha_i + \rho_t + \epsilon_{i,t}$$

For the first three columns, medians are reported in parentheses. Column 4 represents the two-tailed *t*-test for the differences in mean values between BC and non-BC firms. Column 5 presents z-statistics of the Wilcoxon test for differences in distribution between BC and non-BC firms. *t*-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Variables	Full sample	BC firm-years	Non-BC firm-years	t-test	z-test
	(1)	(2)	(3)	(4)	(5)
Cash holdings	0.147	0.146	0.150	0.004*	9.729***
	(0.065)	(0.060)	(0.085)	(1.83)	
Ln(Cash)	-2.883	-2.923	-2.706	0.218***	9.726***
	(-2.732)	(-2.809)	(-2.464)	(10.07)	
Excess cash	0.074	0.036	0.241	0.205***	10.581***
	(0.288)	(0.234)	(0.492)	(10.83)	
Total assets	1,306.48	1,069.08	2,349.10	1,280***	1.982**
	(129.93)	(129.83)	(130.45)	(10.42)	
Market-to-book	1.736	1.738	1.723	-0.016	-0.355
	(1.142)	(1.143)	(1.134)	(-0.61)	
Firm size	18.409	18.385	18.514	0.129***	1.60
	(18.254)	(18.255)	(18.238)	(4.28)	
Cash flow/assets	0.031	0.031	0.029	-0.002	-4.957***
	(0.078)	(0.079)	(0.072)	(-0.84)	
NWC/assets	0.111	0.116	0.085	-0.031***	-12.788***
	(0.107)	(0.115)	(0.070)	(-10.16)	
Capex/assets	0.717	0.069	0.083	0.013***	12.447***
	(0.051)	(0.049)	(0.058)	(12.35)	
Book leverage	0.244	0.246	0.233	-0.013***	-3.335***
	(0.211)	(0.211)	(0.208)	(-4.48)	
Industry sigma	0.099	0.099	0.098	-0.0004	-0.582
	(0.098)	(0.097)	(0.098)	(-0.66)	
R&D/sales	0.044	0.045	0.039	-0.007***	-8.410***
	(0.000)	(0.000)	(0.000)	(-5.75)	
Dividend dummy	0.326	0.321	0.347	0.026***	3.959***
	(0.000)	(0.000)	(0.000)	(3.91)	
Institutional ownership	0.325	0.335	0.278	-0.057***	-18.068***
	(0.286)	(0.304)	(0.209)	(-16.45)	
Obs.	33,596	27,365	6,231		

Table 1.2.
Probit regression predicting the likelihood of incorporating in a non-BC state
This table presents the first-stage estimation results of the Heckman treatment effect model. The dependent variable is 1 if the firm is incorporate in a non-BC state and 0 otherwise. The sample includes 33,596 firm-year observations from 1990 – 2000. Non-BC state-density is computed as the annual average value of the non-BC dummy for all the firms headquartered in firm i's state, excluding firm i. Non-BC industry-density is computed as the annual average value of the non-BC dummy for all the firms in firm i's industry based on the 48 Fama-French (1997) industry definition, excluding firm i. We adjust *t*-statistics for clustering at the firm level and denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variables	Coefficients	*t*-stats
Market-to-book	-0.006	-1.01
Firm size	-0.099***	-11.14
Cash flow/assets	0.202***	3.28
NWC/assets	0.168**	3.04
Capex/assets	0.294**	2.00
Book leverage	-0.236***	-4.18
Industry sigma	-0.944*	-2.88
R&D/assets	-0.158	-1.03
Dividend dummy	0.178***	6.35
Institutional ownership	-0.350***	-5.85
Industry effects	0.025	1.47
State effects	0.166***	7.73
Non-BC industry density	2.969***	34.62
Non-BC state density	3.929***	81.20
Log likelihood	-8,630.44	
Prob > Chi^2	0.0000	
Pseudo R^2	0.155	
Obs.	33,596	

Table 1.3.
The takeover market's impact on corporate cash holdings
This table presents the second-stage estimation results of the Heckman treatment effect model. The full sample covers 1990-2000 and consists of 33,596 firm-year observations. Column 1 presents the pooled OLS regression results. Column 2 utilizes a panel data model controlling for both firm and year fixed effects. Columns 3 and 4 incorporate two time periods. Column 5 reports results after excluding firms incorporated in Delaware. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variables	Pooled OLS	Random effects	1990-1996	1997-2000	Excluding Delaware
	(1)	(2)	(3)	(4)	(5)
Non-BC	0.130***	0.091***	0.112***	0.120***	0.158***
	(7.28)	(2.74)	(2.66)	(3.01)	(3.78)
Market-to-book	0.154***	0.104***	0.160***	0.068***	0.151***
	(8.96)	(4.37)	(4.66)	(2.75)	(4.10)
Firm size	-0.050***	-0.039***	-0.022*	-0.063***	-0.038***
	(-8.99)	(-4.00)	(-1.82)	(-5.50)	(-2.84)
Cash flow/assets	0.128**	0.189***	0.286***	0.181**	0.151
	(2.55)	(3.29)	(3.40)	(2.51)	(1.61)
NWC/assets	-0.923***	-1.200***	-0.598	-1.658***	-0.622
	(-3.50)	(-3.26)	(-1.15)	(-4.38)	(-1.11)
Capex/assets	-5.132***	-2.402	-5.995**	-0.155	-5.727**
	(-3.91)	(-1.32)	(-2.33)	(-0.08)	(-2.06)
Book leverage	-1.937***	-2.101***	-1.463***	-2.442***	-1.718***
	(-7.32)	(-5.66)	(-2.78)	(-6.36)	(-3.06)
Industry sigma	1.003***	3.402***	3.509***	2.815***	3.393***
	(4.71)	(9.62)	(7.00)	(6.67)	(6.89)
R&D/sales	1.499***	0.662***	0.704***	0.924***	0.021
	(14.65)	(5.22)	(3.77)	(5.79)	(0.09)
Dividend dummy	-0.122***	-0.118***	-0.145***	-0.111***	-0.032
	(-6.90)	(-3.98)	(-4.16)	(-2.96)	(-0.77)
Institutional	1.471***	0.439	1.811*	-0.360	1.581
ownership	(2.99)	(0.65)	(1.88)	(-0.51)	(1.53)
Industry effects	0.488***	0.258***	0.411***	0.216**	0.389***
	(7.03)	(2.67)	(3.02)	(2.14)	(2.65)
State effects	-0.679*	-0.022	-0.926	0.613	-0.863
	(-1.88)	(-0.04)	(-1.31)	(1.17)	(-1.13)
Inverse Mills ratio	-3.072***	-0.870	-3.798*	-0.360	-3.507
	(-2.71)	(-0.55)	(-1.71)	(-0.51)	(-1.46)
Firm fixed effects	No	Yes	Yes	Yes	Yes
Year fixed effects	No	Yes	Yes	Yes	Yes
R^2	0.374	0.370	0.341	0.413	0.281
Obs.	33,596	33,596	19,443	14,153	33,596

Table 1.4.
Levels of cash holdings in non-BC firms before the passage of BC laws
The full sample covers 1980-1989 and consists of 19,094 firm-year observations. Column 1 reports the results for the sub-sample period 1980-1984. Column 2 presents the results for the sub-sample period 1985-1989. Column 3 presents the results using the full sample. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variables	1980-1984	1985-1989	Full sample
	(1)	(2)	(3)
Non-BC	-0.100***	-0.012	-0.086**
	(-2.61)	(-0.26)	(-2.57)
Market-to-book	0.089***	0.110***	0.097***
	(5.51)	(7.53)	(8.51)
Firm size	-0.060***	-0.024*	-0.032***
	(-4.33)	(-1.72)	(-2.73)
Cash flow/assets	0.814***	0.562***	0.541***
	(4.86)	(4.63)	(4.84)
NWC/assets	-1.963***	-1.321***	-1.531***
	(-17.64)	(-13.52)	(-17.70)
Capex/assets	-2.036***	-1.465***	-1.721***
	(-9.75)	(-6.68)	(-10.96)
Book leverage	-2.878***	-2.272***	-2.437***
	(-24.12)	(-19.94)	(-26.14)
Industry sigma	1.598*	2.493***	2.229***
	(1.86)	(3.94)	(3.80)
R&D/sales	0.729	0.966***	0.628**
	(1.36)	(2.87)	(2.05)
Dividend dummy	-0.081**	-0.162***	-0.102***
	(-2.07)	(-4.07)	(-3.25)
Institutional ownership	0.254**	0.386***	0.319***
	(2.44)	(3.86)	(3.87)
Industry effects	0.167***	0.232***	0.213***
	(5.66)	(7.71)	(9.40)
State effects	0.134**	0.160***	0.138***
	(2.51)	(2.87)	(3.02)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
R^2	0.258	0.255	0.253
Obs.	9,597	9,497	19,094

Table 1.5.
Differential impact of the takeover market on financially constrained and unconstrained firms
This table displays estimation results for the financially constrained and unconstrained subsamples. We use (C) for constrained firms and (U) for unconstrained firms. The full sample includes 33,596 firm-year observations from 1990 – 2000. We use 5 criteria (SA index, firm size, payout ratio, long-term debt rating, and commercial paper rating) to categorize firm-years as either financially constrained or unconstrained firms. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

	SA index		Size		Payout ratio		Long-term debt rating		Commercial paper rating	
Variables	(C)	(U)	(C)	(U)	(C)	(U)	(C)	(U)	(C)	(U)
Non-BC	0.056**	0.224***	0.067**	0.264***	0.066**	0.165***	0.039**	0.388***	0.054**	0.841***
	(2.25)	(3.40)	(2.38)	(4.53)	(2.15)	(3.34)	(2.08)	(4.78)	(2.04)	(6.04)
Market-to-book	0.128***	0.151***	0.134***	0.139***	0.111***	0.107**	0.132***	0.021	0.115***	-0.009
	(3.52)	(2.57)	(3.65)	(3.64)	(3.84)	(1.98)	(4.87)	(0.44)	(4.67)	(-0.12)
Firm size	0.099***	-0.126***	0.099***	-0.137***	0.028**	-0.127***	0.004	-0.151***	-0.019*	-0.197***
	(4.26)	(-6.51)	(3.62)	(-6.15)	(2.14)	(-8.50)	(0.34)	(-6.24)	(-1.78)	(-3.44)
Cash flow/Assets	0.064	-0.379	0.047	-0.918***	0.039	0.449***	0.150**	-0.535*	0.171***	0.315
	(0.99)	(-1.58)	(0.71)	(-3.30)	(0.62)	(2.82)	(2.52)	(-1.81)	(2.96)	(0.45)
NWC/Assets	-0.549	-1.361	-0.509	-1.376**	-1.017**	-1.627**	-0.822**	-3.019***	-1.096***	-3.137**
	(-1.00)	(-1.55)	(-0.91)	(-2.37)	(-2.33)	(-1.99)	(-1.97)	(-4.16)	(-2.90)	(-2.46)
Capex/Assets	-4.939*	-5.573	-5.094*	-2.800	-2.005	-4.766	-4.290**	4.808***	-2.903	2.852
	(-1.79)	(-1.27)	(-1.82)	(-0.99)	(-0.92)	(-1.16)	(-2.07)	(1.38)	(-1.55)	(0.49)
Book leverage	-1.943***	-1.671*	-1.917***	-1.639***	-1.917***	-2.307***	-1.894***	-2.888	-2.022***	-2.932**
	(-3.51)	(-1.88)	(-3.42)	(-2.88)	(-4.37)	(-2.77)	(-4.50)	(-3.99)	(-5.30)	(-2.33)
Industry sigma	3.995***	1.439**	3.867***	1.186**	4.099***	1.583***	3.881***	1.025***	3.621***	0.237
	(6.89)	(2.38)	(6.48)	(2.14)	(8.21)	(3.11)	(9.64)	(1.40)	(9.88)	(0.18)
R&D/Sales	0.737***	1.941***	0.735***	2.479***	0.672***	1.616***	0.662***	1.274*	0.669***	3.656**
	(4.84)	(3.61)	(4.55)	(5.65)	(4.48)	(5.68)	(4.85)	(1.88)	(5.03)	(2.37)
Dividend dummy	0.123**	-0.095*	0.154***	-0.185***	-0.229**	-0.150***	-0.077**	-0.127**	-0.098***	-0.311***
	(2.04)	(-1.95)	(2.76)	(-4.20)	(-2.09)	(-3.45)	(-2.29)	(-2.00)	(-3.24)	(-2.66)
Institutional ownership	1.739*	1.156	1.803*	0.402	0.477	0.921	1.175	-2.370*	0.622	-2.025
	(1.67)	(0.72)	(1.71)	(0.39)	(0.58)	(0.61)	(1.52)	(-1.84)	(0.89)	(-0.97)
Industry effects	0.415***	0.333	0.381	0.270*	0.304***	0.296	0.357***	-0.160	0.286***	-0.124
	(2.87)	(1.45)	(2.60)	(1.83)	(2.64)	(1.38)	(3.27)	(-0.86)	(2.90)	(-0.40)
State effects	-0.746	-0.612	-0.798	-0.056	0.040	-0.423	-0.554	1.978**	-0.168	1.645
	(-0.98)	(-0.52)	(-1.03)	(-0.07)	(0.07)	(0.38)	(-0.97)	(2.06)	(-0.33)	(1.04)
Inverse Mills ratio	-1.739	-2.524	-3.383	-0.924	-0.897	-1.949	-2.586	5.601	-1.349	4.821
	(-1.33)	(-0.68)	(-1.37)	(-0.39)	(-0.47)	(-0.55)	(-1.44)	(1.29)	(-0.83)	(0.98)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.399	0.296	0.366	0.304	0.388	0.373	0.389	0.139	0.373	0.319
Obs.	11,200	11,190	11,195	11,200	15,962	11,173	25,971	5,919	31,242	2,354

Table 1.6.
Impact of the takeover market on the value of cash
This table presents the results from estimating Equation (4). The full sample includes 40,268 firm-year observations from 1990 – 2000. The dependent variable ($r_{i,t}$ - $R^B_{j,t}$)is the excess stock return, where $r_{i,t}$ is the annual stock return of firm i and $R^B_{j,t}$ is firm i's benchmark portfolio return both during time t. Cash is cash plus marketable securities, Earnings is income before extraordinary items plus interest, deferred tax credits, and investment tax credits, Net assets is total assets net of cash, Interest is interest expense, Dividends is common dividends paid, and Net financing is total equity issuance minus repurchases plus debt issuance minus debt redemption. R&D expenditures are set to zero if missing. We deflate all the above independent variables by the lagged market value of equity. Leverage is the market leverage. Δ denotes the 1-year change in variables. Non-BC is a dummy variable set equal to 1 if the firm is incorporated in a state without BC laws and 0 otherwise. We cluster standard errors at the state of incorporation level while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variables	Pooled OLS	Random effects	1990-1996	1997-2000	Excluding Delaware
	(1)	(2)	(3)	(4)	(5)
ΔCash/ME	1.372***	1.371***	1.305***	1.484***	1.345***
	(26.04)	(25.48)	(19.67)	(16.23)	(15.86)
Non-BC*ΔCash	-0.029	-0.025	0.037	-0.156	0.038
	(-0.45)	(-0.38)	(0.46)	(-1.37)	(0.46)
Non-BC	-0.034***	-0.036***	-0.030**	-0.044***	-0.035**
	(-3.25)***	(-3.58)	(-2.43)	(-2.62)	(-2.49)
ΔEarnings/ME	0.379***	0.377***	0.378***	0.382***	0.364***
	(21.52)	(21.03)	(17.73)	(11.95)	(13.31)
ΔNet assets/ME	0.167***	0.162***	0.181***	0.134***	0.178***
	(17.23)	(16.38)	(17.73)	(7.72)	(11.97)
ΔR&D/ME	0.733***	0.686***	0.693***	0.769**	0.228
	(4.02)	(3.72)	(3.07)	(2.37)	(0.80)
ΔInterest/ME	-0.912***	-0.796***	-1.225***	0.048	-0.797***
	(-6.91)	(-5.74)	(-7.26)	(0.19)	(-3.78)
ΔDividends/ME	1.579***	1.483***	2.078***	0.41	1.736***
	(4.56)	(4.21)	(5.07)	(0.66)	(3.67)
Net financing/ME	0.016	0.030	0.008	0.054*	0.011
	(0.91)	(1.58)	(0.37)	(1.73)	(0.37)
Lagged cash /ME	0.269***	0.314***	0.253***	0.362***	0.293***
	(14.68)	(15.31)	(11.14)	(9.79)	(9.96)
Market leverage	-0.483***	-0.544***	-0.472***	-0.621***	-0.532***
	(-37.43)	(-39.66)	(-28.56)	(-27.40)	(-27.96)
Leverage * ΔCash	-0.978***	-0.983***	-0.963***	-1.060***	-1.187***
	(-10.90)	(-10.70)	(-8.40)	(-6.94)	(-8.63)
Lagged cash * ΔCash	-0.501***	-0.486***	-0.493***	-0.448***	-0.422***
	(-7.76)	(-7.47)	(-6.34)	(-3.59)	(-4.13)
Institutional ownership	0.004	0.005	-0.011	0.032	0.001
	(0.35)	(0.43)	(-0.74)	(1.53)	(0.07)
Industry effects	0.491***	0.485***	0.427***	0.545***	0.437***
	(32.66)	(29.74)	(20.08)	(22.87)	(19.34)
State effects	0.291***	0.264***	0.244***	0262***	0.328***
	(11.02)	(8.75)	(6.24)	(5.78)	(7.96)
Inverse Mills ratio	-0.004	-0.003	0.007	-0.017	-0.002
	(-0.65)	(-0.57)	(1.08)	(-1.99)	(-0.36)
Firm fixed effects	No	Yes	Yes	Yes	Yes
Year fixed effects	No	Yes	Yes	Yes	Yes
R^2	0.204	0.205	0.192	0.226	0.203
Obs.	40,268	40,268	25,460	14,808	19,631

Table 1.7.

Impact of the takeover market on the value of cash using the FF methodology

This table presents the results from estimating Equation (5). The full sample includes 24,585 firm-year observations from 1990 – 2000. All variables are scaled by total assets net of cash (NA). The dependent variable is market-to-book ratio, where book assets are net of cash. Excess cash is from the residuals obtained by estimating Equation (6). Earnings, Net assets, Dividends, and R&D are scaled by net assets. Leverage is book leverage. Non-BC is a dummy variable set equal to 1 if the firm is incorporated in a state without BC laws and 0 otherwise. We cluster standard errors at the state of incorporation level while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variables	Pooled OLS	Random effects	1990-1996	1997-2000	Excluding Delaware
	(1)	(2)	(3)	(4)	(5)
Excess cash	0.221***	0.143***	0.162***	0.144***	0.146***
	(17.69)	(9.18)	(9.18)	(6.13)	(6.08)
Non-BC*Excess cash	-0.022	0.047	0.027	0.013	0.057
	(-0.74)	(1.36)	(0.69)	(0.21)	(1.46)
Non-BC	-0.160***	-0.124	-0.058	-0.212	-0.05
	(-3.04)	(-1.18)	(-0.53)	(-1.504)	(-0.37)
Earnings/Assets	-2.188***	-1.006***	-0.934***	-1.322***	-0.782***
	(-9.99)	(-3.75)	(-3.01)	(-3.53)	(-1.99)
ΔL2 Earnings/Assets	2.958***	1.764***	1.519***	2.045***	1.930***
	(13.48)	(12.90)	(6.36)	(6.32)	(6.04)
R&D/Assets	6.432***	7.165***	7.688***	6.877***	6.951***
	(15.86)	(12.90)	(10.96)	(9.88)	(7.26)
ΔL2 R&D/Assets	7.037***	1.669***	0.459	3.517***	1.345
	(9.84)	(2.68)	(0.48)	(4.29)	(1.32)
Interest/Assets	-0.382	-1.315***	-2.125	2.839	-3.401
	(-0.30)	(-0.823)	(-0.96)	(1.16)	(-1.51)
ΔL2 Interest/Assets	-3.155***	-3.511***	-3.699***	-3.678	-4.523***
	(-2.14)	(-2.79)	(-2.49)	(-1.47)	(-2.30)
Dividends/Assets	16.283***	11.919***	7.638***	14.924***	8.465***
	(15.36)	(5.12)	(3.51)	(4.31)	(3.72)
ΔL2 Dividends/Assets	8.633***	3.751*	6.606***	-3.116	6.064***
	(3.77)	(1.92)	(2.95)	(-0.93)	(2.19)
Institutional ownership	0.846***	1.890***	1.271***	2.059***	1.310***
	(12.63)	(13.77)	(8.83)	(11.93)	(7.99)
Industry effects	0.342***	0.426***	0.364***	0.459***	0.315***
	(19.75)	(14.89)	(10.83)	(12.04)	(9.38)
State effects	0.122***	0.165***	0.080*	0.186***	0.088*
	(5.17)	(4.48)	(1.93)	(3.99)	(1.93)
Inverse Mills ratio	-0.148***	-0.249***	-0.107*	-0.307***	-0.242***
	(-4.32)	(-3.81)	(-1.65)	(-3.28)	(-2.74)
Firm fixed effects	No	Yes	Yes	Yes	Yes
Year fixed effects	No	Yes	Yes	Yes	Yes
R^2	0.473	0.452	0.450	0.494	0.319
Obs.	24,585	24,585	14,639	9,946	12,102

Table 1.8.
The takeover market's impact on investment decisions
This table presents estimates of SUR model examining the relationship between the takeover market and three types of investment decisions, capital expenditures, R&D expenditures, and acquisitions. All dependent variables are industry adjusted (Fama and French (1997) 48 industries). The sample covers 1990-2000 and consists of 25,207 firm-year observations. Columns 2, 4, and 6 report the results after correcting for potential selection biases. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variables	Industry adjusted Capital expenditures		Industry adjusted R&D expenditures		Industry adjusted Acquisitions	
	(1)	(2)	(3)	(4)	(5)	(6)
Non-BC	0.012***	0.009***	-0.004***	0.001***	-0.003***	-0.008***
	(11.65)	(7.23)	(-4.25)	(3.95)	(-3.86)	(-3.72)
Ln(MV)	0.001***	0.001**	-0.001***	-0.001***	0.002***	0.002***
	(3.37)	(2.52)	(-3.30)	(-3.33)	(8.97)	(9.66)
Ln(MB)	0.012***	0.013***	0.024***	0.025***	-0.002***	-0.002***
	(17.72)	(17.77)	(11.99)	(10.92)	(-4.44)	(-4.95)
ROA	0.043***	0.042***	-0.156***	-0.157***	0.004**	0.005**
	(6.86)	(16.07)	(-13.38)	(-11.32)	(2.33)	(2.52)
Leverage	0020***	0.021***	-0.049***	-0.049***	0.031***	0.029***
	(9.86)	(9.74)	(-18.34)	(-17.31)	(10.81)	(19.25)
Ln(1+age)	-0.008***	-0.007***	-0.001	-0.001	-0.002***	-0.003***
	(-11.79)	(-10.16)	(-0.86)	(-0.79)	(-4.36)	(-4.84)
Sales growth	0.009***	0.009***	0.001	0.000	0.015***	0.014***
	(11.33)	(10.91)	(0.17)	(0.96)	(15.77)	(14.10)
Return volatility	-0.002	-0.001	-0.013***	-0.014***	0.002	0.002
	(-0.82)	(-0.49)	(-4.96)	(-4.95)	(0.79)	(0.63)
Institutional ownership	-0.003	0.001	0.017***	0.018***	0.015***	0.011***
	(-1.27)	(-0.40)	(8.23)	(7.95)	(8.25)	(6.03)
Inverse Mills ratio		-0.003***		-0.001***		0.003***
		(-3.55)		(-2.84)		(6.83)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.054	0.053	0.277	0.281	0.059	0.061
Obs.	25,207	23,618	25,207	23,618	25,207	25,207

Table 1.9.
The takeover market's impact on dividend payouts
This table reports estimation results for firms' dividend payout ratios. The sample covers 1990-2000 and consists of 25,735 firm-year observations. We use three measures to evaluate the effects of the takeover market on corporate dividend payouts: $Div_t/Sale_{t-1}$, Div_t/MV_{t-1}, and Div_t/AT_{t-1}. Div is the total dividends declared on the common stock, MV is the market value of equity, and AT is the total book assets. All dependent variables are industry adjusted (Fama and French (1997) 48 industries). Columns 2, 4, and 6 report the results after correcting for potential selection biases. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

	$Div_t/Sale_{t-1}$ (1)	$Div_t/Sale_{t-1}$ (2)	Div_t/MV_{t-1} (3)	Div_t/MV_{t-1} (4)	Div_t/AT_{t-1} (5)	Div_t/AT_{t-1} (6)
Non-BC	0.052***	0.043***	0.030***	0.027***	0.029***	0.026***
	(9.45)	(6.64)	(9.14)	(6.84)	(11.06)	(8.38)
Ln(MV)	0.029***	0.032***	0.018***	0.020***	0.014***	0.016***
	(11.69)	(12.46)	(12.13)	(12.53)	(11.62)	(12.29)
Ln(MB)	-0.027***	-0.028***	-0.019***	-0.020***	-0.011***	-0.012***
	(-11.52)	(-11.56)	(-13.02)	(-12.65)	(-9.72)	(-9.59)
ROA	-0.024***	-0.032***	-0.015***	-0.019***	-0.006	-0.009**
	(-3.36)	(-4.10)	(-3.26)	(-3.94)	(-1.63)	(-2.45)
Leverage	0.015***	0.023***	0.012***	0.015***	0.008***	0.012***
	(2.29)	(3.12)	(2.85)	(3.41)	(2.56)	(3.46)
Ln(1+age)	-0.023***	-0.024***	-0.013***	-0.014***	-0.008***	-0.009***
	(-8.12)	(-8.05)	(-7.69)	(-7.56)	(-6.26)	(-6.24)
Sales growth	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(10.74)	(19.92)	(16.90)	(16.26)	(17.72)	(16.98)
Return volatility	0.004	0.004	-0.001	-0.001	-0.001	-0.001
	(0.54)	(0.49)	(-0.10)	(-0.14)	(-0.06)	(-0.12)
Institutional holdings	-0.031***	-0.032***	-0.023***	-0.024***	-0.013***	-0.013***
	(-3.70)	(-3.55)	(-4.413)	(-4.24)	(-3.16)	(-2.97)
Inverse Mills ratio		-0.018***		-0.007***		-0.008***
		(-5.67)		(-3.61)		(-5.00)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.062	0.067	0.065	0.068	0.065	0.068
Obs.	25,735	24,143	25,735	24,143	25,735	24,143

Table 1.10.
The takeover market's impact on share repurchases

This table reports estimation results for firms' share repurchases. The sample covers 1990-2000 and consists of 25,735 firm-year observations. We use three measures to evaluate the effects of the takeover market on corporate share repurchases: $Rep_t/Sale_{t-1}$, Rep_t/MV_{t-1}, and Rep_t/AT_{t-1}. Rep is the total repurchases of common and preferred stock, MV is the market value of equity, and AT is the total book assets. All dependent variables are industry adjusted (Fama and French (1997) 48 industries). Columns 2, 4, and 6 report the results after correcting for potential selection biases. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

	$Rep_t/Sale_{t-1}$ (1)	$Rep_t/Sale_{t-1}$ (2)	Rep_t/MV_{t-1} (3)	Rep_t/MV_{t-1} (4)	Rep_t/AT_{t-1} (5)	Rep_t/AT_{t-1} (6)
Non-BC	-0.001	-0.003	-0.002*	-0.002	-0.003***	-0.003
	(-0.604)	(-1.40)	(-1.73)	(-1.45)	(-2.60)	(-1.43)
Ln(MV)	0.005***	0.006***	0.002***	0.003***	0.002***	0.002***
	(8.17)	(8.01)	(6.11)	(6.14)	(6.78)	(7.07)
Ln(MB)	-0.004***	-0.004***	-0.007***	-0.007***	-0.001	-0.001*
	(-3.27)	(-3.24)	(-8.48)	(-8.64)	(-1.45)	(-1.78)
ROA	-0.003	-0.002	0.012***	0.012***	0.014***	0.014***
	(-0.73)	(-0.38)	(4.54)	(4.31)	(6.67)	(6.09)
Leverage	0.005	0.005	0.008***	0.008***	0.003	0.003
	(1.30)	(1.36)	(3.60)	(3.29)	(1.61)	(1.58)
Ln(1+age)	-0.005***	-0.005***	-0.001	-0.001	0.000	-0.000
	(-3.89)	(-3.76)	(-0.97)	(-0.84)	(0.05)	(-0.11)
Sales growth	0.001***	0.001***	0.001	0.001***	0.001	0.001***
	(9.53)	(9.37)	(7.53)	(7.46)	(7.34)	(7.24)
Return volatility	0.010**	0.011**	0.004	0.005	0.006***	0.006***
	(1.97)	(2.25)	(1.29)	(1.55)	(2.27)	(2.42)
Institutional ownership	0.015***	0.016***	0.013***	0.013***	0.015***	0.015***
	(3.27)	(3.25)	(4.34)	(4.34)	(6.17)	(5.91)
Inverse Mills ratio		-0.002		-0.001**		-0.001**
		(-1.08)		(-2.26)		(-2.23)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.017	0.018	0.020	0.021	0.031	0.032
Obs.	25,735	24,143	25,735	24,143	25,735	24,143

CHAPTER 2

CAPITAL STRUCTURE ADJUSTMENT SPEED AND PRODUCT MARKET COMPETITION

2.1. Introduction

As an important line of research in corporate finance, the speed of capital structure adjustment has been the focus of a considerable amount of academic interest. Prior studies find that the speed of adjustment is influenced by multiple internal and external factors such as firm size, interest rate conditions, and stock price levels (Jalilvand and Harris (1984)), the terms of debt (Auerbach (1985)), financial constraints (Korajczyk and Levy (2003)), adjustment costs (Leary and Roberts (2005)), above- and under-target leverage positions (Byoun (2008)), macroeconomic conditions (Cook and Tang (2010)), and cash flow realizations (Faulkender et al. (2011)). In this paper, we supplement the literature by documenting the positive impact of product market competition on the speed of capital structure adjustment.

Although there is an extensive theoretical and empirical literature examining the effects of capital structure decisions on product market outcomes,[1] little has been done to determine how the intensity of product market competition affects firms' dynamic adjusting behaviors.[2] Ovtchinnikov (2010) argues that higher product market competition increases the expected benefit of leverage adjustment to target relative to adjustment cost and thus incentivizes firms to speed up their capital structure adjustments. Accordingly, he finds that deregulation triggers

active capital structure rebalancing as firms respond to increased competition. Meanwhile, using exogenous variation in import competition, Xu (2011) also finds evidence in support of capital structure rebalancing as product market competition intensifies. Taken together, we infer that the degree of product market competition may be an important factor in determining the speed of capital structure adjustment, and we expect firms in competitive industries to have faster adjustment speeds than firms in non-competitive industries.

Using the Herfindahl-Hirschman Index (HHI), the industry price-cost margin, the number of firms in an industry, and the level of import penetration to gauge the intensity of product market competition, we find evidence that supports our hypothesis. While our primary measure of product market competition is the HHI based on three-digit SIC codes, our finding is robust across alternative specifications of HHIs. We obtain similar results when we use the Census HHI, and HHIs based on two-digit and four-digit SIC codes. In addition, our result is robust to an alternative proxy for the target leverage ratio, different definitions of leverage, and the presence of financial constraints, and is more pronounced in good macroeconomic states.

Previous studies suggest that adjustments in capital structure toward target do not follow a continuous process.[3] Traditional explanations focus largely on the existence of substantial adjustment costs, which make continuous adjustment suboptimal (see, for example, Leary and Roberts (2005)). Most recently, adjustment costs-based explanations have been challenged (Denis and McKeon (2010)), and new models (see, for example, DeAngelo, DeAngelo, and Whited (2010)) are developed to account for management-initiated movements away from target, which generate slow adjustment speed toward target. Since the speed of adjustment estimated by a typical partial capital structure adjustment model is an average annual reversal rate determined by firms' converging as well as diverging movements, there are two channels through which

product market competition could affect the overall speed of adjustment. First, competition could enhance firms' converging activities by incentivizing managers either to pay off debt when firms are over-levered or to lever up on debt financing when firms are under-levered. Second, competition could reduce firms' diverging activities by preventing managers either from issuing debt to fund investment and "deliberately" move away from target when firms are over-levered or from accumulating earnings when firms are under-levered.

While our initial analysis suggests that greater product market competition increases the speed of capital structure adjustment, it does not indicate through which channel(s) competition works. To address this issue, we examine how product market competition affects the differential speeds of adjustment for over- and under-levered firms. We find that competition significantly increases the speed of adjustment for over-levered firms but it does not affect the adjustment speed for under-levered firms.

Since faster adjustment speeds for firms in competitive industries are driven solely by the capital structure changes in over-levered firms, we examine how product market competition impacts the converging and diverging capital structure movements in these firms. Investment needs may sometimes induce managers to borrow, deviating temporarily from target, while subsequent rebalancing depends on firms' future investment paths and earnings realizations (DeAngelo et al. (2010)). But in competitive industries, concerns about financial distress costs and reduced debt capacity could prevent over-levered firm managers from making capital structure changes that would increase the distance from target. Therefore, over-levered firms in competitive industries may diverge less from target, resulting in faster speeds of capital structure adjustment. Using a logit regression, we analyze firms' financing options of pure debt versus pure equity issuance, and find that over-levered firms in competitive industries are significantly

less likely to use debt financing than their counterparts in non-competitive industries. Examining capital expenditure outlays for over-levered firms from 1971 to 2006, we show that over-levered firms in competitive industries do not appear to have lower levels of investment needs, nor do they have lower investment "spikes" than in non-competitive industries.

Conventionally, faster speeds of capital structure adjustment are presumed to be associated with a higher likelihood of rebalancing toward target when firms have deviated from target. This explanation sounds plausible in the context of product market competition because greater competition forces firms to adjust frequently, closing deviations from target. To analyze whether over-levered firms' converging activities also play a role in the faster speeds of adjustment, we employ a duration analysis to directly test whether product market competition affects the time to commence adjustment toward target and the time interval to close at least half of the deviation from target. However, we find no evidence that product market competition affects the converging capital structure movements for over-levered firms. In other words, over-levered firms in competitive industries do not rebalance more frequently, nor do they close deviations faster than those in non-competitive industries.

We make two contributions to the literature. First, we find that product market competition should be included as one of the important factors that determine the speed of capital structure adjustment. Our results suggest that firms in competitive industries stay close to target, consistent with the notion that product market competition is a powerful disciplinary force which effectively mitigates managerial inefficiencies. Second, to the best of our knowledge, we are the first to separate the converging and diverging capital structure movements that underlie the speed of adjustment estimated by a typical partial adjustment model. We find that competition does not affect the speed of adjustment for under-levered firms. In addition, contrary to conventional

wisdom, we find that the faster speed of adjustment for firms in competitive industries is not caused by an increase in the converging capital structure movements of over-levered firms but by a decrease in their diverging movements.

The rest of our paper proceeds as follows. Section 2 describes data selection and sample statistics. Section 3 presents the paper's main results and robustness checks. Section 4 examines the channel(s) through which product market competition works to increase the speed of capital structure adjustment. Section 5 concludes.

2.2. Data selection and descriptive statistics

2.2.1. Data selection

Our initial sample includes all publicly traded firms from the annual Compustat database over the period 1970 to 2006. We exclude financial firms (SIC codes 6000-6999) and regulated utilities (SIC codes 4900-4999) from the sample because factors that drive these firms' capital structures are likely to be different than the rest of the sample. We delete all firm-year observations when total assets are either missing or non-positive, require leverage to be bound between 0 and 1, inclusive, and eliminate firm-years for which sales are negative. Details regarding variable construction are in APPENDIX A. To mitigate the influence of outliers, we winsorize all variables at the top and bottom one percentile. Because we use lagged data in our estimations, we require all variables to have non-missing values for at least two years. The above selection criteria leave us with 152,962 firm-year observations.

2.2.2. Target leverage

Following prior studies, we choose industry median leverage as our primary measure of the target leverage.[4] As a robustness check, we also use a regression-based leverage ratio as an alternative measure of the target leverage, which is the predicted value from the following regression equation:

$$Lev_{it} = \alpha + \beta X_{it-1} + \gamma_i + \delta_t + \theta_{it} \quad (1)$$

where X denotes the set of control variables in recent studies on capital structure (Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), and Byoun (2008)) and includes firm size, profitability, market-to-book ratio, asset tangibility, depreciation, R&D expenses, R&D dummy, dividend, and industry median leverage ratio. We model γ as a firm fixed effect and δ as a year fixed effect. Since Hovakimian and Li (2010) find that using *ex-post* information to estimate the target leverage ratio in a fixed effect model leads to an upward bias in the estimated speed of adjustment, we use a historical panel to estimate the target leverage ratio. Specifically, we estimate the target leverage ratio for time *T* by utilizing information on X from years 1 through *T*-1 to obtain $\hat{\beta}$ for equation (1) and then generate the predicted value $\hat{\beta}X_{it-1}$ as the target leverage ratio.

2.2.3. Measures of market concentration

Following previous literature, we use four measures to gauge the intensity of product market competition. Our primary measure is the Herfindahl-Hirschman index (HHI) based on three-digit SIC codes. We compute the HHI for industry *j* in year *t* as the sum of squared market shares of firm *i*, where market shares are based on firms' sales:

$$HHI_{jt} = \sum_{i=1}^{Nj} s_{ijt}^2 \quad (2)$$

A lower HHI indicates stronger competition. For each year, we sort firms into quintiles using HHI, and assign those firms in the bottom (top) quintile to competitive (non-competitive) industries.

Our second measure is the industry price-cost margin, known as the Lerner index (see e.g. Lerner (1934), Nickell (1996), and Aghion et al. (2005)). We compute the price cost margin for firm *i* as the operating income after depreciation over sales, and the industry price cost margin is the average price cost margin within the three-digit industry:

$$L_{jt} = \frac{1}{N_{jt}} \sum_{i=1}^{Nj} PCM_{ijt} \quad (3)$$

Firms in non-competitive industries have greater market power and are expected to earn higher profits by charging higher prices. Thus, a higher index implies weaker competition within the industry. For each year, we sort firms into quintiles using the Lerner index, and assign those firms in the bottom (top) quintile to competitive (non-competitive) industries.

Our third measure is the number of firms within an industry (Tirole (1988) and Morellec and Nikolov (2009)), which is expected to be positively correlated to the intensity of competition. For each year, we sort firms into quintiles using the natural logarithm of the number of firms and assign those firms in the top (bottom) quintile to competitive (non-competitive) industries.

Our last measure is the level of import penetration (Bertrand (2004)), Bernard, Jensen and Schott (006), and Irvine and Pontiff (2009)). We obtain the data set from Professor Peter Schott[5] and calculate import penetration as (imports) / (shipments – exports + imports). A higher level of import penetration indicates a larger market share attributed to foreign competitors, implying stronger competition. For each year, we sort firms into quintiles based on import penetration and assign those firms in the top (bottom) quintile to competitive (non-competitive) industries.

2.2.4. Descriptive statistics

Table 1 presents summary statistics for competitive and non-competitive subsamples. Across all four measures of product market competition, the main variables differ significantly between these two subsamples. We note that firms in competitive industries tend to have lower profitability, which is consistent with the argument that intense product market competition wipes out abnormal profits (Ovtchinnikov (2010)). Also consistent with the prediction of the tradeoff theory that lower profitability implies a lower target, the target leverage ratio proxied by the industry median leverage ratio as well as the fitted value from the target regression specified by equation (1) is significantly lower in competitive industries. Meanwhile, firms in competitive industries generally have smaller deviations than firms in non-competitive industries, thus it is not likely that deviations from target play a role in generating the faster speed of adjustment.[6] We further note that firms in competitive industries are smaller, suggesting that the faster speed of capital structure adjustment in competitive industries could not be driven by the size effect.[7] While firms in competitive industries have lower asset tangibility and are less likely to pay dividends, they spend more on R&D and also have higher growth opportunities. Estimating the average speeds of capital structure adjustment reveals that firms in competitive industries generally have faster speeds of adjustment than firms in non-competitive industries.

2.3. Regression analysis on the speed of capital structure adjustment

In this section, we examine whether product market competition affects the speed of capital structure adjustment. Estimates of capital structure adjustment speeds are usually generated by partial adjustment models, and a typical partial adjustment model takes the following form:

$$Lev_{i,t} - Lev_{i,t-1} = \alpha + \lambda(Target_{i,t} - Lev_{i,t-1}) + \mu_{i,t} \quad (4)$$

When Target is estimated by the regression equation in (1), the result is a two-step partial adjustment model. Substituting (1) into (4) and rearranging generates the single step partial adjustment model:

$$Lev_{i,t} = \alpha + \lambda\beta X_{i,t} + (1- \lambda)Lev_{i,t-1} + \mu_{i,t} \quad (5)$$

where the target leverage ratio and the speed of adjustment are estimated simultaneously. However, since our primary measure of the target is the industry median leverage ratio and the regression-based target is estimated using historical information, it is more appropriate to use the two-step partial adjustment model.[8]

2.3.1. Main empirical results

Table 2 presents our estimation results when we use the industry median leverage ratio to measure the target leverage ratio. Consistent with prior studies, speeds of capital structure adjustment estimated using cross sectional data, while ignoring both firm and year fixed effects, are much lower than panel data estimates. We are mainly interested in the coefficients on the interaction term *Competitive* Deviation*, where a significantly positive coefficient would indicate a faster speed of capital structure adjustment for firms in competitive industries. Across all four measures, firms in competitive industries have speeds of adjustment 3%-11% higher than firms in non-competitive industries. Similar results hold in Table 3 when we use a regression-based leverage ratio to measure the target leverage ratio. In summary, intensified product market competition positively impacts the speed of capital structure adjustment.

2.3.2. Robustness checks

2.3.2.1. The presence of financial constraints and boundary issues

We follow Cook and Tang (2009) and account for the presence of financial constraints and boundary conditions.[9] First, we use the most up-to-date measure of financial constraints, the SA index (Hadlock and Pierce (2011)), to perform a quintile sorting on our original sample. We then assign firms in the top quintile to the financially constrained subsample and those in the bottom quintile to the financially unconstrained subsample. We find that the effect of competition on the speed of capital structure adjustment still holds in the financially constrained subsample. Second, we rerun Tables 2 and 3 after excluding zero-debt firm-year observations, and obtain estimation results similar to those in Table 2 and 3. For brevity, we do not report these results.

2.3.2.2. Alternative measures of HHI

While our primary measure of product market competition is the HHI based on three-digit SIC codes,[10] we also use HHIs based on two- and four-digit SIC codes as robustness checks. Further, we also consider the Census HHI computed using all public and private firms. Although the Census HHI is broader than the Compustat-based HHIs, it is only available for manufacturing industries (SIC codes 2000-3999) and for the years 1982, 1987, and 1992. Accordingly, we use the HHI indices from 1982, 1987, and 1992 for the sample periods covering 1970-1986, 1987-1991, and 1992-2006, respectively. Table 4 reports the estimation results which show that the coefficients on the interaction term *Competitive* Deviation* remain significantly positive, suggesting that the speed of capital structure adjustment is faster for firms in competitive industries.

2.3.2.3. Macroeconomic conditions

Cook and Tang (2009) find that firms adjust their leverage toward target faster in good macroeconomic states compared to bad ones. Therefore, we expect the effect of product market competition on the speed of adjustment to be more pronounced in good macroeconomic states since the easy access to capital markets would allow firms in competitive industries to raise capital and make the necessary capital structure adjustments in order to stay close to target. We incorporate Cook and Tang's results and examine how the speeds of capital structure adjustment are affected when we account for external macroeconomic conditions. We use the NBER historical dating procedure and follow Cook and Tang's method to identify recession and boom years. Based on our sample period, we identify years 1980, 1981, 1982, 1990, and 2001 as recession years, and the remaining years as boom years. We then build a dummy variable *Good* and set it equal to one if a firm is in a boom year and zero otherwise. Table 5 reports the estimation results that are consistent with our conjecture. When the dummy variable *Good* equals zero, the coefficients on the interaction term *Competitive* Deviation* capture the effect of competition on the speed of capital structure adjustment in recession years. As is shown, both the magnitude and the statistical significance are weakened during the recession years. In contrast, during boom years, the interaction term between *Competitive* Deviation* and *Good* has coefficients ranging from 0.06 to 0.08 (0.04 to 0.08) for book (market) leverage, and all of them are statistically significant at the 1% level.

2.4. Why do firms have faster speeds of capital structure adjustment?

Since firms' speeds of capital structure adjustment are influenced by converging and diverging movements in their capital structures, we identify two channels through which product market competition could impact the overall speed of adjustment: Competition could incentivize

managers to either increase converging movements or decrease diverging movements. Conventionally, faster speeds of adjustment are considered to be associated with an increase in firms' converging movements. In this section, we evaluate this conventional belief and test the hypothesis that competition impacts the speed of adjustment by decreasing firms' diverging movements.

2.4.1. The impact of product market competition on asymmetric speeds of adjustment

Byoun (2008) finds that over- and under-levered firms face different incentives when adjusting their capital structures toward target and thus exhibit differential speeds of adjustment. We follow Byoun (2008) and estimate asymmetric speeds of capital structure adjustment for over- and under-levered firms, and we then investigate how competition affects the adjusting behaviors of these two types of firms. Columns 1 and 3 in Table 6 present the estimation results for asymmetric speeds of adjustment. Consistent with Byoun's results, we find that over-levered firms have higher adjustment speeds compared to under-levered firms. In columns 2 and 4, the coefficient on the interaction term *Deviation*Over*Competitive* (*Deviation*Under*Competitive*) capture the effect of product market competition on over-levered (under-levered) firms. While the speed of capital structure adjustment is significantly faster for over-levered firms, competition exerts no impact on under-levered firms. This analysis suggests that the faster speeds of capital structure adjustment we have documented in previous sections are driven solely by changes in the capital structures of over-levered firms. In the next two subsections, we focus on over-levered firms and examine how competition affects their diverging and converging behaviors.

2.4.2. Logit regression predicting debt versus equity choice

When facing external financing needs, managers sometimes choose to issue debt and thus deliberately deviate from target and such changes negatively impact the overall speed of capital structure adjustment (DeAngelo et al. (2010)). Given the fact that intensified product market competition increases the benefits of staying close to target, managers of over-levered firms have incentives to decrease diverging movements by choosing equity over debt when raising capital. In Table 7, we employ a logit regression to predict the likelihood of an over-levered firm to issue debt rather than equity. We include firm-year observations that involve only pure debt or pure equity issuance.[11] we present these estimation results in columns 1 and 3, and in columns 2 and 4, we repeat the analysis using a cutoff threshold of 5% to define net debt and equity issuance. For both analyses, the signs on *Competitive* are negative, and the coefficients are significant at the 1% level, suggesting that over-levered firms in competitive industries are less likely to issue debt than equity when raising external financing.

One possibility is that over-levered firms in competitive industries face fewer investment opportunities. To evaluate this possibility, we conduct univariate comparisons of investment outlays and investment "spikes" between competitive and non-competitive industries. Table 8 presents the results. In Panel A of Table 8, we note that both the mean and median values of capital expenditure outlays for over-levered firms are significantly higher in competitive industries than in non-competitive industries. We also examine investment "spikes", defined by DeAngelo et al. (2010) to be an annual investment outlay that is two or more standard deviations above the mean for the firm's two-digit SIC code industry. Panel B shows that the mean and median values of investment "spikes" are significantly larger for over-levered firms in competitive industries.

In summary, we find that over-levered firms are less likely to deliberately deviate from target in competitive industries, leading to faster speeds of capital structure adjustment.

2.4.3. Duration analysis

Conventionally, faster speeds of capital structure adjustment are presumed to result from intensified converging movements. In this subsection, we employ a duration analysis and evaluate whether this conventional belief holds in the context of product market competition. Specifically, we ask two questions. First, does competition impact how much time passes before an over-levered firm adjusts its capital structure toward target? Second, does competition impact how long it takes for an over-levered firm to close at least half of its deviation from target? Answers to these questions will reveal whether competition affects two central elements in capital structure adjustments toward target: Frequency and magnitude.

There are three approaches to modeling a duration analysis. First, duration analyses can be modeled using a non-parametric approach which uses life tables and makes no assumption regarding distribution. However, this approach does not allow us to control for the cross-sectional heterogeneity by including firm-specific covariates. Second, duration analyses can be modeled using a semi-parametric hazard model which requires regressors but still does not need distributional assumption. Third, duration analyses can be modeled using a parametric approach which uses various statistical distributions. The second approach is the most popular. Used by Leary and Roberts (2005), Whited (2006) and Akdogu and MacKay (2008), this approach is also appropriate for our study since we can easily include the dummy variable *Competitive* as a regressor and examine the impact of competition on adjustment timing.

Following previous studies, we estimate the following Cox's proportional hazard model:

$$\lambda_i(x_i, t_i) = \omega_i \lambda_0(t_i) \exp(x_i' \beta) \quad (6)$$

where $\lambda_i(x_i, t_i)$ is the hazard function dependent on both x_i and t_i, ω_i is a random variable capturing unobserved heterogeneity, $\lambda_0(t_i)$ is the baseline hazard function, x_i is a vector of covariates including the dummy variable *Competitive*, deviation, firm size, market-to-book, profitability, asset tangibility, depreciation, R&D expenses, R&D dummy, dividend, and industry median leverage ratio, and β is a vector of unknown coefficients.

Table 9 presents the estimation results for a four-year observation period. In columns 1 and 3, we define the dependent variable as the number of years an over-levered firm waits until it adjusts its capital structure back to target. In columns 2 and 4, we define the dependent variable as the number of years required for an over-levered firm to close at least half its deviation from target. For product market competition to have a positive association with the hazard rate, we would expect the coefficients on the dummy variable *Competitive* to be significantly positive. However, we note that the coefficients on the dummy variable *Competitive* are not statistically significant across all estimations. These results suggest that the over-levered firms in competitive industries do not appear to adjust faster toward target than their counterparts in non-competitive industries.

2.5. Conclusion

In this paper, we examine whether product market competition affects the speed of capital structure adjustment. Using the Herfindahl-Hirschman Index (HHI), the industry price-cost margin, the number of firms within an industry, and the level of import penetration to measure the intensity of product market competition, we find that competition positively impacts the speed of capital structure adjustment. Our result is robust to an alternative measure of the target

leverage ratio, different definitions of leverage, and the presence of financial constraints, and is more pronounced in good macroeconomic states. Our finding is consistent with the notion that firms in competitive industries have incentives to stay close to target.

Adjustment costs and management-initiated diverging movements from target prevent firms from adjusting toward target continuously. Since the speed of capital structure adjustment estimated by a typical partial adjustment model is positively (negatively) affected by converging (diverging) capital structure movements, we dig deeper and investigate the channel (s) through which intensified product market competition works to increase the speed of capital structure adjustment. We estimate asymmetric speeds of adjustment conditional on whether firms are over- or under- levered but find no evidence that competition affects the speed of adjustment for under-levered firms. Focusing on the adjusting behaviors of over-levered firms, we find that over-levered firms in competitive industries are far less likely to engage in deliberate diverging movements through debt issuance. However, contrary to conventional belief, we find no evidence that over-levered firms in competitive industries adjust faster toward target. In summary, intensified product market competition positively impacts the overall speed of capital structure adjustment by reducing the diverging movements in over-levered firms.

APPENDIX A: Variable definitions

Variables	
Total debt	Short-term debt (DLC) + long-term debt (DLTT).
Book leverage	Total debt / total assets (AT).
Market equity	Stock's closing price at the fiscal year-end (PRCC_F) * number of shares (CSHO).
Market leverage	Total debt / (total debt + market equity).
Market-to-book ratio	Market equity + total debt + preferred stock liquidating value (PSTKL) – deferred taxes and investment tax credits (TXDITC) / total assets (AT).
Firm size	Ln(total assets (AT)), where total assets are converted to 1983 dollars using the CPI.
Profitability	Operating income before depreciation (OIBDP) / total assets (AT).
Tangibility	Gross PPE (PPEGT) / total assets (AT).
Depreciation	Depreciation (DP) / total assets (AT).
R&D	R&D expenditures (XRD) / total assets (AT). Missing values are set to zero.
R&D Dummy	Dummy variable set equal to 1 for firms without R&D expenditures and zero otherwise.
Dividend	Common stock dividends (DVC) / total assets (AT).
Industry median	Industry median leverage ratio based on Fama and French (1997) industry definitions.
Deviation	Target leverage ratio – lagged leverage ratio.
Competitive	Dummy variable set equal to 1 for firms in competitive industries and zero for firms in non-competitive industries.
Good	Dummy variable set equal to 1 for firms in boom years and zero for firms in recession years.
Over	Dummy variable set equal to 1 for firms with negative deviations and zero otherwise.
Under	Dummy variable set equal to 1 for firms with positive deviations and zero otherwise.

FOOTNOTES

[1] An incomplete list of theoretical papers includes Brander and Lewis (1986), Maksimovic (1988), Bolton and Scharfstein (1990), Showalter (1995), and Maurer (1999). Examples of empirical papers include Chevalier (1995a), Chevalier (1995b), Phillips (1995), Kovenock and Phillips (1997), and Showalter (1999).

[2] Using a balanced panel of Chinese listed firms from 1999 to 2004, Jiang et al. (2010) find that the impact of product market competition on the speed of capital structure adjustment is neither significant nor robust.

[3] Myers (1984) comments that firms appear to take extended excursion away from their targets. Baker and Wurgler (2002) find that past efforts to time the equity market have a persistent impact on capital structures. Welch (2004) shows that US firms do not rebalance their capital structures to counteract the cumulative effects of stock returns.

[4] According to Bowen, Daley, and Huber (1982), industry average leverage ratios remain stable over time and firms have a tendency to converge to such ratios. Hovakimian (2004) uses the industry median leverage as a proxy for the target leverage ratio in his study of security issues and repurchases. Most recently, DeAngelo et al. (2010) proxy the target leverage using the industry average leverage when they estimate the speed of capital structure adjustment. Our industry definition is based on Fama-French 48 industry classifications (1997).

[5] The dataset set is available at http://faculty.som.yale.edu/peterschott/sub_international.htm.

[6] Prior studies find that firms' speeds of capital structure adjustment are positively associated with distance from target (See, e.g. Drobetz and Wanzenried (2006)).

[7] Large firms have better access to capital markets and thus can easily close deviations from target at lower transaction costs (Drobetz and Wanzenried (2006), and Cook and Tang (2011)).

[8] Hovakimian and Li (2009) discusses the flexibility of using the two-step partial adjustment model.

[9] We refer interested readers to Cook and Tang (2011) for a detailed discussion of the rationales behind these robustness tests.

[10] Giroud and Mueller (2010) point out that the three-digit partition is a compromise between the two-digit partition, coarse enough to cause unrelated industries to pool together, and the four-digit partition, narrow enough to result in misclassification.

[11] We follow Hovakimian et al. (2001) and define net debt issuance as the increase in total debt (short-term plus long-term). Net equity issuance is the proceeds from the sale of common and preferred stock minus the amount of common and preferred stock repurchased. When the cutoff threshold of 5% is used, a firm is defined as issuing debt (equity) when net debt (equity) issued scaled by pre-issue total assets exceeds 5%

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Table 2.1.
Descriptive statistics
This table reports summary statistics for firms in competitive and non-competitive industries. The original sample includes 17,001 unique firms and 152,962 firm-year observations covering the period 1970 to 2006. Variable definitions are in Appendix A. We winsorize all variables at the 1st and 99th percentiles to avoid the influence of extreme values. We use four measures to gauge the intensity of product market competition: the Herfindahl-Hirschman index (HHI) based on three-digit SIC codes, the industry price-cost margin, the number of firms within an industry, and the level of import penetration. Based on each of four measures, we perform quintile sorting on the original sample. For sorting based on the HHI and the industry price-cost margin, we assign those in the bottom (top) quintile to the competitive (non-competitive) group. For sorting based on the number of firms within an industry and the level of import penetration, we assign those in the top (bottom) quintile to the competitive (non-competitive) group. B denotes book leverage, and M denotes market leverage. *t*-Statistics are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. We estimate the average SOA (speed of adjustment) using the following regression equation:

$$Lev_{i,t} - Lev_{i,t-1} = \alpha + \lambda(Target_{i,t} - Lev_{i,t-1}) + \mu_{i,t}$$

	HHI			Price-cost margin			Number of firms			Import penetration		
	C	N	t-test	C	N	t-test	C	N	t-test	C	N	t-test
Industry median(B)	0.179	0.231	-0.051*** (-68.31)	0.152	0.244	-0.092*** (-129.49)	0.129	0.247	-0.117*** (-184.18)	0.165	0.226	-0.061*** (-74.47)
Deviation (B)	-0.024	-0.043	0.018*** (11.83)	-0.028	-0.044	0.016*** (9.85)	-0.001	-0.046	0.032*** (20.91)	-0.020	-0.041	0.021*** (8.91)
Industry median (M)	0.175	0.244	-0.069*** (-60.03)	0.146	0.252	-0.105*** (-98.08)	0.113	0.271	-0.157*** (159.79)	0.162	0.249	-0.087*** (-54.22)
Deviation (M)	-0.046	-0.051	0.005** (2.43)	-0.052	-0.043	-0.008*** (-4.65)	-0.035	-0.043	0.008*** (4.34)	-0.045	-0.051	0.005* (1.96)
Size	17.986	18.107	-0.121*** (-6.65)	17.374	18.905	-1.531*** (-89.60)	17.367	18.454	-1.087*** (-64.72)	17.578	18.401	0.823*** (28.84)
Profitability	-0.006	0.056	-0.062*** (-24.64)	-0.094	0.136	-0.23*** (-92.24)	-0.056	0.088	-0.144*** (-56.05)	0.049	0.111	-0.061*** (-18.76)
MB	2.111	1.507	0.603*** (31.97)	2.435	1.270	1.164*** (61.54)	2.446	1.314	1.132*** (56.95)	1.799	1.234	0.565*** (22.85)
Tangibility	0.621	0.551	0.071*** (21.46)	0.522	0.625	-0.103*** (-32.67)	0.523	0.572	-0.047*** (-14.42)	0.459	0.559	-0.100*** (-24.76)
Depreciation	0.053	0.045	0.007*** (23.89)	0.051	0.045	0.005*** (17.56)	0.058	0.044	0.014*** (40.76)	0.474	0.411	-0.006*** (-15.90)
R&D	0.071	0.019	0.051*** (60.45)	0.086	0.008	0.078*** (88.76)	0.105	0.011	-0.095*** (-106.27)	0.076	0.018	-0.058*** (-57.13)
R&D Dummy	0.491	0.633	-0.143*** (-36.07)	0.455	0.710	-0.256*** (-66.31)	0.344	0.717	-0.373*** (-99.95)	0.153	0.521	-0.368*** (-60.13)
Dividend	0.007	0.009	-0.003*** (-18.42)	0.005	0.013	-0.007*** (-47.71)	0.005	0.010	-0.005*** (-42.20)	0.005	0.012	-0.007*** (-34.13)
Regression-based target (B)	0.228	0.243	-0.016**** (-16.19)	0.192	0.280	-0.089*** (-97.82)	0.176	0.264	-0.087*** (-102.33)	0.185	0.248	-0.062*** (-37.64)
Regression-based target(M)	0.245	0.282	-0.036*** (-21.21)	0.188	0.338	-0.151*** (-95.43)	0.161	0.318	-0.157*** (-104.80)	0.188	0.301	0.113*** (38.40)
Average SOA(B)	0.508	0.431		0.511	0.409		0.514	0.409		0.490	0.432	
Average SOA(M)	0.494	0.413		0.498	0.418		0.505	0.402		0.469	0.450	
Obs.	30,881	30,650		30,462	30,570		30,947	30,444		10,532	10,522	

Table 2.2.
Estimation results for the speed of adjustment using industry median leverage ratio as target

This table presents the estimation results for the speed of capital structure adjustment using the industry median leverage ratio to measure the target leverage. The original sample includes 17,001 unique firms and 152,962 firm-year observations covering the period 1970 to 2006. We use four measures to gauge the intensity of product market competition: the Herfindahl-Hirschman index (HHI) based on three-digit SIC codes, the industry price-cost margin, the number of firms within an industry, and the level of import penetration. Based on each of four measures, we perform quintile sorting on the original sample. For sorting based on the HHI and the industry price-cost margin, we assign those in the bottom (top) quintile to the competitive (non-competitive) group. For sorting based on the number of firms within an industry and the level of import penetration, we assign those in the top (bottom) quintile to the competitive (non-competitive) group. Variable definitions are in Appendix A. We adjust standard errors for heteroscedasticity and serial correlation while *t*-Statistics are in parentheses under each coefficient estimate. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. Panel A (B) reports results for the book (market) leverage ratios.

	HHI		Price-cost margin		Number of firms		Import penetration	
Panel A: Book leverage								
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Constant	0.009***	0.021***	0.005***	0.015***	0.007***	0.043***	0.007***	0.029***
	(14.56)	(5.49)	(9.67)	(14.03)	(12.20)	(3.41)	(7.58)	(7.21)
Competitive	0.006***	0.001	0.015***	0.012***	0.013***	-0.041*	0.007***	-0.020**
	(7.01)	(0.25)	(17.12)	(5.68)	(14.30)	(-1.65)	(5.34)	(-2.53)
Competitive*Deviation	0.061***	0.076***	0.089***	0.074***	0.08***	0.105***	0.037***	0.059**
	(8.45)	(5.00)	(12.73)	(6.43)	(10.62)	(6.80)	(3.09)	(2.44)
Deviation	0.168***	0.428***	0.137***	0.398***	0.152***	0.409***	0.174***	0.425***
	(37.26)	(40.50)	(37.05)	(47.80)	(36.70)	(40.03)	(24.43)	(25.57)
Firm fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Year fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Obs.	61,531	61,531	61,032	61,032	61,391	61,391	21,054	21,054
R-square	0.0943	0.0934	0.0887	0.0856	0.0878	0.0748	0.0888	0.0841
Panel B: Market leverage								
Constant	0.017***	0.034***	0.011***	0.021***	0.015***	0.108***	0.015***	0.035***
	(21.90)	(7.87)	(16.50)	(15.59)	(19.36)	(8.45)	(12.62)	(5.77)
Competitive	0.002**	-0.008	0.013***	0.017***	0.006***	-0.158***	0.003**	-0.012
	(2.02)	(-0.94)	(12.71)	(6.22)	(6.57)	(-6.23)	(2.42)	(-1.05)
Competitive*Deviation	0.054***	0.078***	0.044***	0.040***	0.061***	0.103***	0.026**	0.015
	(8.82)	(6.60)	(6.99)	(3.99)	(9.06)	(7.70)	(2.58)	(0.75)
Deviation	0.158***	0.410***	0.153***	0.404***	0.155***	0.401***	0.185***	0.446***
	(42.80)	(47.86)	(44.64)	(54.83)	(43.88)	(48.75)	(30.53)	(31.97)
Firm fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Year fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Obs.	61,531	61,531	61,032	61,032	61,391	61,391	21,054	21,054
R-square	0.0934	0.0917	0.0869	0.0861	0.0879	0.0485	0.1048	0.1035

Table 2.3.
Estimation results for the speed of adjustment using regressed-based leverage ratio as target

This table presents the estimation results for the speed of capital structure adjustment using the predicted value from equation (1) to measure the target leverage. The original sample includes 17,001 unique firms and 152,962 firm-year observations covering the period 1970 to 2006. We use four measures to gauge the intensity of product market competition: the Herfindahl-Hirschman index (HHI) based on three-digit SIC codes, the industry price-cost margin, the number of firms within an industry, and the level of import penetration. Based on each of four measures, we perform quintile sorting on the original sample. For sorting based on the HHI and the industry price-cost margin, we assign those in the bottom (top) quintile to the competitive (non-competitive) group. For sorting based on the number of firms within an industry and the level of import penetration, we assign those in the top (bottom) quintile to the competitive (non-competitive) group. Variable definitions are in Appendix A. We adjust standard errors for heteroscedasticity and serial correlation while *t*-Statistics are in parentheses under each coefficient estimate. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. Panel A (B) reports results for the book (market) leverage ratios.

	HHI		Price-cost margin		Number of firms		Import penetration	
Panel A: Book leverage								
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Constant	0.007***	0.012***	0.001	0.003***	0.005***	0.012**	0.003***	0.019***
	(10.59)	(3.04)	(0.94)	(2.77)	(7.81)	(2.14)	(3.47)	(4.24)
Competitive	-0.002**	-0.011	0.011***	0.004**	0.004***	-0.011	0.005***	-0.019**
	(-2.15)	(-1.36)	(11.59)	(2.11)	(4.73)	(-1.01)	(3.84)	(-2.14)
Competitive*Deviation	0.046***	0.068***	0.096***	0.089***	0.075***	0.107***	0.022**	0.059**
	(6.51)	(4.31)	(13.93)	(8.03)	(10.38)	(6.81)	(2.13)	(2.58)
Deviation	0.151***	0.439***	0.115***	0.395***	0.131***	0.418***	0.126***	0.426***
	(32.15)	(39.49)	(31.93)	(47.27)	(31.48)	(31.98)	(18.98)	(25.77)
Firm fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Year fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Obs.	61,531	61,531	61,032	61,032	61,391	61,391	21,054	21,054
R-square	0.0754	0.0750	0.0742	0.0702	0.0714	0.0694	0.0542	0.0537
Panel B: Market leverage								
Constant	0.011***	-0.026**	-0.001	-0.003**	0.007***	0.065***	0.006***	0.014**
	(13.30)	(-2.55)	(-0.70)	(-2.39)	(9.61)	(2.81)	(4.05)	(2.06)
Competitive	-0.005***	-0.026***	0.016***	0.012***	0.003***	-0.116**	0.005***	-0.004
	(-4.99)	(-2.55)	(14.98)	(4.38)	(3.26)	(-2.51)	(3.10)	(-0.36)
Competitive*Deviation	0.015***	0.026**	0.037***	0.025***	0.025***	0.034**	0.008	0.007
	(2.78)	(1.99)	(6.67)	(2.82)	(4.33)	(2.51)	(1.07)	(0.41)
Deviation	0.128***	0.444***	0.116***	0.417***	0.125***	0.436***	0.112***	0.463***
	(36.01)	(44.49)	(36.06)	(56.19)	(35.56)	(48.50)	(22.01)	(30.74)
Firm fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Year fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Obs.	61,531	61,531	61,032	61,032	61,391	61,391	21,054	21,054
R-square	0.0587	0.0586	0.0589	0.0558	0.0561	0.0405	0.0518	0.0510

Table 2.4.
Speeds of adjustment using alternative measures of HHI

This table presents the estimation results for the speed of capital structure adjustment using alternative measures of HHI. The original sample includes 17,001 unique firms and 152,962 firm-year observations covering the period 1970 to 2006. Columns 1 and 2 present results using the HHI based on the two-digit SIC codes. Columns 3 and 4 present results using the HHI based on the four-digit SIC codes. Columns 5 and 6 present results based on the Census HHI. Variable definitions are in Appendix A. We adjust standard errors for heteroscedasticity and serial correlation while *t*-Statistics are in parentheses under each coefficient estimate. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. Panel A (B) reports results for the book (market) leverage ratios.

	Two-digit HHI		Four-digit HHI		Census HHI	
Panel A: Book leverage	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	FE	OLS	FE	OLS	FE
Constant	0.010***	0.013***	0.012***	0.019***	0.001	0.007
	(16.44)	(3.16)	(18.09)	(7.62)	(1.52)	(0.90)
Competitive	0.002**	0.015*	0.002***	0.006	0.004***	-0.009
	(2.59)	(1.70)	(3.02)	(1.19)	(3.45)	(-0.63)
Competitive*Deviation	0.049***	0.016***	0.026***	0.025***	0.019*	0.033**
	(6.65)	(3.02)	(3.48)	(3.68)	(1.72)	(2.55)
Deviation	0.168***	0.461***	0.183***	0.459***	0.176***	0.447***
	(36.73)	(46.32)	(37.00)	(42.38)	(22.60)	(27.97)
Firm fixed effects	NO	YES	NO	YES	NO	YES
Year fixed effects	NO	YES	NO	YES	NO	YES
Obs.	59,833	59,833	59,018	59,018	30,340	30,340
R-square	0.0899	0.0884	0.0895	0.0894	0.0783	0.0719
Panel B: Market leverage						
Constant	0.018***	0.018***	0.017***	0.029***	0.003***	0.001
	(24.43)	(3.41)	(23.55)	(9.92)	(3.40)	(0.12)
Competitive	-0.003***	0.024**	0.002**	0.003	0.004***	0.007
	(-3.33)	(2.29)	(2.12)	(0.60)	(3.08)	(0.31)
Competitive*Deviation	0.033***	0.043***	0.033***	0.045***	0.017*	0.029**
	(5.42)	(3.24)	(5.27)	(3.57)	(1.88)	(2.51)
Deviation	0.158***	0.424***	0.171***	0.424***	0.131***	0.405***
	(41.32)	(48.09)	(42.35)	(49.20)	(22.36)	(27.53)
Firm fixed effects	NO	YES	NO	YES	NO	YES
Year fixed effects	NO	YES	NO	YES	NO	YES
Obs.	59,833	59,833	59,018	59,018	30,340	30,340
R-square	0.0844	0.0818	0.0917	0.0916	0.0575	0.0575

Table 2.5.
Speeds of adjustment, competition, and macroeconomic conditions
This table presents the estimation results for the speed of capital structure adjustment when we account for external macroeconomic conditions. The original sample includes 17,001 unique firms and 152,962 firm-year observations covering the period 1970 to 2006. We use four measures to gauge the intensity of product market competition: the Herfindahl-Hirschman index (HHI) based on three-digit SIC codes, the industry price-cost margin, the number of firms within an industry, and the level of import penetration. Based on each of four measures, we perform quintile sorting on the original sample. For sorting based on the HHI and the industry price-cost margin, we assign those in the bottom (top) quintile to the competitive (non-competitive) group. For sorting based on the number of firms within an industry and the level of import penetration, we assign those in the top (bottom) quintile to the competitive (non-competitive) group. Using NBER historical dating procedure, we identify years 1980, 1981, 1982, 1990, and 2001 as recession years, and the remaining ones as boom years. Variable definitions are in Appendix A. We adjust standard errors for heteroscedasticity and serial correlation while *t*-Statistics are in parentheses under each coefficient estimate. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. Panel A (B) reports results for the book (market) leverage ratios.

	HHI	Price-cost margin	Number of firms	Import penetration
Panel A: Book leverage				
Competitive	0.006***	0.015***	0.013***	0.007***
	(7.18)	(17.42)	(14.52)	(5.59)
Competitive*Deviation	0.017*	0.049***	0.038***	-0.015
	(1.67)	(5.11)	(3.36)	(-1.16)
Deviation	0.168***	0.115***	0.152***	0.174***
	(37.28)	(31.90)	(36.69)	(23.85)
Competitive*Deviation	0.063***	0.069***	0.059***	0.081***
*Good	(5.36)	(5.88)	(4.59)	(4.54)
Good	0.010***	0.004***	0.008***	0.009***
	(10.41)	(3.91)	(8.54)	(6.03)
Obs.	61,532	61,032	61,391	21,054
R-square	0.0963	0.0758	0.0766	0.0916
Panel B: Market leverage				
Competitive	0.002**	0.013***	0.006***	0.005***
	(2.45)	(12.87)	(6.88)	(3.12)
Competitive*Deviation	0.015*	0.018**	0.031***	0.004
	(1.96)	(2.19)	(3.46)	(0.37)
Deviation	0.158***	0.152***	0.156***	0.113***
	(42.83)	(44.50)	(43.87)	(22.05)
Competitive*Deviation	0.061***	0.040***	0.046***	0.080***
*Good	(6.35)	(3.82)	(4.05)	(2.71)
Good	0.001	-0.003***	-0.001	-0.004***
	(0.88)	(-3.59)	(-1.17)	(-2.66)
Obs.	61,532	61,032	61,391	21,054
R-square	0.0932	0.0876	0.0885	0.0512

Table 2.6.
The impact of competition on asymmetric speeds of adjustment
This table presents the estimation results for the impact of competition on asymmetric speeds of adjustment. The original sample includes 17,001 unique firms and 152,962 firm-year observations covering the period 1970 to 2006. We use the Herfindahl-Hirschman index (HHI) based on three-digit SIC codes to gauge the intensity of product market competition. Based on this measure, we perform quintile sorting on the original sample and assign those in the bottom (top) quintile to the competitive (non-competitive) group. Variable definitions are in Appendix A. We adjust standard errors for heteroscedasticity and serial correlation while *t*-Statistics are in parentheses under each coefficient estimate. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Book leverage		Market leverage	
	(1)	(2)	(3)	(4)
Deviation*Over*Competitive		0.089***		0.058***
		(5.69)		(5.05)
Deviation*Under*Competitive		0.002		0.035
		(0.10)		(1.26)
Competitive		0.011***		-0.003
		(4.36)		(-1.49)
Deviation*Over	0.374***	0.326***	0.311***	0.287***
	(47.21)	(30.01)	(52.87)	(35.70)
Deviation*Under	0.184***	0.195***	0.111***	0.096***
	(20.23)	(17.01)	(14.37)	(9.52)
Constant	0.045***	0.028***	0.044***	0.045***
	(14.42)	(16.92)	(12.29)	(14.60)
F-test *p*-value for difference	0.0001		0.0001	
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
R^2	0.101	0.098	0.128	0.129
Obs.	61,508	61,508	61,508	61,508

Table 2.7.
Logit regression predicting debt vs. equity choice for over-levered firms
This table presents the estimation results from a logit regression predicting debt/equity issue for the over-levered firms. The sample includes 5,375 unique firms and 15,239 firm-year observations covering the period 1970 to 2006. The dependent variable is a dummy variable set equal to one if an over-levered firm issues debt and zero if the firm issues equity. We use the Herfindahl-Hirschman index (HHI) based on three-digit SIC codes to gauge the intensity of product market competition. Based on this measure, we perform quintile sorting on the original sample and assign those in the bottom (top) quintile to the competitive (non-competitive) group. Variable definitions are in Appendix A. Columns 2 and 4 present results when we use the cutoff threshold of 5% to define debt and equity issuances. *t*-stat are in parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Book leverage		Market leverage	
	(1)	(2)	(3)	(4)
Competitive	-0.178***	-0.189***	-0.143***	-0.162***
	(-4.89)	(-4.27)	(-3.90)	(-3.63)
Deviation	-0.791***	-0.287**	-0.489***	-0.671***
	(-6.62)	(-2.03)	(-4.82)	(-5.48)
Firm size	0.038***	-0.069***	0.029***	-0.078***
	(3.86)	(-5.75)	(2.98)	(-6.43)
Market-to-book	-0.080***	-0.075***	-0.051***	-0.038**
	(-5.80)	(-4.66)	(-3.62)	(-2.35)
Profitability	0.377***	0.636***	0.564***	0.792***
	(3.39)	(4.74)	(4.94)	(5.76)
Tangibility	0.101*	-0.051	0.101*	-0.044
	(1.69)	(-0.71)	(1.71)	(-0.62)
Depreciation	-2.989***	-2.76***	-3.244***	-2.805***
	(-4.94)	(-3.93)	(-5.36)	(-4.00)
R&D	-0.334	-0.188	0.009	-0.013
	(-1.10)	(-0.61)	(0.03)	(-0.04)
R&D Dummy	0.393***	0.520***	0.329***	0.476***
	(9.32)	(9.95)	(7.77)	(9.10)
Dividend	10.176***	8.312***	13.139***	10.752***
	(7.00)	(5.05)	(8.58)	(9.10)
Industry median	0.623***	1.499***	1.213***	1.558***
	(2.63)	(5.32)	(6.25)	(7.17)
Year dummies	Yes	Yes	Yes	Yes
Log likelihood	-9,728.63	-6,739.74	-9732.46	-6,725.47
Prob>Chi^2	0.000	0.000	0.000	0.000
Pseudo R^2	0.078	0.098	0.078	0.101
Obs.	15,239	11,142	15,239	11,142

Table 2.8.
Investment outlays and investment spikes
This table presents the t-statistics for differences in means and z-statistics of the Wilcoxon test for differences in distribution between firms in competitive and non-competitive industries. The original sample includes 17,001 unique firms and 152,962 firm-year observations covering the period 1970 to 2006. Investment outlays are defined as capital expenditures scaled by the book value of total assets. An investment spike is defined by DeAngelo et al. (2010) to be an annual capital expenditure outlay that is two or more standard deviations above the mean for the firm's two-digit SIC code industry. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

		Competitive industries	Non-competitive industries	t-test	z-value
Panel A					
Investment outlay	N	30,476	30,165		
	Mean	0.114	0.078	0.036*** (36.78)	
	Median	0.064	0.047		32.366***
	S.D.	0.146	0.105		
Panel B					
Investment spike	N	1,448	1,350		
	Mean	0.456	0.401	0.054*** (6.11)	
	Median	0.396	0.343		6.844***
	S.D.	0.214	0.211		

Table 2.9.
Duration analysis
This table presents the results from estimating the Cox's proportional hazard model. The observation window is four-year and sample period covers 1970-2006. In Columns 1 and 3, the dependent variable is defined as the number of years an over-levered firm has not adjusted its capital structure back to target. In Columns 2 and 4, the dependent variable is defined as the numbers of years it takes for an over-levered firm to close at least half the deviation from target. We use the Herfindahl-Hirschman index (HHI) based on three-digit SIC codes to gauge the intensity of product market competition. Based on this measure, we perform quintile sorting on the original sample and assign those in the bottom (top) quintile to the competitive (non-competitive) group. Variable definitions are in Appendix A. *t*-stat are in parentheses and ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Book leverage		Market leverage	
	(1)	(2)	(1)	(2)
Competitive	-0.004	-0.009	0.003	-0.004
	(-0.31)	(-0.56)	(0.21)	(-0.23)
Deviation	0.523***	-0.889***	0.812***	-0.646***
	(11.00)	(-14.72)	(19.74)	(-12.96)
Firm size	-0.011***	-0.031***	-0.014***	-0.036***
	(-3.13)	(-7.01)	(-3.91)	(-8.53)
Market-to-book	0.031***	0.037***	0.088***	0.073***
	(7.47)	(9.28)	(18.09)	(15.91)
Profitability	0.493***	0.126***	0.547***	0.417***
	(11.65)	(3.18)	(11.68)	(9.68)
Tangibility	0.010	-0.112***	0.035	-0.070***
	(0.65)	(-4.26)	(1.54)	(-2.77)
Depreciation	-0.154	0.760***	0.362	0.446*
	(-0.67)	(3.02)	(1.57)	(1.81)
R&D	0.346***	-0.159	0.711***	0.133
	(3.26)	(-1.43)	(6.23)	(1.17)
R&D Dummy	-0.044***	0.057***	-0.081***	0.056***
	(-2.77)	(2.87)	(-5.05)	(2.84)
Dividend	0.025	1.711***	2.556***	2.119***
	(0.05)	(2.60)	(4.50)	(3.39)
Industry median	0.211**	-0.256***	0.403***	-0.373***
	(2.48)	(-2.42)	(7.41)	(-4.30)
Year dummies	Yes	Yes	Yes	Yes
Log likelihood	-220,505	-142,026	-215,577	-149,161
LR test	292.66	398.20	698.78	1,393.99
Prob>Chi^2	0.000	0.000	0.000	0.000
Obs.	24,445	17,020	24,221	17,687

CHAPTER 3

ON THE TRENDS OF CASH HOLDINGS

3.1. Introduction

Recently, Bates et al. (2009) provide evidence that the average cash holdings of U.S. firms have increased dramatically from 1980 to 2006. While this increase appears to be pervasive, it is more pronounced for young firms. We follow Bates et al. (2009) and regress the average cash holdings on a constant and time. The coefficient on time for young firms[1] is 0.0101, which is significant at the 1% level and implies that the average cash holdings of young firms have increased by 1.01% per year. In sharp contrast, the coefficient on time for old firms is only 0.0007, implying an annual increase of 0.07% that may not carry much economic significance. In this paper, we investigate why old firms' cash holdings do not experience the same large increase as young firms' by evaluating changes not only in firm characteristics but also in the sensitivities of cash to firm-specific characteristics, and we then provide an explanation based on the impact of cash holdings on old firms' product market performance.

Bates et al. (2009) analyze four motives[2] for holding cash and find that the precautionary motive is responsible for the dramatic increase in the cash holdings of a typical U.S. firm from 1980 to 2006. Specifically, they find that changes in cash flow volatility, net working capital, capital expenditures, and R&D expenditures have caused the demand for precautionary cash to rise. Meanwhile, they also observe a difference in the cash holdings between young and old

firms.[3] If the increase in cash holdings is attributable to the changes in firm characteristics, one would infer that lack of changes in firm characteristics must have generated the flat time trend in the cash holdings of old firms. This seemingly logical inference has motivated us to study the interaction between changes in firm characteristics and changes in the sensitivities of cash to those firm characteristics.

We find that similar to young firms, the firm characteristics of old firms have experienced significant changes over time. When we use a Fama-Macbeth model of cash holdings estimated using data from the period 1970 to 1980 to predict cash holdings of old firms for the period 1996 to 2006, we significantly over-predict by an annual average of 49%. Such over-predictions suggest the extent to which changes in firm characteristics could drive up the cash holdings if the sensitivities of cash to firm characteristics remained the same, and thus invalidate the conjecture that the small increase in the cash holdings of old firms is due to lack of changes in their firm characteristics.

Next, we examine the correlations between cash holdings and firm characteristics in old firms and find that the sensitivity of cash to each firm characteristic has evolved considerably over time. Specifically, changes in the sensitivities of cash to net working capital and capital expenditures positively impact cash holdings while changes in the sensitivities of cash to cash flow volatility, R&D expenditures, acquisition, market-to-book ratio, firm size, cash flow, and leverage negatively impact cash holdings. Among all the changes in the sensitivities of cash, reduced sensitivity of cash to cash flow volatility has the largest negative impact on cash holdings. We focus our analyses on the precautionary motive for holding cash since cash flow volatility is closely related to this motive.[4] Thus, by examining why old firms are less likely to

hold precautionary cash, we provide an explanation for the difference in cash holdings between young and old firms.

Having the lowest (highest) average SA index[5] among all firms, old (young) firms can be characterized as being financially unconstrained (constrained). Thus, one proper explanation lies in the ability of old firms to access capital markets and raise funds when they face liquidity needs. Han and Qiu (2007) suggest that sufficient financing capacity enables financially unconstrained firms to invest at the optimal level even if the future cash flow volatility increases, making precautionary cash holdings unnecessary. This explanation is questionable. Old firms tend to have large and positive cash flow streams, and cash reserves saved from cash flows are always less expensive than external funds raised from borrowing. Thus, why would managers prefer more expensive external financing to precautionary cash if they expect an increase in the risk of future cash flows? We conjecture that the primary reason for the unwillingness of old firms to hold precautionary cash may be associated with some real negative consequences of such cash holdings.

Our conjecture is motivated by the mixed evidence produced by on-going studies on the effects of large cash reserves on firm value and operating performance. When firms face external financing costs associated with asymmetric information in an imperfect capital market, precautionary cash holdings could have important strategic implications for firms by enabling managers to reduce underinvestment problems (Harford (1999)). However, large cash reserves could be abused by managers when firms have low investment opportunities, leading to value destruction. Thus, empirical testing using different samples could generate contrasting results regarding the impact of cash on firm value. For example, Blanchard, Lopez-de-Silanes, and Shleifer (1994) find that a sample of firms with low estimated investment opportunities tends to

spend cash in ways that harm shareholders' wealth. In contrast, using a sample of small and fast-growing firms with high market-to-book ratios, Mikkelson and Partch (2003) show that high cash holdings do not negatively impact operating performance.

Approaching the strategic role played by cash holdings from another angle, Fresard (2010) investigates the relationship between a firm's cash reserves and its market share growth and provides evidence that precautionary cash holdings can benefit a firm's product market performance. If cash reserves could deliver positive competitive outcomes in the product market, why are old firms not particularly attracted to this strategy? When old firms hold more cash, the free cash flow problem becomes more severe since such firms on average have lower investment opportunities compared to young firms. We expect the resultant negative consequences of managerial inefficiencies to go beyond the valuation realms of firm value and operating performance and penetrate into the product market. If this is the case, we should be able to find a negative relationship between cash holdings and product market performance for old firms. Product market competition mitigates managerial slack by driving down profitability, thus forcing managers to increase efficiency to enhance survival probability (Jensen (1986)). If holding more cash causes old firms to lose market share and eventually threatens their survival, managers will discipline themselves and become relatively conservative when it comes to holding precautionary cash. And this explains why the cash holdings of old firms do not experience the same large increase as young firms' cash holdings do.

Consistent with our conjecture, we find that old firms with more cash reserves perform significantly worse in the product market while cash reserves are positively associated with product market performance for young firms. All else being equal, a 1% increase in precautionary cash in year *t* results in a 0.031% (0.054%) loss (gain) in the market share of old

(young) firms from years *t* to *t*+1. Moreover, we also find a significantly negative (positive) association between cash holdings and firm value for old (young) firms. Therefore, the negative effects of precautionary cash on old firms' product market performance may explain the decrease in the sensitivity of cash to cash flow volatility in such firms. Furthermore, we show that similar to the empirical evidence for the effects of cash on firm value, the evidence for the effects of cash on product market performance also has the potential to produce contrasting results depending on the sample used.

Although the cash holdings of old firms remain relatively stable from 1970 to 2006, the overall trend in the cash holdings of a typical U.S. manufacturing firm is largely driven by the dramatic increase in the cash holdings of young firms. Bates et al. (2009) suggest that a substantial portion of the increase in the cash holdings is due to the changing nature of newly listed firms over time. We posit that this new listings effect[6] also dominates Fresard (2010)'s results. While Fresard finds that the overall effect of cash on product market performance is significantly positive, we demonstrate that cash reserves have an opposite effect on the market share growth of old firms. If our hypothesis holds, then we should be able to observe changes in the correlation between cash and product market outcomes as the newly listed firms begin to account for an increasingly larger proportion of the publicly traded firms over time. We find evidence supporting our hypothesis. From 1970 to 2006, the correlation between cash and product market performance becomes stronger. For example, in the sub-period from 1970-1985, a 1% increase in cash holdings in year *t* brings about a 0.032% increase in market share from years *t* to *t*+1, while in the sub-period from 1995 to 2006, the same change in cash holdings in year *t* results in a 0.09% increase in market share from years *t* to *t*+1. Meanwhile, the impact of

cash on firm value also exhibits a similar pattern: The value premium generated by a 1% increase in cash holdings increases over time.

This paper makes three contributions to the literature. First, we find that changes in firm characteristics alone could have a much stronger positive impact on the cash holdings of old firms if the sensitivities of cash to firm characteristics remained the same. A reduced likelihood of old firms to hold precautionary cash plays the most important role in yielding the flat time trend in their cash holdings. Second, the evidence that cash reserves negatively impact old firms' product market performance better explains why old firms are less likely to hold precautionary cash. Further, by showing that cash could have opposite effects on product market performance for the young and the old firms, we not only provide evidence that managerial inefficiencies due to free cash flows extend to the product market, but also provide a foundation that helps reconcile the mixed evidence on the relationships between cash and firm value. Third, we show that the new listings effect is pervasive and could drive the empirical results on corporate cash policies. This cautions us about the interpretations and implications of the results in studies on corporate cash holdings.

The remainder of this paper proceeds as follows. In section 2, we describe the data and sample selection process, and present summary statistics. Section 3 analyzes changes in firm characteristics and in the sensitivities of cash to firm characteristics. Section 4 analyzes the impact of cash on product market performance for old firms. Section 5 analyzes the impacts of the new listings effect. We conclude in Section 6.

3.2. Sample selection and summary statistics

Our original sample includes all U.S. public manufacturing firms (SIC Code 2000-2999) from Compustat annual database over the period 1970-2006. Following Fresard (2010), we use the four-digit SIC codes to define industries and exclude four-digit SIC codes ending with zero and nine.[7] We delete all firm-year observations with missing information on sales, cash holding, or total assets. We require leverage to be bound between 0 and 1, inclusive, and eliminate firm-years for which asset growth is greater than 200%. Details regarding variable construction are in APPENDIX A. Our final sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries.

Using the number of years a firm has existed in Compustat database with a non-missing stock price, we divide our final sample of firms into four subsamples: The old subsample (including firms that have existed for at least 30 years), the 20-year subsample (including firms that have existed for more than 20 but less than 30 years), the 10-year subsample (including firms that have existed for more than 10 but less than 20 years), and the young subsample (including firms that have existed for less than 10 years). By construction, the old subsample has the lowest average SA index, suggesting that firms in this sample can be characterized as being financially unconstrained. In contrast, the young subsample has the highest average SA index, suggesting that firms in this sample are most likely to be financially constrained.

Table 1 reports the average annual cash holdings and median cash holdings for the full sample, the old subsample, and the young subsample. The number of firms in column 2 applies to the full sample. By restricting our sample to the manufacturing firms (SIC Code 2000-3999), we find an even sharper increase in cash holdings of U.S. firms, compared to the increase in Bates et al. (2009)'s sample, which only excludes financial firms (SIC Code 6000-6999) and utilities (SIC Code 4900-4999). The average cash ratio of Bates et al. (2009)'s sample increases

from 10.5% in 1980 to 23.2% in 2006, while this ratio in our sample increases from 9.2% to 32%. Since our sample includes only "old-economy" manufacturing firms, the time trend in the cash holdings from Table 1 is consistent with Bates et al. (2009)'s finding that the dramatic increase in cash holdings is not caused by an increase in the proportion of high-tech firms. Columns 7 to 8 compare the cash holdings of the old and the young subsamples. From 1970 to 2006, the average cash ratio has more than quintupled for the young subsample, while this ratio has not even doubled for the old subsample. The median cash ratio demonstrates similar trends for these two subsamples.

Figure 1 illustrates the varying average cash ratios for all four subsamples. Over time, the average cash holdings have remained stable for the old subsample, picking up only slightly after 2000. Following Bates et al. (2009), we regress the average cash ratio on a constant and time, and report the estimation results in Table 2. The coefficient on time for the full sample implies an annual increase of 0.69% in cash holdings and the increase is significant at the 1% level. Of the four subsamples, the young subsample has the highest coefficient, which corresponds to an annual increase of 1.01%, significant at the 1% level. The regression on the old subsample has very low R^2, suggesting that the time factor does not offer power explanations to the evolution in the cash holdings of the old subsample. Although the coefficient reported in column 2 for the old subsample is significant at the 1% level, an annual increase of 0.07% in the average cash ratio lacks economic significance. Taken together, our evidence suggests that the difference in cash holdings between the old and the young subsamples is too huge to be ignored, and it is not driven by high-tech firms, which have a tendency to hold large amount of cash.

3.3. Changes in firm characteristics and in the sensitivities of cash to firm characteristics

Bates et al. (2009) find that changes in firm characteristics can explain why cash holdings have increased dramatically over time. Based on their finding, it could be possible that firm characteristics of old firms have not changed much, giving rise to the flat time trend in their cash holdings. To evaluate this hypothesis, we compare firm characteristics in two sub-periods for old and young firms. Table 3 reports the results. Surprisingly, firm characteristics have changed significantly from the 1970s to the 1990s not only for young firms but also for old firms. Except for book leverage, the direction of change in each firm characteristic is the same for both subsamples. Specifically, cash flow volatility, market-to-book ratio, firm size, R&D expenditures, and acquisitions have increased. In contrast, cash flow, net working capital, capital expenditures, and the proportion of firms paying a positive dividend have fallen. For young firms, R&D expenditures (425% higher), cash flow (293.90% lower), and cash flow volatility (265.71% higher) have experienced the most dramatic changes from the 1970s to the 1990s, while for old firms, acquisition (366.67% higher), cash flow volatility (196.96% higher), and net working capital (50% lower) have changed most significantly. Bates et al. (2009) demonstrate that cash holdings increase most dramatically for industries with the largest increase in cash flow volatility and vice versa. While the increase in cash holdings of young firms is supported by the precautionary motive for holding cash, this motive fails to explain why cash holdings of old firms do not increase as much since the increase in cash flow volatility for old firms is both statistically and economically significant.

We next evaluate how changes in firm characteristics can change cash holdings for old firms if we hold constant the sensitivities of cash holdings to each firm characteristic. We proceed in two steps.[8] First, we follow Opler et al. (1999)'s model and use Fama-Macbeth regressions to estimate the coefficients on each firm characteristic over the period 1970 to 1980.

Each coefficient estimate is obtained by averaging the coefficients from 11 annual cross-sectional regressions from 1970 to 1980. Second, we use the coefficient estimates to predict cash holdings for the period 1996 to 2006. By comparing predicted cash holdings to actual cash holdings, we are able to show the amount of change in cash holdings that is solely attributable to changes in firm characteristics.

Column 1 of Panel A in Table 4 presents predicted cash holdings for old firms over the period 1996 to 2006 and Column 3 reports the difference between predicted and actual cash holdings. Consistent with Bates et al. (2009)'s results, our model also significantly over-predicts cash holdings over the period 1996 to 2006. The average annual over-prediction reaches 49%. If the sensitivities of cash to firm characteristics remained the same, cash holdings of old firms would be much higher than they actually are. Comparing the coefficient estimates of the Fama-MacBeth model estimated over the period 1970 to 1980 to those of the model estimated over the period 1996 to 2006, we find that there is significant change in all estimated coefficients, suggesting that the sensitivities of cash to firm characteristics have also changed from the 1970s to the 1990s. Thus, changes in the sensitivities of cash to firm characteristics may have suppressed the impacts of changes in firm characteristics on cash holdings.

We proceed to investigate which change plays the most important role in generating the flat time trend in the cash holdings of old firms. We begin by replacing the coefficient estimate on cash flow volatility in the model of the 1970s with the coefficient estimate on the same characteristic from the model of the 1990s and computing predicted cash holdings. Column 5 of Panel A in Table 4 reports the results on predicted cash holdings adjusted for the change in the sensitivity of cash to cash flow volatility. Since we hold other coefficient estimates constant when we bring in the new coefficient on cash flow volatility, we are able to observe the effect of

change in this sensitivity on cash holdings. We repeat the process for each remaining firm characteristic and report the results in Columns 6 through 8 of Panel A, and in Columns 1 through 5 of Panel B. Overall, we find that changes in the sensitivities of cash to net working capital and capital expenditures increase predicted cash holdings, while changes in the sensitivities of cash to cash flow volatility, R&D expenditures, acquisition, market-to-book ratio, firm size, cash flow, and leverage decrease predicted cash holdings. A comparison of adjusted predicted cash holdings and predicted cash holdings suggests that the decrease in the sensitivity of cash to cash flow volatility has the greatest negative impact on cash holdings.

In summary, the flat time trend in the cash holdings of old firms is not due to lack of changes in firm characteristics but instead mainly caused by a reduced sensitivity of cash to cash flow volatility. Over time, old firms' demand for precautionary cash falls, thus they are increasingly less likely to hold cash for precautionary motive even when their cash flows are getting more volatile.

3.4. The impact of cash on the product market performance of old firms

In this section, we investigate why old firms are far less likely to hold precautionary cash relative to young firms. Our conjecture is that large cash holdings in old firms with mediocre investment opportunities induce managers to engage in negative NPV projects and other organizational inefficiencies and such activities negatively impact both firm value and product market performance. If value destruction simply reflects agency costs and will not motivate managers to discipline themselves, then the loss of market share and a threat to survival in the product market are powerful enough to incentivize managers to cut down on precautionary cash holdings.

To test our hypothesis, we build on Fresard (2010)'s methodology and proceed in three steps. First, we regress cash holdings on their first and second lagged values and asset tangibility.[9] Second, we obtain predicted cash holdings from the first step as instrumented cash holdings.[10] Third, we construct three dummy variables (S30, S20, and S10)[11] and obtain interaction terms between each dummy variable and instrumented cash holdings.

Table 5 reports the results of the two-stage IV estimation of the impact of cash holdings on market share growth. We replicate Fresard (2010)'s results in Columns 1, 3, and 5. Column 5 presents the coefficient estimates of the first-stage regression. The sign and magnitude of each coefficient estimate and the R^2 of this regression are close to those in Fresard (2010). In Columns 1 and 3, we report the results of the second-stage estimation. R^2s of the second-stage regressions are low (less than 5%) since the dependent variable is industry-adjusted, which is likely to include a large idiosyncratic component (Harford et al. (2008)). We differ from Fresard (2010) in that we do not z-score instrumented cash holdings from the first-stage regression. We are able to obtain similar coefficient estimates using z-scored instrumented cash holdings but the R^2s are lower than those using non-z-scored instrumented cash holdings. Our evidence confirms Fresard (2010)'s finding that cash holdings have a positive impact on market share growth.

Next we add dummy variables (*S30*, *S20*, and *S10*) and interaction terms (*Cash*S30*, *Cash*S20*, and *Cash*S10*) to control for the number of years a firm has existed in Compustat and to test whether this positive relation between cash holdings and market share growth is consistent across all subsamples. Columns 2 and 4 display the estimation results. The coefficients on *Cash*S30* are significantly negative, suggesting that cash holdings negatively impact the product market performance of old firms. In contrast, the positive coefficients on *Cash* indicate that there is a positive correlation between cash holdings and product market

performance for young firms.[12] Specifically, a 1% increase in the cash holdings of old (young) firms would result in a loss (gain) of 0.03% (0.05%) in market share between years *t* to *t*+1. Across all specifications, the Durbin-Hausman-Wu test rejects the null hypothesis that exogeneity conditions are satisfied, suggesting that cash holdings need to be instrumented. Meanwhile, the null hypothesis that excluded instruments are exogenous is not rejected by the test of overidentification restrictions (Hansen-J Statistics).

In Table 6, we investigate whether the positive relation between cash and firm value as documented in Fresard (2010) is consistent across different subsamples. Our hypothesis is that *ceteris paribus*, cash negatively (positively) impacts the value of old (young) firms. Following Fresard (2010), we use industry-adjusted market-to-book ratio to proxy for firm value and include firm size, cash flow, investment, leverage, and dividend dummy as control variables. Consistent with the finding in Fresard (2010), the results in Columns 1 and 3 indicate that firms with large cash reserves receive higher market valuation. In Columns 2 and 4, the coefficient on *Cash*S30* is significantly negative while the coefficient on *Cash* is significantly positive, providing evidence that all else being equal, higher cash holdings destroy (create) value for old (young) firms.

3.5. The impact of new listings

In previous sections, we show that cash holdings have two contrasting effects on product market performance/firm value. Specifically, cash holdings are positively (negatively) associated with product market performance/firm value in young (old) firms. We also show that the overall effect supports a positive relation between cash holdings and product market performance/firm value. If the overall effect is dominated by the impact of cash holdings on

young firms, we should be able to observe an increase in the relational strength between cash holdings and product market performance/firm value as more young and riskier firms become listed and account for a larger proportion of publicly traded firms.

We test this hypothesis in Table 7 and 8 by splitting the sample period into three sub-periods: 1970-1985, 1986-1995, and 1996-2006. In Table 7, cash holdings positively impact market share growth across all sub-periods and the magnitude of coefficient estimates on *Cash* increases over time. For example, over the sub-period of 1970 to 1985, a 1% increase in cash holdings results in a 0.03% increase in market share growth from years *t* to *t*+1, while from 1996 to 2006, a 1% increase in cash holdings leads to a 0.09% increase in market share growth from years *t* to *t*+1. Table 8 displays the results of cash holdings on firm value and we find that cash holdings significantly increase firm value only in the third sub-period.

6. Conclusion

The average cash holdings of young firms have increased from 7.3% in 1970 to 42.7% by the end of 2006. In contrast, the average cash holdings of old firms have stayed relatively stable (8.1%-12.1%) throughout our entire sample period. Bates et al. (2009) provide evidence that the drastic increase in cash holdings can be explained by changes in cash flow volatility, capital expenditures, net working capital, and R&D expenditures. Based on their findings, a logical inference is that lack of changes in firm characteristics must have stabilized the level of cash holdings in old firms. However, we find significant changes both in the firm characteristics and in the sensitivities of cash to firm characteristics over the period 1970 to 2006. If the sensitivities of cash to firm characteristics remained the same, old firms would have an average cash-to-assets ratio of 15.7%, which almost doubles the ratio in 1970. We also show that the decrease in the

sensitivity of cash to cash flow volatility has the largest negative impact on old firms' cash holdings.

We show that the unwillingness of old firms to hold precautionary cash may be explained by the negative correlation between cash holdings and product market performance. Loss of market share resulting from holding higher levels of cash would incentivize managers to cut down on cash holdings and maintain a relatively small cash balance. Meanwhile, the overall effect of cash holdings on product market performance/firm value is getting stronger as the composition of manufacturing firms progressively tilts toward newly listed firms.

APPENDIX A: Variable definitions

Variables	
Cash holding	Cash and equivalents (CHE) / total assets (AT)
ΔMarketShares	($Sale_t$ (SALE) – $sale_{t-1}$) / $sale_{t-1}$ – industry-year average
Investment	(PPE_t (PPENB) – PPE_{t-1}) / PPE_{t-1}
Total debt	Short-term debt (DLC) + long-term debt (DLTT)
Market equity	Stock's closing price at the fiscal year-end (PRCC_F) * Number of shares (CSHO)
Market-to-book ratio	[Total assets (AT) – common equity (CEQ) + Stock price (PRCC_F) * common shares outstanding (CSHO)] / total assets (AT)
Firm size	Log[total assets (AT)], where total assets are converted to 2004 dollars using CPI
Cash flow ratio	[Operating income (OIBDP) – interest expense (XINT) – taxes (TXT) – dividends (DVC)] / total assets (AT)
Tangibility	0.715*Receivables (RECT) + 0.547*inventories (INVT) + 0.535*fixed capital (PPEGT), see Berge et al. (1996)
Book leverage	[Short-term debt (DLC) + long-term debt (DLTT)] / total assets (AT)
Dividend dummy	Equal to 1 if a firm paid a positive dividend and 0 otherwise
Industry sigma	The average of prior 10 year standard deviations of cash flow ratio (CF) for firms in the same industry defined by 2 digit SIC codes, at least three observations required
S30	Dummy variable set to equal 1 if a firm has existed for more than 30 years in Compustat with a non-missing stock price
S20	Dummy variable set to equal 1 if a firm has existed for more than 20 but less than 30 years in Compustat with a non-missing stock price
S10	Dummy variable set to equal 1 if a firm has existed for more than 10 but less than20 years in Compustat with a non-missing stock price

FOOTNOTES

[1] We define young firms to be those that have existed for less than 10 years, and old firms to be those that have existed for more than 30 years. By construction, young firms are likely to be financially constrained while old firms are likely to be financially unconstrained.

[2] In addition to the transaction and the precautionary motives developed by Kynes (1936), there are the tax motive and the agency motive for holding cash. Foley et al. (2007) find that U.S. firms prefer to hold high levels of cash in order to avoid the taxes associated with repatriating foreign earnings. Jensen (1986) argues that entrenched managers tend to accumulate cash and invest inefficiently rather than distribute cash to shareholders.

[3] See Bates et al. (2009), "Cash holdings do not increase for older, established firms that pay dividends, but firms that do not pay dividends increase their cash holdings dramatically." p.1987, and "In particular, we find that cash holdings increase more in firms that are financially constrained,……" p.1998

[4] Keynes (1936) describes two motives for holding cash. First, firms hold cash to avoid assets liquidation and thus save transaction costs by using cash reserves to make payment. This is referred to as the transaction motive. Second, firms hold cash to cope with possible future cash shortfalls, or to finance investment opportunities when alternative sources are either unavailable or too costly. This is referred to as the precautionary motive.

[5] The SA index is developed by Hadlock and Pierce (2010) and uses solely firm size and age as predictors of financial constraint levels to construct financially constrained and unconstrained samples. A higher SA index corresponds to a greater probability that a firm is financially constrained.

[6] Brown and Kapadia (2007) provide evidence that new listings by riskier companies attribute to the increase in idiosyncratic risk in the U.S. stock market. Fama and French (2004) show that the newly listed firms with weak fundamentals have changed the composition of firms.

[7] This filter is used by Clarke (1989) and Fresard (2010) to minimize the concerns that some of the three- and four-digit codes may fail to combine firms to homogenous economic markets.

[8] Bates et al. (2009) use these two steps to compute the difference between actual cash holdings and predicted cash holdings and attribute the difference to changes in firm characteristics.

[9] We follow Berger, Ofek, and Swary (1996) and Fresard (2010) and define asset tangibility as a function of receivables, inventory, and fixed capital.

[10] We do not z-score instrumented cash holdings for two reasons. First, Fresard (2010) focuses on the impact of relative-to-rivals financial strength on product market performance while we are more concerned with the effect of cash holdings on product market performance. Second, we are able to obtain similar results using z-scored instrumented cash holdings but R^2s are less than 1%,

thus, we feel more comfortable reporting results estimated from non-z-scored instrumented cash holdings.

[11] S30 is set to equal 1 if a firm has existed for more than 30 years, 0 otherwise. S20 is set to equal 1 if a firm has existed for more than 20 but less than 30 years, 0 otherwise. S10 is set to equal 1 if a firm has existed for more than 10 but less than 20 years, 0 otherwise.

[12] The coefficient estimate on *Cash* picks up the effect of cash holdings on market share growth for young firms when all dummy variables are equal to 0.

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Table 3.1.
Average and median cash holdings from 1970 to 2006
This table presents the annual average cash holdings and median cash holdings for the full sample, the old subsample, and the young subsample. The old subsample includes firms that have been on Compustat for at least 30 years, and the young subsample includes those that have been on Compustat for less than 10 years. The full sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries. Details regarding variable construction are in APPENDIX A.

Year	N	Full sample		Old firms		Young firms	
		Average Cash ratio	Median Cash ratio	Average Cash ratio	Median Cash ratio	Average Cash ratio	Median Cash ratio
1970	582	0.073	0.049	0.081	0.055	0.073	0.048
1971	609	0.083	0.057	0.094	0.065	0.090	0.054
1972	628	0.082	0.055	0.090	0.063	0.088	0.053
1973	859	0.078	0.047	0.082	0.052	0.081	0.048
1974	996	0.068	0.042	0.074	0.045	0.069	0.038
1975	1,011	0.086	0.056	0.092	0.064	0.088	0.052
1976	999	0.093	0.062	0.102	0.075	0.091	0.048
1977	986	0.085	0.052	0.092	0.056	0.079	0.044
1978	1,001	0.083	0.050	0.087	0.058	0.083	0.039
1979	1,039	0.081	0.045	0.078	0.051	0.093	0.043
1980	1,073	0.092	0.051	0.081	0.050	0.113	0.047
1981	1,085	0.103	0.057	0.086	0.056	0.130	0.070
1982	1,152	0.113	0.064	0.091	0.060	0.137	0.067
1983	1,180	0.137	0.081	0.112	0.077	0.159	0.074
1984	1,266	0.136	0.068	0.102	0.062	0.158	0.082
1985	1,327	0.144	0.073	0.106	0.059	0.165	0.097
1986	1,334	0.157	0.085	0.110	0.066	0.190	0.116
1987	1,393	0.161	0.080	0.105	0.061	0.191	0.088
1988	1,437	0.157	0.079	0.098	0.047	0.198	0.094
1989	1,382	0.153	0.073	0.095	0.048	0.177	0.073
1990	1,376	0.149	0.068	0.093	0.046	0.169	0.070
1991	1,396	0.167	0.087	0.097	0.053	0.178	0.091
1992	1,408	0.188	0.096	0.093	0.052	0.259	0.173
1993	1,527	0.203	0.112	0.090	0.049	0.268	0.179
1994	1,657	0.196	0.107	0.083	0.045	0.263	0.202
1995	1,734	0.204	0.109	0.082	0.044	0.246	0.165
1996	1,819	0.218	0.111	0.082	0.049	0.267	0.215
1997	1,915	0.237	0.130	0.093	0.047	0.296	0.216
1998	1,896	0.225	0.113	0.082	0.039	0.288	0.198
1999	1,762	0.226	0.114	0.083	0.036	0.285	0.186
2000	1,652	0.240	0.123	0.09	0.034	0.311	0.232
2001	1,691	0.278	0.180	0.106	0.055	0.384	0.349
2002	1,619	0.275	0.185	0.114	0.063	0.368	0.322
2003	1,525	0.293	0.215	0.123	0.076	0.382	0.340
2004	1,469	0.297	0.218	0.136	0.096	0.384	0.342
2005	1,460	0.314	0.233	0.142	0.088	0.423	0.386
2006	1,250	0.320	0.232	0.121	0.076	0.427	0.416

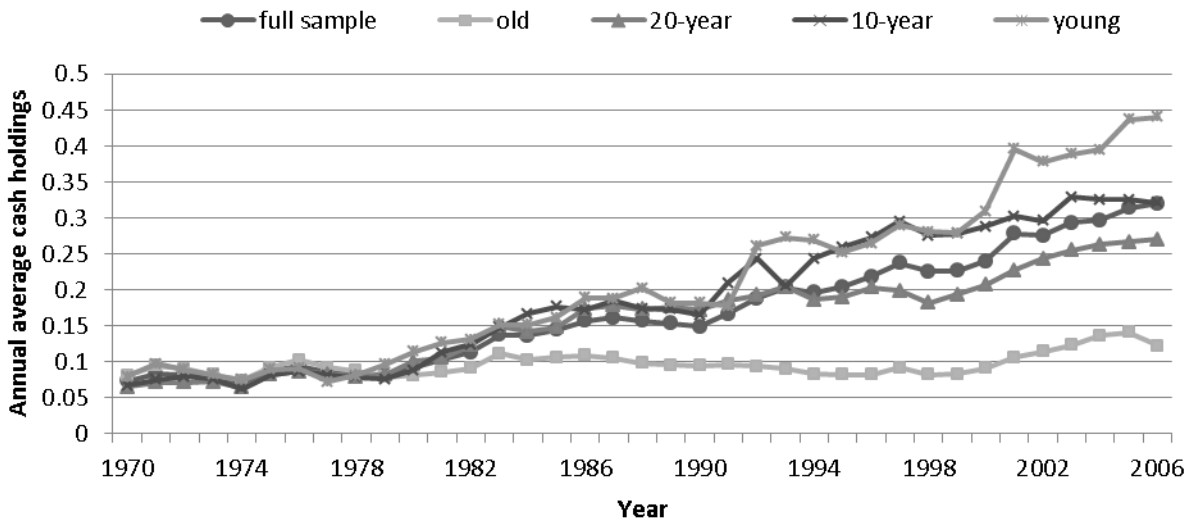

Figure 3.1. Average cash ratios from 1970 to 2006
The full sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries. Firms in the full sample are assigned to four subsamples based on the number of years a firm has existed in the Compustat database with a non-missing stock price. The old subsample includes firms that have existed for at least 30 years. The 20-year subsample includes firms that have existed for more than 20 but less than 30 years. The 10-year subsample includes firms that have existed for more than 10 but less than 20 years. The young subsample includes firms that have existed for less than 10 years.

Table 3.2.
Regression results of the time trend in cash holdings
This table presents the estimation results from regressing annual average cash ratios on a constant and time. The full sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries. Firms in the full sample are assigned to four subsamples based on the number of years a firm has existed in the Compustat database with a non-missing stock price. The old subsample includes firms that have existed for at least 30 years. The 20-year subsample includes firms that have existed for more than 20 but less than 30 years. The 10-year subsample includes firms that have existed for more than 10 but less than 20 years. The young subsample includes firms that have existed for less than 10 years. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variable	Full sample	Old subsample	20-year	10-year	Young subsample
Intercept	0.0351***	0.0827***	0.0495***	0.0281***	0.0165
	(5.97)	(18.00)	(9.75)	(4.75)	1.55
Time	0.0069***	0.0007***	0.0057***	0.0083***	0.0101***
	(25.78)	(3.64)	(25.06)	(28.74)	(20.68)***
Obs.	37	37	37	37	37
Adjusted R^2	0.948	0.253	0.945	0.958	0.922

Table 3.3.
Changes in firm characteristics from 1970 to 2006
This table compares firm characteristics for two sub-periods. The full sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries. A firm is classified as an old firm if it has existed for more than 30 years, and as a young firm if it has existed for less than 10 years. The first sub-period is from 1970 to 1980 while the second sub-period is from 1996-2006. Columns 3 and 6 show the two-tailed *t*-test for the differences in mean values between the two sub-periods, and *t*-statistics are reported in parentheses. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

	Old firms			Young firms		
Variable	1970-1980	1996-2006	Diff	1970-1980	1996-2006	Diff
Cash	0.086	0.104	0.012***	0.085	0.342	0.257***
			(6.17)			(37.89)
Industry sigma	0.033	0.098	0.067***	0.035	0.128	0.093***
			(81.17)			(112.71)
Market-to-book	1.333	1.834	0.502***	1.224	2.635	1.410***
			(14.63)			(23.39)
Firm size	5.225	7.041	1.845***	3.054	4.844	1.790***
			(35.16)			(32.72)
Cash flow	0.099	0.086	-0.014***	0.082	-0.159	-0.241***
			(-5.62)			(-29.72)
NWC	0.246	0.124	-0.122***	0.274	0.049	-0.226***
			(-31.24)			(-28.77)
Capex	0.072	0.050	-0.02***	0.072	0.043	-0.029***
			(-19.42)			(-10.77)
Leverage	0.168	0.179	0.010***	0.170	0.125	-0.045***
			(3.00)			(-6.43)
R&D	0.025	0.035	0.01***	0.032	0.168	0.136***
			(8.24)			(-28.82)
Dividend dummy	0.796	0.699	-0.098***	0.402	0.105	-0.297***
			(-8.97)			(-14.13)
Acquisition	0.006	0.028	0.023***	0.005	0.016	0.011***
			(18.07)			(5.08)

Table 3.4.
The impact of changes in the sensitivities of cash to firm characteristics on cash holdings
This table presents predicted cash holdings and adjusted predicted cash holdings for old firms from 1996 to 2006. The subsample of old firms includes 11,786 firm-year observations for 401 unique manufacturing firms and 103 four-digit industries. The coefficients estimated from a Fama-MacBeth model over the period 1970 to 1980 and used to predict cash holdings from 1996 to 2006 are as follows:

Cash = 0.172 + 0.570*Cash flow volatility + 0.026*Market-to-book ratio – 0.009*Firm size + 0.171*Cash flow – 0.234*Net working capital – 0.480*Capital expenditures – 0.159*Leverage + 0.056*R&D + 0.016*Dividend – 0.122*Acquisition.

The coefficients used to make adjustments to the predicted cash holdings are estimated from Fama-MecBeth regressions over the period 1996 to 2006:

Cash = 0.218 + 0.157*Cash flow volatility + 0.016*Market-to-book ratio – 0.012*Firm size + 0.159*Cash flow – 0.161*Net working capital – 0.543*Capital expenditures – 0.213*Leverage + 0.718*R&D – 0.024*Dividend – 0.239*Acquisition.

Column 3 in Panel A presents the differences between predicted and actual cash holdings by year, and Column 4 shows the two-tailed *t*-test for the differences. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively. Details regarding variable construction are in Appendix A. Panel B is a continuation of Panel A.

Panel A								
Year	Predicted (1)	Actual (2)	Predict-Actual (3)	*t*-Stat (4)	Sigma (5)	NWC (6)	R&D (7)	CAPEX (8)
1996	0.140	0.082	0.054***	9.29	0.105	0.152	0.137	0.165
1997	0.147	0.093	0.049***	7.85	0.111	0.158	0.144	0.170
1998	0.145	0.082	0.059***	9.43	0.106	0.156	0.140	0.168
1999	0.148	0.083	0.058***	9.68	0.109	0.157	0.144	0.171
2000	0.153	0.09	0.058***	7.78	0.112	0.162	0.150	0.174
2001	0.154	0.106	0.042***	5.13	0.111	0.163	0.151	0.175
2002	0.156	0.114	0.037***	4.24	0.112	0.165	0.153	0.178
2003	0.164	0.123	0.035***	4.53	0.122	0.173	0.161	0.184
2004	0.169	0.136	0.026***	2.91	0.127	0.177	0.166	0.190
2005	0.168	0.142	0.023**	2.51	0.127	0.175	0.165	0.189
2006	0.157	0.121	0.036***	3.33	0.116	0.165	0.154	0.182

Panel B					
Year	Acquisition (1)	MB (2)	SIZE (3)	Cash flow (4)	Leverage (5)
1996	0.137	0.123	0.120	0.139	0.131
1997	0.144	0.149	0.126	0.146	0.138
1998	0.140	0.126	0.123	0.143	0.134
1999	0.143	0.130	0.126	0.147	0.137
2000	0.149	0.136	0.131	0.152	0.143
2001	0.151	0.137	0.132	0.153	0.143
2002	0.153	0.140	0.134	0.155	0.146
2003	0.161	0.146	0.141	0.162	0.154
2004	0.166	0.150	0.146	0.167	0.160
2005	0.166	0.149	0.144	0.166	0.159
2006	0.153	0.139	0.133	0.156	0.148

Table 3.5.
The impact of cash on market share growth
This table presents results of panel regressions examining the effect of cash holdings on market share growth. The dependent variable is ΔMarketshares, defined as the annual industry-adjusted sales growth. Columns 1 through 4 report the second-stage instrumental variable (IV) estimates, where cash holdings are instrumented by their lagged values and asset tangibility. We also present diagnostic statistics for instrument overidentification restrictions (*J*-statistics) and exogeneity conditions (Durbin-Hausman-Wu). Column 5 reports the first-step estimation results of cash holdings on lagged values and tangibility. The full sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries. Variable definitions are in Appendix A. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

	Second-stage estimation				First-stage estimation	
	(1)	(2)	(3)	(4)		(5)
$Cash_{t-2}$	0.034***	0.049***			Tangibility	-0.428***
	(4.94)	(6.13)				(-5.62)
$Cash_{t-1}$			0.061***	0.054***	$Cash_{t-1}$	0.506***
			(9.04)	(7.76)		(48.54)
$Cash_{t-2}$*S30		-0.035***			$Cash_{t-2}$	0.082*
		(-3.13)				(1.69)
$Cash_{t-2}$*S20		-0.029***				
		(-3.03)				
$Cash_{t-2}$*S10		-0.006				
		(-0.72)				
$Cash_{t-1}$*S30				-0.031***		
				(-2.90)		
$Cash_{t-1}$*S20				-0.015*		
				(-1.71)		
$Cash_{t-1}$*S10				0.007		
				(0.88)		
S30		0.009***		0.008***		
		(3.96)		(3.82)		
S20		0.007***		0.004**		
		(3.16)		(2.05)		
S10		0.004*		0.001		
		(1.71)		(0.71)		
$Size_{t-1}$	-0.006***	-0.001***	-0.007***	-0.001***		
	(10.13)	(-4.58)	(-11.89)	(-6.13)		
$Leverage_{t-1}$	0.016***	0.016***	0.017***	0.016***		
	(3.83)	(6.96)	(4.25)	(7.22)		
$Leverage_{t-2}$	-0.017***	-0.013***	-0.014***	-0.010***		
	(-4.19)	(-5.12)	(-3.82)	(-4.47)		
ΔMS_{t-1}	-0.008***	-0.001	-0.007***	-0.001**		
	(-5.67)	(-0.10)	(-5.16)	(-2.10)		
ΔMS_{t-2}	-0.007***	-0.002***	-0.005***	-0.002***		
	(-5.12)	(-4.08)	(-4.12)	(-3.35)		
Firm fixed effects	Yes	Yes	Yes	Yes		Yes
Year fixed effects	Yes	Yes	Yes	Yes		Yes
Obs.	31,750	31,750	35,152	35,152		39,491
R^2	0.029	0.012	0.039	0.021		0.776
J-statistic	0.16	0.19	0.22	0.17		
Durbin-Hausman-Wu	0.00	0.00	0.03	0.00		

Table 3.6.
The impact of cash on firm value
This table presents results of panel regressions examining the effect of cash holdings on firm value. The dependent variable is industry-adjusted market-to-book ratio. Columns 1 through 4 report the second-stage instrumental variable (IV) estimates, where cash holdings are instrumented by their lagged values and asset tangibility. We also present diagnostic statistics for instrument overidentification restrictions (*J*-statistics). The first-step estimation results of cash holdings on lagged values and tangibility are reported in column 5 of Table 5. The full sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries. Variable definitions are in Appendix A. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variables	(1)	(2)	(3)	(4)
$Cash_{t-1}$	0.071***	0.253***	0.030*	0.101***
	(2.70)	(8.87)	(1.66)	(5.47)
$Cash_{t-1}$*S30		-0.137***		-0.044***
		(-3.56)		(-2.75)
$Cash_{t-1}$*S20		-0.125***		-0.004
		(-3.64)		(0.14)
$Cash_{t-1}$*S10		-0.016		0.048**
		(-0.50)		(2.33)
S30		0.491***		0.140**
		(4.74)		(2.33)
S20		0.327***		0.042
		(3.41)		(0.75)
S10		0.214**		-0.028
		(2.42)		(-0.54)
$Size_{t-1}$	-0.395***	-0.264***	-0.261***	-0.066**
	(-12.18)	(-28.47)	(-11.79)	(-12.00)
$Investment_{t-1}$	0.113***	0.122***	-0.091	-0.145***
	(2.75)	(4.56)	(-2.57)	(-6.06)
$Leverage_{t-1}$	-0.185*	-0.275***	0.036	0.002
	(-1.65)	(-4.57)	(0.45)	(0.03)
Cash $flow_{t-1}$	-0.292***	-0.475***	-0.191***	-0.339***
	(-4.81)	(-21.18)	(-3.16)	(-16.80)
$Dividend_{t-1}$	0.118***	0.066***	0.072***	0.002
	(3.15)	(2.56)	(2.89)	(0.10)
Sales $growth_{t-1}$			0.026	0.027**
			(0.91)	(1.99)
MB_{t-1}			0.407***	0.559***
			(25.00)	(27.84)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Obs.	34,358	33,580	34,358	33,580
R^2	0.117	0.471	0.189	0.605
J-statistic	0.41	0.39	0.16	0.15

Table 3.7.

The impact of new listings on the correlations between cash and market share growth

This table presents results of panel regressions examining the impact of new listings effect on the relational strength between cash and market share growth. The dependent variable is ΔMarketshares, defined as the annual industry-adjusted sales growth. Columns 1 and 2 report the second-stage instrumental variable (IV) estimates for the sub-period over 1970 to 1985, where cash holdings are instrumented by their lagged values and asset tangibility. Columns 3 and 4 report estimation for the sub-period over 1986 to 1995. Columns 5 and 6 report estimation for the sub-period over 1996 to 2006. The first-step estimation results of cash holdings on lagged values and tangibility are reported in column 5 of Table 5. We also present diagnostic statistics for instrument overidentification restrictions (*J*-statistics). The full sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries. Variable definitions are in Appendix A. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variable	1970-1985		1986-1995		1996-2006	
	(1)	(2)	(3)	(4)	(5)	(6)
$Cash_{t-2}$	0.023*		0.022*		0.053***	
	(1.77)		(1.85)		(4.16)	
$Cash_{t-1}$		0.032***		0.061***		0.090***
		(2.99)		(4.11)		(7.67)
$Size_{t-1}$	0.009***	-0.008***	-0.012***	-0.014***	-0.006***	-0.009***
	(-7.24)	(-7.16)	(-7.06)	(-8.08)	(-3.58)	(-4.85)
$Leverage_{t-1}$	-0.002	0.001	0.008	0.010	0.024***	0.024***
	(-0.36)	(-0.12)	(1.39)	(1.71)	(3.05)	(3.05)
$Leverage_{t-2}$	-0.007	-0.007	-0.018***	-0.012**	-0.024***	-0.020***
	(-1.55)	(-1.62)	(-3.54)	(-2.54)	(-2.99)	(-2.66)
ΔMS_{t-1}	-0.002	-0.001	-0.011	-0.011***	-0.016***	-0.014***
	(-1.09)	(-0.46)	(-3.77)	(-3.85)	(-7.37)	(-7.18)
ΔMS_{t-2}	-0.009***	-0.007***	-0.009***	-0.006***	-0.012***	-0.009***
	(-6.22)	(-5.12)	(-3.88)	(-2.59)	(-5.88)	(-5.19)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	9,006	10,414	9,842	10,728	12,902	14,010
R^2	0.042	0.047	0.046	0.049	0.051	0.053
J-statistic	0.42	0.27	0.16	0.14	0.14	0.12

Table 3.8.

The impact of new listings on the correlations between cash and firm value

This table presents results of panel regressions examining the impact of new listings effect on the relational strength between cash holdings and firm value. The dependent variable is industry-adjusted market-to-book ratio. Columns 1 and 2 report the second-stage instrumental variable (IV) estimates for the sub-period over 1970 to 1985, where cash holdings are instrumented by their lagged values and asset tangibility. Columns 3 and 4 report estimation for the sub-period over 1986 to 1995. Columns 5 and 6 report estimation for the sub-period over 1996 to 2006. We also present diagnostic statistics for instrument overidentification restrictions (*J*-statistics). The first-step estimation results of cash holdings on lagged values and tangibility are reported in column 5 of Table 5. The full sample includes 39,491 firm-year observations for 3,804 unique manufacturing firms and 128 four-digit industries. Variable definitions are in Appendix A. We adjust standards errors for heteroscedasticity and serial correlation while *t*-statistics are in parentheses under each coefficient estimate. We denote significance at the 10%, 5%, and 1% levels by *, **, and ***, respectively.

Variable	1970-1985		1986-1995		1996-2006	
	(1)	(2)	(3)	(4)	(5)	(6)
$Cash_{t-1}$	0.045	0.008	0.052	0.033	0.074***	0.072***
	(1.30)	(0.31)	(1.60)	(1.06)	(2.09)	(2.36)
$Size_{t-1}$	-0.207***	-0.147***	-0.501***	-0.356***	-0.832***	-0.659***
	(-4.44)	(-4.84)	(-7.77)	(-6.94)	(-15.09)	(-13.85)
$Investment_{t-1}$	0.118**	0.021	-0.032	-0.147**	0.169***	0.001
	(2.08)	(0.42)	(-0.46)	(-2.32)	(2.71)	(0.01)
$Leverage_{t-1}$	-0.069	0.078	-0.109	0.051	-0.267	-0.157
	(-0.47)	(0.84)	(-0.63)	(0.36)	(-1.34)	(-0.92)
$Cash\ flow_{t-1}$	0.195	0.012	-0.112	-0.106	-0.101	-0.081
	(0.69)	(0.05)	(-0.74)	(-0.74)	(-1.48)	(-1.24)
$Dividend_{t-1}$	0.133***	0.082***	0.093	0.048	0.092	0.054
	(3.38)	(3.36)	(1.23)	(0.77)	(1.35)	(0.96)
$Sales\ growth_{t-1}$		-0.039		0.107**		0.015
		(-1.00)		(2.01)		(0.39)
MB_{t-1}		0.399***		0.312***		0.256***
		(9.70)		(9.08)		(12.40)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	10,105	10,058	10,522	10,284	13,686	13,238
R^2	0.052	0.505	0.057	0.312	0.068	0.198
J-statistic	0.47	0.27	0.27	0.20	0.57	0.51