Three essays on corporate finance

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SUMMARY

This dissertation contains three essays on corporate finance. Essay One decomposes cash flow into a temporary and a permanent component, and show that the temporary component has little information content about future growth opportunities. We then study how firms allocate cash flow by estimating the cash flow sensitivities of various uses of cash flow with respect to the temporary component. We demonstrate several methodological advantages of our approach to alternative GMM methods. A key finding is that financially more constrained firms show significantly a lower sensitivity of investment, but a higher sensitivity of change in cash holdings, to the temporary component of cash flow than financially less constrained firms.

Essay Two models the impact of firm misvaluation on the allocation of internal cash flow across its various uses, including investment, cash holdings, and financing activities. Our model predicts that when firms are undervalued, they allocate additional cash flow towards investment and cash holdings, away from substituting costly external finance. Conversely, when overvalued, firms shift additional cash flow from investment and cash holdings to reductions in external financing. Our empirical results confirm these predictions. Furthermore, consistent with the premise that debt is less mispriced than equity, firms reduce more equity than debt using additional cash flows as they become more overvalued. Taken together, our results imply that (1) overvaluation (undervaluation) alleviates (exacerbates) financial constraints; (2) firms dampen the effects of misvaluation on corporate policies via altering the allocation of internal cash flow across different uses.

Essay Three examines the information role of financial advisors by focusing on mergers and acquisitions in which acquiring firms hire target firms' ex-advisors. We document that by employing targets' ex-advisors, acquirers pay lower takeover premiums and secure a larger proportion of merger synergies. The corresponding targets exhibit lower announcement returns and are less likely to be

propositioned by competing bidders. These results indicate that acquiring firms access and exploit value-relevant information about target firms through targets' ex-advisors, and achieve a bargaining advantage in deal negotiations. In contrast, when targets hire acquirers' ex-advisors, there are no discernible value effects on either firm, consistent with targets' weak ability to use the promise of future business to engage acquirers' ex-advisors.

Essay One:

Cash Flow Sensitivities and the Allocation of Internal Cash Flow

ABSTRACT

We decompose cash flow into a temporary and a permanent component, and show that the temporary component has little information content about future growth opportunities. We then study how firms allocate cash flow by estimating the cash flow sensitivities of various uses of cash flow with respect to the temporary component. We demonstrate several methodological advantages of our approach to alternative GMM methods. A key finding is that financially more constrained firms show significantly a lower sensitivity of investment, but a higher sensitivity of change in cash holdings, to the temporary component of cash flow than financially less constrained firms.

JEL classification: G31, G32

Keywords: Cash flow sensitivity, Internal cash flow, High-order GMM, Beveridge-Nelson decomposition

I. Introduction

How do firms allocate internally generated cash among its various uses? The answer to this question is important for several reasons. Firms could pay out additional cash flow as dividends, use cash to reduce debt or equity financing, hold it as precautionary savings, or spend the additional cash flow on investment. How firms use internally generated cash could affect the speed with which an economy recovers from a recession, which is typically accompanied by improvements in profitability.

The allocation of cash flow could also provide important insights into the types of frictions firms face in financing investment and how firms mitigate the constraints imposed by these frictions. There is very little theoretical guidance on how the degree of financial constraints is supposed to affect the allocation of cash flow. For example, theory does not provide a clear answer to the question of whether firms facing more severe financial constraints should invest more or save more when they have additional cash flow.¹ Given this, there is a need for empirical evidence to inform theory. However, as we discuss below, it has been difficult to interpret available empirical evidence because existing empirical approaches face several challenges. One of the main contributions of this paper is to provide a methodology that addresses some of these challenges and informs theory as to how firms facing different degrees of financial constraints allocate cash flows to various uses.

One approach to determining the allocation of cash across its various uses is in terms of the coefficients of cash flow in a regression framework in which various uses of cash are regressed on cash flow and other controls. This is an extension of existing approaches that

¹ For instance, Kaplan and Zingales (1997) show that even in a one-period model, investment-cash flow sensitivities do not necessarily increase with the degree of financing constraints.

examine the so-called “cash flow sensitivities” of investment or change in cash holdings.² Previous studies mainly examine the response of a particular use of cash flow to cash flow innovations (for example, the sensitivity of investment or additions to cash holdings to cash flow) in isolation. However, the results have proved to be mixed (and controversial). In particular, given the diversity of methodologies and results on cash flow sensitivities of specific uses of cash flow, it is perhaps fair to say that there is no clear consensus as to where an additional dollar of cash flow goes. There is also no clear consensus on the question of whether the degree to which firms face frictions in raising external finance (i.e., the extent of financial constraints) affects the allocation of cash flow.

Two recent papers that look at the allocation of cash flow across various uses in an integrated framework are Dasgupta, Noe and Wang (2011; DNW hereafter) and Gatchev, Pulvino, and Tarhan (2010; GPT hereafter). DNW point out that under the Ordinary Least Square methodology, by virtue of the cash flow identity, the cash flow sensitivities of various uses of cash flow must add up to unity, even when the equations are estimated as standalone equations, as long as the same set of regressors appear on the right-hand-side.³ GPT, however argue that failure to impose the “adding up constraint” as a separate constraint and not estimating the equations simultaneously leads to erroneous coefficient estimates. The authors show that forcing the constraint to hold leads to substantially different coefficient estimates than those obtained if the equations for various uses of cash flow are estimated as standalone equations. However, we show in this paper that that GPT’s claim is unwarranted. Similar to these authors, we test our models both with the restriction that the cash flow sensitivity coefficients across

² See, among others, Fazzari, Hubbard, and Petersen (1988) and Almeida, Campello, and Weisbach (2004).

³ The paper then examines the *inter-temporal* allocation of cash flow – that is, how a cash flow innovation in the current period affects investment both in the current and future periods (e.g., via cash savings that are later depleted, or debt reduction that alleviates debt overhang).

various uses of cash flow should add up to unity, and without it. Unlike GPT, however, we find that imposing the constraint makes no difference to our results.⁴

Although the adding up constraint holds under OLS estimation, the methodology has its own challenges. A common critique of interpreting cash flow coefficients in an OLS regression framework is that cash flows may contain information about a firm's future prospects if future growth opportunities are not properly controlled for. This is an implication of the measurement error problem related to Tobin's marginal Q , which in a neoclassical setting is supposed to represent the present value of marginal profits from capital. Since the true marginal Q cannot be observed, the literature uses the average Q (the ratio of the market value of firm to the replacement cost or book value of capital) as a proxy.⁵ However, Erickson and Whited (2000) point out that this measurement error can have serious consequences on inference based on the cash flow coefficients, and propose a modified GMM (Generalized Method of Moments) method based on high-order moments to correct for the measurement error. This methodology has been profoundly influential in subsequent literature that examines the cash flow sensitivities of investment or cash holdings.⁶

It is not straightforward, however, to apply the modified GMM methodology to the estimation of cash flow allocations, which involve a system of equations that must satisfy an aggregate constraint such as that the sum of the cash flow coefficients must add up to unity

⁴ The reason is simple: when variables are consistently defined and satisfy the cash flow identity that cash flow must equal the sum of all uses of cash flow, the constraint is redundant under ordinary least squares (OLS) estimation, as long as the specifications incorporate the same set of right-hand-side variables. We show in Section IV.A that GPT's results are due to inconsistent variable definitions, which violate the cash flow identity for a substantial percentage of observations in their sample.

⁵ In a recent paper, Gala and Gomes (2013) advocate the inclusion of cash flow, firm size, and sales in the estimation of the investment model as they capture the relevant state variables that determine investment productivity. This further underlines the need to purge cash flows of information content about future productivity of investment. Importantly, in the general framework that the authors develop, marginal Q or market values play no role, so measurement error related to Q is not a concern.

⁶ E.g., Whited (2001, 2006), Hennessey (2004), Colak and Whited (2007), Riddick and Whited (2009).

across all its uses. As we show, the aggregate constraint that the coefficients must add up to unity is violated when the GMM method is applied to estimate each equation separately, and often by large amounts. In contrast, under OLS, the aggregate constraint is always satisfied. However, interpretation of the OLS coefficients is still subject to the critique that perhaps cash flow contains information about future growth prospects. To address this issue, we follow an approach due to Beveridge and Nelson (1981) to decompose cash flows into a trend (permanent) and a cycle (temporary) component.⁷ As shown by Beveridge and Nelson (1981), the cycle measure contains little information about the future beyond short-term momentum. While the coefficients of both components of cash flow satisfy the aggregate constraint under OLS, only those for the cycle component can be reliably interpreted as estimates of the use of cash. This is because whereas the trend component of cash flow contains information about future growth and thus is likely correlated with the error terms when growth opportunities are inadequately controlled for, this is less likely for the cycle component. Therefore, to the extent that the cycle component is uncorrelated with future growth opportunities, the coefficient of this component is consistently estimated and can be meaningfully interpreted.

Consistent with this notion, we find that investment responds much more to the trend component of cash flow than to the cycle component. A major part of the cycle component of cash flow is used to reduce external financing – an additional dollar of the cycle component of cash flow leads to a reduction of new debt financing by about 35 cents over most subsamples we consider. Larger and less financially constrained firms also reduce new equity financing by a small amount, but this magnitude increases to 10 cents for smaller and more financially constrained firms. The rest of the cycle component of cash flow goes to investment and addition

⁷ Beveridge and Nelson's decomposition is widely used in the asset pricing literature, such as Cochrane (1994), Bansal, Dittmar, and Kiku (2009), Garleanu, Kogan, and Panageas (2012) and Garleanu, Panageas, and Yu (2012). However, its use in the corporate finance literature is rather limited.

to cash holdings. Here, again, we see a remarkably consistent pattern: irrespective of which criteria is used to distinguish financially more constrained and less constrained firms, the former group's investment cash flow sensitivity is lower and cash holding-cash flow sensitivity is higher, respectively, than those of the latter group. We discuss some possible reasons for these results later.

For us to interpret the coefficients of the cycle component, it is important that this component be uncorrelated with the firm's growth opportunities, which can be mis-measured and therefore enter into the error term(s). The Beveridge-Nelson decomposition implies that the cycle component does not contain information about future cash flow growth, suggesting that it should be uncorrelated with future growth opportunities. Consistent with this, we find that the cycle component is uncorrelated with the measured Q . In addition, we confirm that there is more information content in the trend component than in the cycle component by estimating the valuation impact of an additional dollar of each type of cash flow following the methodology of Faulkender and Wang (2006). We modify their methodology slightly by controlling for all the other uses of cash in the right hand side except change in cash holdings, which (by virtue of the cash flow identity) allows us to include the contemporaneous cash flow and interpret the trend and cycle components as the valuation impact of additional cash holding from these two sources. Consistent with the notion that the trend component is contaminated with information about future prospects and does not represent the pure valuation effect of additional cash holdings, we find much larger impact of the trend component than the cycle component on stock returns. Indeed, the coefficient of the cycle component in our various specifications is typically close to unity, whereas that of the trend can be 50% higher in magnitude.

Our paper makes a number of contributions, both methodologically and in terms of the estimates of allocation of cash flow. First, it corrects for an error in GPT by showing, both theoretically and empirically, that when the cash flow identity holds and all variables are consistently defined, there is no need to impose the requirement that all the cash flow coefficients should add up to unity as a constraint in estimating the system. Second, our approach suggests that when equations are interdependent and variables must satisfy aggregate constraints, it is problematic to interpret coefficient estimates based on *available* higher-order moment methods applied to individual equations since the aggregate constraint can be easily violated. Related, by establishing that the OLS method has the virtue that the adding-up constraint is always satisfied, we suggest a way in which the allocation of the transitory component of cash flow can be meaningfully studied without the information content of cash flows affecting our inference. Finally, we document that substitution of external financing is the most important single use of transitory cash flow, and that financially more constrained firms allocate more out of an additional dollar to cash holdings but less to investment than less constrained firms.

The rest of the paper is organized as follows. Section II describes the empirical methodologies. Our sample and data are described in Section III. Empirical results are reported Section IV. Section V concludes.

II. Empirical Methodologies

A. Cash Flow Identity

Our empirical analysis critically hinges upon the following cash flow identity defined using flow-of-funds (the cash flow statement) data:

$$Inv_t + \Delta Cash_t + Div_t - \Delta D_t - \Delta E_t = CF_t, \quad (1)$$

where the uses of funds include investment (Inv), the change in cash holdings ($\Delta Cash$), and cash dividends (Div). The sources of funds comprise the internally generated cash flows (CF) and external financing that consists of the net debt issuance (ΔD) and the net equity issuance (ΔE). Note that $-\Delta D$ and $-\Delta E$ can be regarded as reductions in external financing, or as uses of funds.

Our baseline empirical models regress different uses of cash (e.g., investment, the change in cash holdings, cash dividends, and reductions in external financing) on CF , the market-to-book ratio (MB) as a proxy for investment opportunities, and other control variables (Y). We also include firm dummies (f) to control for unobserved heterogeneity, and year dummies (y) to control for time effects. The regression equations are written as follows:

$$Inv_{it} = \alpha^{Inv} CF_{it} + \beta^{Inv} MB_{it-1} + \gamma^{Inv} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{Inv}, \quad (2)$$

$$\Delta Cash_{it} = \alpha^{\Delta Cash} CF_{it} + \beta^{\Delta Cash} MB_{it-1} + \gamma^{\Delta Cash} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{\Delta Cash}, \quad (3)$$

$$Div_{it} = \alpha^{Div} CF_{it} + \beta^{Div} MB_{it-1} + \gamma^{Div} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{Div}, \quad (4)$$

$$\Delta D_{it} = \alpha^{\Delta D} CF_{it} + \beta^{\Delta D} MB_{it-1} + \gamma^{\Delta D} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{\Delta D}, \quad (5)$$

$$\Delta E_{it} = \alpha^{\Delta E} CF_{it} + \beta^{\Delta E} MB_{it-1} + \gamma^{\Delta E} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{\Delta E}. \quad (6)$$

where the superscripts of the coefficients (α , β , and γ) denote different equations.

GPT argue that since investment and financing decisions are made jointly, subject to the constraint that cash flow must equal uses of cash flow, the cash flow sensitivities of various uses of cash flow must add up to unity. Failure to impose the constraint and estimate all the cash flow sensitivities simultaneously leads to erroneous coefficient estimates. Specifically, to incorporate the interrelated corporate decisions into the empirical analysis, GPT state that it is crucial to impose the following linear constraints and estimate all equations simultaneously:

$$\alpha^{Inv} + \alpha^{\Delta Cash} + \alpha^{Div} - \alpha^{\Delta D} - \alpha^{\Delta E} = 1, \quad (7)$$

$$\beta^{Inv} + \beta^{\Delta Cash} + \beta^{Div} - \beta^{\Delta D} - \beta^{\Delta E} = 0, \quad (8)$$

$$\gamma^{Inv} + \gamma^{\Delta Cash} + \gamma^{Div} - \gamma^{\Delta D} - \gamma^{\Delta E} = 0, \quad (9)$$

Constraint (7) reflects the accounting identity that sources of cash equal uses of cash. In other words, a one-dollar increase in internal cash flows needs to be used to increase investment, increase cash holdings, pay cash dividends, or repurchase outstanding debt or equity. Constraints (8) and (9) stipulate that the total response across different sources and uses of cash must sum to zero if the shock stems from an exogenous or predetermined variable that represents neither a source nor a use of funds in the current period.⁸ The authors show that estimating equations (2)-(6) *simultaneously* while forcing constraints (7)-(9) to hold leads to substantially different coefficient estimates than those obtained if the equations are estimated as standalone equations without imposing constraints (7)-(9).

GPT's claim, however, is false. In Section IV, we estimate equations (2)-(6) with constraints (7)-(9), and without. Unlike GPT, however, we find that imposing the constraints makes no difference to our estimates. The reason is simple: When variables are consistently defined and satisfy the cash flow identity (equation (1)) in the data, constraints (7)-(9) are redundant under the OLS estimation, as long as the specifications incorporate the same set of right-hand-side variables. Appendix A provides a brief econometric proof showing that system of equations (SUR) estimates and OLS estimates are numerically equivalent and equally efficient if the regressors are identical.⁹

⁸ For instance, suppose the coefficient of *MB* is 0.1 in equation (2), suggesting that investment increases by 10% of total assets if *MB* increases by one. Since investment is a use of funds and total uses of funds must be equal to the total sources of funds, the net effect of the increase of *MB* on other use and source variables must sum to -10% of total assets.

⁹ More general derivations can be found in Greene (2012) (pages 293-295).

B. High-order Moment GMM

A well-known critique on cash flow sensitivities in an OLS regression framework is that estimated coefficients are inconsistent due to the measurement errors associated with Tobin's marginal Q , which is supposed to capture investment opportunities. Since the true marginal Q cannot be observed, we follow previous studies and use as a proxy the average Q , which is computed as the market-to-book ratio (MB). To understand the potential biases, consider a cross-section single-equation model as follows:

$$y_i = z_i\alpha + \chi_i\beta + u_i \quad (10)$$

$$x_i = \chi_i + \varepsilon_i \quad (11)$$

where y_i is the dependent variable, z_i is the vector of perfectly measured explanatory variables, such as cash flow and firm size, χ_i is the unobserved marginal Q and x_i is the average Q - the proxy for the unobserved marginal Q .

By substituting (11) into (10), we have $y_i = z_i\alpha + x_i\beta + v_i$, where $v_i = u_i - \varepsilon_i\beta$. The correlation between x_i and v_i causes the coefficient of interest, β , to be biased downward (attenuation bias). Another common critique of interpreting coefficients is that cash flow contains information about future growth opportunities. Given the likely positive correlation between the mismeasured Tobin's Q and the well-measured regressor (cash flow), the attenuation bias of the mismeasured regressor causes the coefficient of the well-measured regressor (cash flow) to be biased upward.

Erickson and Whited (2000) propose a modified GMM (Generalized Method of Moments) based on high-order moments to address the measurement error in Tobin's Q . To derive the GMM estimates, they firstly "partial out" the perfectly measured variables (z_i) in (10) and (11):

$$y_i - z_i\mu_y = \eta_i\beta + u_i \quad (12)$$

$$x_i - z_i\mu_x = \eta_i + \varepsilon_i \quad (13)$$

where $(\mu_y, \mu_x, \mu_\chi) = E[(z'_i z_i)]^{-1} E[(z'_i(y_i, x_i, \chi_i))]$ and $\eta_i = \chi_i - z_i\mu_\chi$.

The GMM estimators are calculated using the moment equations of $y_i - z_i\mu_y$ and $x_i - z_i\mu_x$ which are functions of unknown β and the moments of $(u_i, \varepsilon_i, \eta_i)$. By constructions, there are three second-order moment equations:

$$E[(y_i - z_i\mu_y)^2] = \beta^2 E(\eta_i^2) + E(u_i^2) \quad (14)$$

$$E[(y_i - z_i\mu_y)(x_i - z_i\mu_x)] = \beta E(\eta_i^2) \quad (15)$$

$$E[(x_i - z_i\mu_x)^2] = E(\eta_i^2) + E(\varepsilon_i^2) \quad (16)$$

The third-order product moment equations comprise two equations with two unknowns:

$$E[(y_i - z_i\mu_y)^2(x_i - z_i\mu_x)] = \beta^2 E(\eta_i^3) \quad (17)$$

$$E[(y_i - z_i\mu_y)(x_i - z_i\mu_x)^2] = \beta E(\eta_i^3) \quad (18)$$

Thus, we can have $\beta = E[(y_i - z_i\mu_y)^2(x_i - z_i\mu_x)] / E[(y_i - z_i\mu_y)(x_i - z_i\mu_x)^2]$ if $\beta \neq 0$ and $E(\eta_i^3) \neq 0$. The condition $E(\eta_i^3) = 0$ is called identification test. The estimated GMM3 estimator, β , is exactly identified and its validity requires the rejection of the identification test. An overidentified equation system can be obtained by combining the above second-order and third-order moment equations together with additional fourth-order moment equations, which include only one additional new parameter, $E(\eta_i^4)$:

$$E[(y_i - z_i\mu_y)^3(x_i - z_i\mu_x)] = \beta^3 E(\eta_i^4) + 3E(\eta_i^2)E(u_i^2) \quad (19)$$

$$E[(y_i - z_i\mu_y)^2(x_i - z_i\mu_x)^2] = \beta^2 [E(\eta_i^4) + E(\eta_i^2)E(u_i^2)] + E(u_i^2)[E(\eta_i^2) + E(\varepsilon_i^2)] \quad (20)$$

$$E[(y_i - z_i\mu_y)(x_i - z_i\mu_x)^3] = \beta[E(\eta_i^4) + 3E(\eta_i^2)E(\varepsilon_i^2)] \quad (21)$$

We denote the estimates as GMM4, which can be estimated by numerically minimizing a quadratic form of asymptotic variance.¹⁰ Following the same logic, we can have GMM5 estimates, which additionally utilize the equations for the fifth-order product moments and the third-order non-product moments. To examine the validity of both GMM4 and GMM5, over-identification tests should be performed because the number of moment equations involved is larger than that of unknown parameters. Note that GMM estimates are originally designed for cross-sectional data. Thus, to apply this methodology to an unbalanced panel structure, Erickson and Whited (2012) use a Minimum Distance Estimator (MDE) to aggregate GMM estimates from different cross-sections. The final value is the weighted average of the coefficients from different cross-sections with more accurate coefficients assigned with higher weights.

This modified GMM methodology has a profound impact on the subsequent literature that studies the cash flow sensitivities. Almeida, Campello, and Galvao (2010) use Monte Carlo simulated and real data to show that fixed effects, error heteroscedasticity, or a low degree of data skewness make the modified GMM methods generate inefficient and biased coefficients for both mismeasured and perfectly measured regressors. In response to the critique, Erikson and Whited (2012) propose several remedies for the GMM estimators. One of them is to use multiple starting values for the computation of GMM4 and GMM5, which requires numerical minimization of asymptotic variance functions. The usage of multiple different starting values ensures that GMM estimators correspond to a global, rather than a local minimum. Note that the performance of GMM3 is unaffected by the adoption of multiple starting values since it is exactly identified.

¹⁰ The detailed format of the quadratic form can be found in Erickson and Whited (2012).

So far, the debate focuses on the cash flow coefficient in the investment equation, rather than in a system of equations framework. If we estimate various equations separately and independently with GMM estimators using real data, it is difficult to judge whether GMM estimates are consistent since we do not know the true values of the parameters in real data.¹¹

However, in our system of equations framework, if the GMM estimators are consistent, the coefficients of Q should add up to zero across different equations, while the coefficients of cash flows should add up to unity across different equations. Thus by looking at the sum of coefficients across different equations, we can evaluate the performance of the GMM approach using real data.

C. Beveridge-Nelson Decomposition of Cash Flow

Beveridge and Nelson (1981; BN hereafter) propose a methodology to decompose a univariate time series into trend (permanent) and cycle (temporary) components. The BN trend is defined as the limiting forecast of the level of the series (minus any deterministic drift) and the BN cycle is the difference between the level of the series and the trend component. Specifically, assume a univariate time series y_t , which is an I(1) (integrated of order 1) process with Wold representation as follows

$$\Delta y_t = \mu + \psi(L)\varepsilon_t = \mu + \sum_{j=0}^{\infty} \psi_j \varepsilon_{t-j} \quad (22)$$

where L is the lagged operator, Δ is the first difference, i.e., $\Delta = 1 - L$, $\psi(0) = 1$, $\psi(1) \neq 0$,

$$\sum_{j=0}^{\infty} j^{1/2} |\psi_j| < \infty, \text{ and } \varepsilon_t \text{ are iid}(0, \sigma^2).$$

¹¹Although Monte Carlo simulations may address the issue, the assumptions on which Monte Carlo simulations are based is likely to be inconsistent with what is going on in real data.

By definition, the trend component τ_t is defined as the limiting forecast of the level of the series (adjusted for the mean growth rate) or, equivalently, the current level of the series plus the infinite sum of the expected j -period-ahead change in y :

$$\tau_t = \lim_{J \rightarrow \infty} E_t[y_{t+J} - J \cdot \mu] = y_t + \lim_{J \rightarrow \infty} \sum_{j=1}^J E_t[(\Delta y_{t+j} - \mu)] \quad (23)$$

We then can have:

$$\tau_t - \tau_{t-1} = \lim_{J \rightarrow \infty} [E_t(y_{t+J}) - E_{t-1}(y_{t+J}) + \mu]$$

We can view $E_t(y_{t+J}) - E_{t-1}(y_{t+J})$ as the response of y_{t+J} to the shock at t . $E_t(y_{t+J})$

$$-E_{t-1}(y_{t+J}) = \sum_{j=1}^J \psi_j \varepsilon_t \text{ and } \lim_{J \rightarrow \infty} [E_t(y_{t+J}) - E_{t-1}(y_{t+J})] = \psi(1) \varepsilon_t, \text{ Thus,}$$

$$\tau_t - \tau_{t-1} = \mu + \psi(1) \varepsilon_t \quad (24)$$

Hence, the BN trend is a pure random walk with drift μ and its innovation variance is $\sigma^2 \psi(1)^2$. The BN cycle, c_t , is treated as the gap between the present level of the series (y_t) and the trend component (τ_t):

$$c_t = y_t - \tau_t = \tilde{\psi}(L) \varepsilon_t \quad (25)$$

$$\text{where } \tilde{\psi}(L) = \sum_{j=0}^{\infty} \tilde{\psi}_j L^j \text{ and } \tilde{\psi}_j = - \sum_{k=j+1}^{\infty} \psi_k.$$

Essentially, the analysis above suggests that the trend component is a random walk with drift and the cycle component is a stationary process with mean zero. We follow the methodology of Morley, Nelson, and Zivot (2003) and calculate the BN decomposition of the first difference of unscaled cash flow series by fitting an $ARMA(2,2)$ model. The decomposition is detailed in Appendix B. After obtaining the trend and cycle components of unscaled cash flow,

we deflate both components by the beginning-of-period book value of assets to get CF_Trend_t and CF_Cycle_t .

D. The Information Content of Cash Flow Components

In order to confirm that there is more information content about investment opportunities in the trend component than in the cycle component, we estimate the valuation impact of an additional dollar of each type of cash flow using the methodology developed by Faulkender and Wang (2006) who examine the relation between the marginal value of cash and corporate financial policies. Faulkender and Wang (2006) examine the valuation effect of the change in cash holding by regressing the firm's annual return (less the Fama-French size and book-to-market portfolio return) on the change in cash holding. They control for other uses of cash such as dividends, investment, and net issuances, but they do not control for cash flow. We argue that when other uses of cash flow (but not cash flow) are controlled for, because of the cash flow identity, there is a one-to-one relationship between the change in cash holding and cash flow. Thus, the coefficient of change in cash holding should be the same as that of cash flow – a claim that is supported in our empirical tests. The main advantage of this is that Faulkender and Wang's (2006) methodology can then be applied to examine if the valuation effects of the permanent and temporary components of cash flow are the same. In particular, we hypothesize that since the permanent component is likely to have information content regarding future cash flow growth, its coefficient should be larger than that of the temporary component (and therefore, the latter should more appropriately measure the “value of cash”).

Specifically, our regression is specified as follows:

$$r_{i,t} = \beta_0 + \beta_1 CF_Cycle_{i,t} + \beta_2 CF_Trend_{i,t} + \beta_3 Inv_{i,t} + \beta_4 Div_{i,t} + \beta_5 \Delta D_{i,t} + \beta_6 \Delta E_{i,t} + f_{sbmt,i} + \gamma' X_{i,t-1} + \varepsilon_{i,t} \quad (26)$$

In Faulkender and Wang (2006), the dependent variable is the excess return over the fiscal year, which is defined as the raw return of the stock less the Fama-French size and book-to-market portfolio returns. However, as suggested by Gormley and Matsa (2013), to deal with estimation bias introduced by unobserved heterogeneity, instead of subtracting the size and book-to-market portfolio returns, we include fixed effects (f_{sbmt}) at the level of year, size, and book-to-market quintile in our regressions. The key variables of our interest are trend and cycle components of the cash flow series. For consistency with our other regression specifications, the cash flow components are scaled by lagged book value of assets. Therefore, we also change the dependent variable to the change in market value of equity scaled by lagged book value of assets ($\Delta MVE/Assets$).¹² We expect that shareholder positively value additional dollar of each type of cash flow; however, the trend component is likely to have information content about future growth and therefore should have a larger valuation impact compared to cycle component ($\beta_2 > \beta_1 > 0$). The vector X_{t-1} comprises firm-specific characteristics measured at $t-1$: M/B, sale growth, size, financial leverage, and tangibility.

III. Data and Variables

A. Data

Our sample consists of firms listed in the Compustat Industrial Annual files at any point between 1971 and 2011. We follow Frank and Goyal (2003) and use the flow-of-funds data to define the cash flow identity. We set the starting point of our sample at 1971, since it is the year

¹² However, as discussed below, our results remain qualitatively the same if we scale cash flows by lagged equity value and the dependent variable is raw returns.

starting in which flow-of-funds data are extensively reported in Compustat. Data on stock prices and returns are retrieved from the Center for Research on Security Prices (CRSP) files. Dollar values are converted into 2000 constant dollars using the GDP deflator.

Following common practice in the literature, we discard observations from financial institutions (SIC codes 6000-6999), utilities (SIC codes 4900-4999), not-for-profit organizations, and government enterprises (SIC codes greater than 8000).¹³ We require firms to provide valid information on their total assets, sales growth, market capitalization, changes in cash holdings, investment, cash dividends, cash flow, and external financing. Following Almeida, Campello, and Weisbach (2004) and Almeida and Campello (2010), we exclude firm-years for which the market value of assets is less than \$1 million, those displaying asset growth exceeding 100%, and those with annual sales lower than \$1 million to minimize the sampling of financially distressed firms.¹⁴ Furthermore, to ensure that the cash flow identity holds in our data, we exclude observations with the absolute value of the difference between the left-hand and right-hand sides of equation (1) greater than 1% of the beginning-of-period total assets.¹⁵ These screens leave us with an unbalanced sample panel that consists of 73,366 firm-year observations (11,818 firms).

¹³ Utility firms, not-for-profit organizations, and government enterprises are excluded because they are heavily regulated. We discard financial firms because their financing decisions are likely affected by different factors (e.g., capital adequacy regulations) than nonfinancial firms.

¹⁴ Very small firms (with the market value of assets or sales less than \$1 million) are removed because they have severely limited access to capital markets. Our results are essentially unchanged if we increase the cutoff for defining very small firms from \$1 million to \$5 million. Firms experiencing extremely high growth are eliminated because they are typically involved in major corporate events, such as mergers and acquisitions.

¹⁵ For around 1% of our observations, the absolute value of the difference between the left-hand and right-hand sides of equation (1) exceeds 0.01. This is mainly due to rounding errors, misrecorded data, and winsorization. In particular, winsorization leads to a mild violation of the cash flow identity because not all flow-of-funds variables are winsorized at the same time in a given firm-year.

B. Variables in the Cash Flow Identity

According to Compustat data manuals, it is important to consider the format code when defining variables using flow-of-funds data. Effective for fiscal years ending July 15, 1988, Statement of Financial Accounting Standards (SFAS) #95 requires U.S. companies to report the Statement of Cash Flows (format code = 7). Prior to the adoption of SFAS #95, companies may have reported one of the following statements: Working Capital Statement (format code = 1), Cash Statement by Source and Use of Funds (format code = 2), and Cash Statement by Activity (format code = 3). Thus the variable definitions vary depending on which format code a firm follows in reporting flow-of-funds data. In particular, for investment we include capital expenditure, acquisitions paid by cash, and other investment that result in cash outflows. For issuance and repurchase activities, we consider those that generate actual cash flow from the capital markets into the firm and vice versa. As suggested by Fama and French (2005), the issuance activities generating no cash flow to the firm, such as granting shares to employees or financing acquisitions with stock, are excluded from our analysis. Table I details the construction of all variables in equation (1) based on different format codes of flow-of-funds data.

[Insert Table I here]

It is worth noting that, following recent studies on cash flow sensitivities (e.g., Bushman, Smith, and Zhang (2011), DNW, GPT), we define cash flow (CF) as the operating cash flows, net of the change in working capital.¹⁶ Bushman, Smith, and Zhang (2011) suggest that the cash flow measure used almost universally in the investment-cash flow literature is actually earnings before depreciation, which contains a true cash component (operating cash flows) and a non-cash

¹⁶ For instance, for firms with format code = 7, CF is defined as income before extra items + extra items and discontinued operation + depreciation and amortization + deferred taxes + equity in net loss + gains in sale of PPE and investment + other funds from operation + exchange rate effect - change in working capital (ΔWC). The definitions of CF for firms with other format codes are detailed in Table I.

component in the form of working capital accruals. The authors find that the investment-cash flow sensitivity documented in previous studies is mainly due to the naturally positive correlation between investment and working capital accruals.¹⁷ By removing the effect of the change in working capital and focusing on cash flows from operations, we mitigate the concern that our results are driven by the correlations between the uses of funds (investment in particular) and working capital accruals.

C. Comparisons between Our Variables and Sample and Those of GPT

Using Compustat firms over the period 1952–2007, GPT examine the intertemporal effects of financial decisions on cash flow sensitivities. After removing financial and utilities firms, their empirical analysis is based on 237,412 firm-years, a sample much larger than ours. In addition, compared with our equation (1), their sources-equal-uses identity contains more variables, as follows:

$$\begin{aligned} \Delta Cash_t + Div_t + CAPX_t + ACQUIS_t - ASALES_t \\ -(EQISSU - RP)_t - (\Delta LTD + \Delta STD)_t = CF_t, \end{aligned} \quad (27)$$

where $CAPX$ is net capital expenditures, $ACQUIS$ is acquisitions, $SALES$ is sale of assets and investment, $EQISSU$ stands for equity issuances, RP represents equity repurchases, and ΔLTD and ΔSTD are net long-term debt issuances and net short-term debt issuances, respectively.

Our cash flow identity (equation (1)) is less detailed than that of GPT (equation (27)) because several variables in equation (1) consolidate some of the items in equation (27). In particular, our measure of investment (Inv) aggregates capital expenditure ($CAPX$), acquisition

¹⁷ Since fixed assets investments normally increase firm scale, it is natural to expect corresponding increases in non-cash working capital items such as accounts receivables and inventories. However, as pointed out by Bushman, Smith, and Zhang (2011), this relation has little to do with financing constraints caused by capital market imperfections, but rather is a manifestation of increasing scale.

(*ACQUIS*), and the sales of investment (*ASALES*). Our measure of net debt issuance (ΔD) captures funds from both short-term (ΔSTD) and long-term debt (ΔLTD) financing. In addition, ΔE is equal to the difference between two items in equation (27), *EQISSU* and *RP*. The purpose of consolidation is to simplify the empirical analysis and ease exposition. Robustness checks (untabulated but available upon request) indicate that our results remain qualitatively the same if we use equation (27) instead of equation (1), so long as all items are defined properly using cash flow statements.

Although the length of the cash flow identity is unimportant, the definitions of variables in the identity do matter. To ensure that equation (1) holds in the data for each firm each year, we rely solely on cash flow statements (flow-of-funds data) in defining variables. In contrast, GPT define variables in equation (27) using data from different sources. To be more specific, they use balance sheet data to define $\Delta Cash$, the change in net working capital, and long- and short-term debt issuances, use income statement data to define cash flow, and rely on cash flow statement data to define equity issuances and repurchases, investment items, and cash dividends (Table III of GPT, page 737). As a result, their sources-equal-uses identity generally does not hold in the data.

The disturbance to equality in equation (27) is further magnified by GPT's treatment of missing values in defining variables. The authors replace any missing values of the variables in equation (27) by zeros.¹⁸ Due to this practice, their sample (237,412 firm-years) is much larger than ours (73,366 firm-years). This unusual treatment of missing values worsens the cash flow

¹⁸ For instance, without setting missing values to zero, their measure of cash flow can only be computed for roughly 124,406 firm-years for 1952-2007 in Compustat because of missing values in operating income, interest expenses, taxes, or the change in net working capital. In addition, GPT define a few variables, such as *EQISSU* and *RP*, over 1952-2007 using cash flow statement data; however, Compustat cash flow statement data are only available from 1971 onwards. Thus they set all missing values between 1952 and 1970 to zero. In footnote 9 of their paper, GPT suggest that their results are not qualitatively affected if they drop the observations with missing Compustat variables instead of setting them to zero. This is not surprising, given that the identity is still violated, because the variables are defined using data from different sources.

inequality since not all components in equation (27) have missing values at the same time in a given firm-year.

Panel A of Table II reports summary statistics for cash flow statement variables in equation (1) for our sample, excluding observations with missing Compustat variables. All variables are deflated by the beginning-of-period total assets and have been winsorized at the top and bottom 1% of their distributions. This approach reduces the impact of extreme observations by assigning the cutoff value to values beyond the cutoff point. Our results (untabulated) are qualitatively very similar when we truncate the distribution instead of winsorizing it.

[Insert Table II here]

On average, our sample firms invest (*Inv*) 9.9%, increase cash holdings ($\Delta Cash$) by 1%, and pay out as dividends (*Div*) 1% of the beginning-of-period assets. To finance these uses of funds, an average firm in our sample taps external capital markets by issuing debt and equity that amounts to 2.1% and 3.2% of the beginning-of-period assets, respectively. The gap between the uses of funds and external financing is met by internally generated cash flows (*CF*), which accounts for 6.6% of the beginning-of-period assets. Except for dividends (*Div*), all flow-of-funds variables exhibit significant variation, ranging from large negative to large positive values.¹⁹

To examine whether the cash flow identity holds in our data, we define $DIF^{Equation\ 1}$ as the difference between the left-hand and right-hand sides of equation (1). The mean, median, and standard deviation of $DIF^{Equation\ 1}$ are 0, 0, and 0.003, respectively, suggesting that our cash flow identity (equation (1)) holds up well in the data, albeit not perfectly.

¹⁹ Our sampling approach and variable definitions closely follow the literature; thus the figures reported in Table II resemble those in previous studies, including Frank and Goyal (2003) and Almeida and Campello (2010).

To contrast our sample with that of GPT, we define variables in equation (27) by closely following their variable definitions and using data from different sources, that is, income statements, balance sheets, and cash flow statements. By following their sampling process and setting the missing values of variables in equation (27) to zero, we end up with 221,119 firm-years, similar to the size of their sample (237,412 firm-years). Panel B of Table II reports the summary statistics of variables in this sample, which are comparable to those reported in Table IV of GPT.²⁰ We also tabulate the statistics of $DIF^{Equation\ 27}$, defined as the difference between the left-hand and right-hand sides of equation (27). The results reveal that, although the mean and median values of $DIF^{Equation\ 27}$ are close to zero (0.013 and 0.001, respectively), its distribution is dispersed, with a standard deviation equal to 0.396. Additional statistics (untabulated) indicate that the sample contains roughly 76% (25%) of observations with the absolute value of $DIF^{Equation\ 27}$ larger than 1% (10%) of total assets, confirming our conjecture that the cash flow identity (equation (27)) generally does not hold in the data of GPT.

It is worth pointing out that although GPT scale all variables in the sources-equal-uses identity (equation (27)) by total assets in their data summary (GPT, Table IV), they use *unscaled* measures in their regression analysis (GPT, Tables V-X). In contrast, following common practice, we use scaled variables in all regressions to mitigate concerns about heterogeneity across firms.

IV. Empirical Results

²⁰ The figures reported in Panel B of Table II are not identical to those in GPT's Table IV due to the difference in sample size and the way of handling extreme observations (winsorization).

A. Static Standalone Equations versus Static System of Equations

Panel A of Table III reports the results obtained by estimating equations (2)-(6) as standalone equations. To estimate regressions with firm fixed effects, we demean the dependent and independent variables in equations (2)-(6).²¹

[Insert Table III here]

We document in Panel A of Table III positive investment-cash flow and cash-cash flow sensitivities and a negative external finance-cash flow sensitivity. More specifically, a one-dollar increase in cash flow increases investment by 17 cents, increases cash holdings by 21 cents, increases dividends by 1 cent, reduces the use of debt by 28 cents, and lowers the use of equity by 33 cents. To summarize, in response to a one-dollar increase in cash flow, firms, on average, increase the uses of cash by roughly 40 cents and reduce reliance on external finance by roughly 60 cents.

Importantly for our purpose, we find that in Panel A of Table III, $\alpha^{Inv} + \alpha^{\Delta Cash} + \alpha^{Div} - \alpha^{\Delta D} - \alpha^{\Delta E} = 1$. For the other explanatory variables, we have $\beta^{Inv} + \beta^{\Delta Cash} + \beta^{Div} - \beta^{\Delta D} - \beta^{\Delta E} = 0$ and $\gamma^{Inv} + \gamma^{\Delta Cash} + \gamma^{Div} - \gamma^{\Delta D} - \gamma^{\Delta E} = 0$. It is important to highlight that these results are obtained *without* simultaneously estimating equations (2)-(6) and *without* imposing any linear constraints on the estimation. However, this result is natural rather than surprising, since they are implied by the underlying cash flow identity (equation (1)), which holds in the data, by definition.

The system of equations (2)-(6) qualify as seemingly unrelated regressions (SUR), since each equation in the system has its own dependent variables and the explanatory variables in all equations are either exogenous or predetermined. Using our data, we then estimate the system of

²¹ Alternatively, we estimate regressions by including firm dummies. Not surprisingly, the resulting coefficients are identical to those obtained by demeaning the variables. However, the estimation with firm dummies generally has a higher R-squared value than in the demeaning approach, since the former explains the level of the dependent variable, while the latter explains the deviation of the dependent variable from the firm-specific mean.

equations (2)-(6) with the linear constraints (7)-(9) using the SUR method and report the results in Panel B of Table III. Contrary to GPT, we find that the estimated coefficients (α , β , and γ), t -statistics, and R-squared values in Panel B are almost identical to those in Panel A.²² This result is not surprising, as shown in Appendix A, it follows immediately from Kruskal's (1960) theorem that SUR estimates turn out to be equivalent to equation-by-equation OLS estimates if the same set of explanatory variables is included in each equation, which is precisely the case in the system of equations (2)-(6). Perhaps more importantly, our findings in Table III clearly suggest that it is unnecessary to impose linear constraints on the estimation of static system of equations so long as the cash flow identity holds in the data. Taken together, the results in Table III indicate that standalone equations are not any worse than system of equations when estimating *static* models that include no lagged dependent variables as explanatory variables.

B. Dynamic Standalone Equations versus Dynamic System of Equations

If system of equations does not outperform single equations in estimating static models, do dynamic model estimations make system of equations a better choice in capturing the impact of cash flows and firm valuation on corporate decisions? GPT argue that it is indispensable to take into account the intertemporal dependencies within and across corporate decision variables. For example, apart from commonly used determinants of investment (e.g., CF and Q), the current investment of a company may be affected by investment made last year, the change in cash holdings, and debt or equity issued last year. Without incorporating lagged dependent variables into equations (2)-(6), system of equations estimation can suffer from model misspecification and omitted variable biases.

²² Note that the coefficients and t -statistics in Panel B of Table III are very similar but not identical to those in Panel A. Because the cash flow identity (equation (1)) does not hold perfectly in our data, imposing the linear constraints (7)-(9) in Panel B leads to slightly different results from those in Panel A.

Thus, to account for the interdependent nature of corporate policies, we include lagged dependent variables (Inv_{t-1} , $\Delta Cash_{t-1}$, Div_{t-1} , ΔD_{t-1} , and ΔE_{t-1}) in equations (2)-(6). We estimate five equations as standalone equations in Panel A of Table IV. Panel B of Table IV reports the results obtained by estimating the system of five equations, which is subject to the constraint that the cash flow coefficients (α) add up to one across equations, and the coefficients of the other explanatory variables, including the five lagged dependent variables, sum to zero across equations.

[Insert Table IV here]

Because both panels of Table IV include the same set of explanatory variables and consider the interdependencies of corporate policies by including the lagged dependent variables, the differences in coefficients between the two panels can only be attributed to the difference between the unconstrained dynamic standalone equations and the constrained dynamic system of equations. However, we find that the coefficients in Panels A and B of Table IV are almost identical. This result not only confirms our earlier inference that linear constraints are redundant if the cash flow identity holds in the data, but also reveals that system-of-equations and single-equation estimates are almost identical, even for dynamic models, if the right-hand-side exogenous (e.g., CF) or predetermined variables (e.g., MB and lagged dependent variables) in all equations are the same.

Most of the coefficients of the lagged dependent variables are statistically significant in Table IV, consistent with the intertemporal nature of financial decisions and the interdependence of corporate policies. However, by comparing the coefficients in Table IV with those in Table III, which omits lagged dependent variables, we find the inclusion of lagged dependent variables has no material impact on the coefficient estimates of key explanatory variables such as CF and

MB. This result indicates that omitted variable biases, which are caused by excluding lagged dependent variables from all equations, are almost negligible and not as significant as proposed by GPT.

We also use the variables and sample summarized in Panel B of Table II, which closely follow GPT, to repeat the same analysis as in Sections IV.A and IV.B.²³ The results (untabulated but available upon request) reveal that although we fail to obtain identical coefficient estimates due to the difference in sample size, we indeed document drastic changes in the coefficients of the explanatory variables when we move from static unconstrained single-equation models to dynamic constrained system-of-equations models. However, our findings in Sections IV.A and IV.B suggest that the importance of linear constraints and the intertemporal and interdependent nature of financial decisions are hugely exaggerated by GPT's use of a severely unbalanced cash flow identity in the data.

C. High-order Moment GMM

Each year we estimate five equations with dependent variables being (*Inv*, Δ *Cash*, *Div*, Δ *D*, and Δ *E*) and obtain coefficients using the OLS, GMM3, GMM4, and GMM5.²⁴ To aggregate yearly coefficient estimates, we use Fama-MacBeth for OLS and the minimum distance method (Erickson and Whited (2012)) for GMM estimators.²⁵ Almeida, Campello, and Galvao (2010) argue that the investment equation should be estimated with firm fixed effects

²³ For this regression analysis we proceed, as in GPT, by using unscaled variables in the sources-equal-uses identity (equation (27)).

²⁴ The control variables are the same as those in Table III.

²⁵ For the GMM estimation in this paper, we use the Stata codes used by Erickson and Whited (2012), which is publicly available at Toni Whited's website. We have also tried to use the Gauss codes of Erickson and Whited (2000) and find qualitatively the same results.

(within transformation form), which are not included in Erickson and Whited (2000).²⁶ In response, Erickson and Whited (2012) suggest reporting the within-transformation form together with the level form. We follow Erickson and Whited (2012) and report both forms.

In Panel A of Table V, we estimate the sum of five cash flow coefficients using the within transformation form. Not surprisingly, for the OLS regressions, the coefficients of cash flows add up to one, and the coefficients of Q add up to 0 across different equations. However, for the GMM estimators, the coefficients do not add up to theoretical values. The GMM3 estimator appears to be the worst because it is exactly identified and can not utilize the information from higher order moments. As pointed by Erickson and Whited (2012), choosing multiple starting values for the coefficient on Tobin's Q can avoid local optima and extreme estimates. Using their codes, we start with 101 different starting values and get the estimate that minimizes the objective function.²⁷ However, even equipped with multiple starting values, the sum of GMM4 and GMM5 coefficients of Q are still far away from 0. The sum of coefficients of cash flow ranges between 0.81 and 0.84 for the three GMM estimators.

The detailed yearly coefficient estimates for the investment regression (equation (2)) in the Panel A are shown in Appendix C. For the GMM estimators, we use the minimum distance method (Erickson and Whited (2012)) to aggregate yearly estimates from each cross-section and report the results at the end of the table. Occasionally, coefficients take large values (larger than one).²⁸ Thus, using multiple starting values fails to eliminate extreme estimates. In addition,

²⁶Transforming the observations for each firm into deviations from firm-specific average (within transformation hereafter) is a remedy for biases caused by the correlation between firm fixed effects and regressors. However, using within transformation makes the resulting models not satisfying the identification condition. Thus, Erickson and Whited (2000) use data in the level form.

²⁷ Specifically, we vary the starting value from -0.1 to 0.5 with a step of 0.006. Their codes are downloaded from <http://toni.marginalq.com/ewestimators.htm>.

²⁸ Similar findings are documented in Table A.1 of Almeida, Campello, and Galvao (2010).

some of problematic coefficient estimates have extremely small standard errors.²⁹ Since, averaging the coefficients obtained from cross-sectional regressions follows the minimum distance algorithm, which assigns larger weights to more accurate coefficients (i.e., those with small standard errors or large z values), extreme estimates with small standard errors dominate the final results. For example, in Appendix C, we observe that a large estimate of -5.39 (the standard error = 0.00) for the Q coefficient estimated by GMM4 in year 2009 drives up the corresponding final estimate to -5.39 (the standard error = 0.00).

Another point worth emphasizing is that, as shown in Appendix C, there are only a few instances in which the combination of identification and over-identification are satisfied. The cases where they are satisfied are highlighted in grey. This finding is consistent with previous studies (e.g., Almeida and Campello (2007), Agca and Mozumda (2007)). The estimation of the investment equation, for example, in our sample passes both the identification and over-identification tests in 12 out of 40 years. However, in not even a single year in our sample is the combination of identification and over-identification satisfied for all five equations for the different uses of cash.³⁰ In Panel B of Table V, we estimate the sum of the five cash flow coefficients using the level form and find similar results.

D. Cash Flow Decomposition and the Allocation of the Cycle Component

While the OLS coefficients satisfy the aggregate constraints, their interpretation is still subject to the critique that cash flows contain information about future growth prospects. To

²⁹ Standard errors reported in Table 7 of Erickson and Whited (2012) are also very small. So, their results are quite similar to ours.

³⁰ We conduct a Monte Carlo simulation for 500 years and keep the years which simultaneously satisfy the combination of identification and over-identification among the system of equations. However, we still fail to get a single year for which all the restrictions are satisfied for all the equations for the use of cash. The design of the Monte Carlo simulation is similar to that of Erikson and Whited (2012) and the details are available upon request.

address this issue, we follow the approach outlined in Section II.C to decompose cash flows into a trend (permanent) and a cycle (temporary) component.³¹ To estimate the trend and cycle components of cash flow, we restrict the sample to firms that have at least consecutive 15 years of annual cash flows. As a result, the sample size is reduced to 46,991 firm-years.³² The mean of cycle component is zero which is consistent with literature, whereas both the trend component and the level of cash flow have the mean of 0.08. The standard deviations for cycle, trend, and level are 0.08, 0.11 and 0.12, respectively. The correlation coefficient between trend and cycle components is -0.21, which is significant at the 1% level. We first reproduce what we do in Panel A of Table III using the reduced sample, and tabulate the results in Panel A of Table VI.

Not surprisingly, since we lose many firms and possibly pick different types of firms by imposing the requirement that firms must have at least 15 years of non-missing data for all the components of the cash flow identity, coefficient estimates change somewhat. A dollar of additional cash flow reduces debt issuance by the same amount (28 cents) in both samples. However, in the larger sample, which includes more small and young firms without 15 years of continuous cash flow observations, there is much higher substitution of cash flow for equity. The results are consistent with the notion that smaller and younger firms are more equity-dependent, i.e., they tend to rely much more on equity financing (given that they have limited capacity for debt and weak cash flows) so that positive shocks to cash flows allow them to cut down on costly equity financing. As a consequence, they also invest less and accumulate less cash buffer in response to positive cash flow shocks.

³¹ Gorbenko and Strebulaev (2010) investigate corporate financial policies in the presence of both temporary and permanent shocks to firm's cash flows. In this theoretical paper, the authors emphasize the role of transitory shocks which are neglected by prior capital structure studies. They mainly examine the impact of transitory shocks on financing policies, without studying investment and cash policies.

³² We thank James Morley for sharing his BN decomposition codes used in Morley, Nelson, and Zivot (2003) on his website. Our results are qualitatively unchanged if we require the firms to have at least consecutive 20 years of cash flow.

These interpretations, however, have to be treated with caution because of the measurement error critique. Since we require a reasonable time-series of cash flows for the decomposition so that we can focus on the cycle component which should be less subject to this concern, we cannot address the differences in the coefficient estimates for these two samples satisfactorily. Instead, in Panel B, we focus on the allocation of cash flow, which is our primary concern. In later tables, we also extensively examine differences in the cash flow allocations (cash flow sensitivities) of financially more constrained and less constrained firms. While we follow standard (and multiple) methods of classification for the latter exercise, it is still worthwhile to note that the subsamples are different from the usual ones in the literature because we still require continuous observations for at least 15 years. Nonetheless, several robust regularities emerge.

Turning to Panel B, we first notice that for both the cycle and trend components, the adding-up constraint is satisfied – the coefficients for each component across the various uses add up to very close to unity (recall that the signs for debt and equity issuance columns need to be flipped). Next, consistent with the argument that cash flows contain information about future growth, and that the trend component is much more subject to this concern than the cycle component, in column (6) we find that the coefficient of the trend component in the investment equation is 50% higher than that for the cycle component. Focusing on the coefficients of the cycle component, we find that an additional dollar of temporary shock to cash flow reduces external financing by about 41 cents, and boosts the cash buffer by 36 cents. While the investment response is much lower (23 cents), it is still far from negligible.³³

³³ Much of the Investment-Cash flow sensitivity literature has focused on capital expenditure rather than investment (the latter includes, for example, cash acquisition activity). We find that the coefficient of the trend component is twice as large for Capex than that of the cycle component. However, consistent with several studies, (see, for

The result that an extra dollar of cash flow is allocated to all the uses of cash is consistent with the existence of financial frictions. The immediate question that arises is how the degree of financial frictions affects this allocation. There is a general lack of theoretical clarity on this issue, since existing models do not deliver clear predictions regarding whether firms facing more frictions should exhibit higher or lower cash flow sensitivity of investment than those facing less friction. There is almost no theory in this regard addressing the allocation of cash flow among its various uses.

Since theory either does not exist, or has no clear predictions, one would hope that empirical results would inform theory. However, for reasons discussed earlier, it has proved difficult to interpret the cash flow coefficients corresponding to various uses of cash. Thus, we proceed now to document how firms facing different degrees of financial constraints allocate cash flow, using a variety of classification schemes used in the literature.

Specifically, we use classification schemes based on firm size ($\ln(Assets)$), dividend payout, and credit ratings (e.g., Almeida, Campello and Weisbach 2004), and more recent approaches suggested by Whited and Wu (2006; henceforth the WW index), Hadlock and Pierce (2010; henceforth the HP index). By construction, *higher* scores of HP index and WW index indicate that firms are *more* financially constrained. Each year a firm is classified as more (less) financially constrained if its $\ln(Assets)$ is in the bottom (top) three deciles of the distribution, it pays zero (non-zero) dividends, its *HP* index or the *WW* index is the top (bottom) three deciles of the distribution, or lacks (has) a credit rating. All constraints measures provide consistent results, as shown in Table VII. In particular, the coefficient of the cycle component in the investment regression is lower, and that in the cash holding regression is higher, for firms that are classified

example, Almeida and Campello (2007)), we find that a dollar of additional cycle component of cash flow increases Capex by only 5 cents.

as more financially constrained, than those for firms classified as less constrained.³⁴ There is no significant difference in the amount of external financing that is substituted by cash for the two groups.³⁵ One other regularity consistently observed is that the more constrained firms substitute more (less) equity (debt) than the less constrained ones. This is consistent with the possibility that firms more likely to be constrained, e.g., smaller firms, are likely to be more equity dependent.³⁶

We now briefly speculate on these results, leaving the modeling challenge to theory. Perhaps the most surprising aspect of these results is that the financially less constrained firms exhibit higher investment-cash flow sensitivity than the more constrained firms. The literature has usually assumed that the firms that are classified as “less constrained” here are readily able to access capital markets and face few financing frictions. If so, they should be able to readily undertake all positive NPV projects, and we should not expect investment to respond to cash flows that do not reflect growth opportunities. One possible explanation is that these firms are in fact also constrained, though less so. However, more constrained firms face tighter financial constraints not only in the present, but also in the future. Consequently, cash holdings are more valuable for these firms, and they add more to cash at the expense of investment today in

³⁴ The only exception is that for the dividend payout classification scheme, while the investment-cash flow sensitivity is higher for less constrained firms with respect to the cycle component, the difference is not significant at conventional levels. Similar results are obtained when we measure investment using Capex only: the cash flow sensitivity of Capex with respect to the cycle component is consistently lower for more constrained firms than for less constrained firms. The coefficient for less constrained firms is between 0.07 and 0.11, while that for more constrained firms is between 0.04 and 0.05.

³⁵ Except for the WW classification scheme, where the less constrained firms substitute less external finance.

³⁶ Two other classification schemes in the literature but not reported here are due to Kaplan and Zingales (KZ) (1997) and Cleary (1999). Firms classified as constrained by the KZ index substitute external funding much more than for other classification schemes, and consequently hold much less as cash buffer relative to those classified as unconstrained by this scheme. There is no significant difference in the investment response to the cycle component of cash flow. We get similar results for the classification due to Cleary, but the cash flow sensitivity of investment for financially constrained firms is still significantly lower than for unconstrained firms with respect to the cycle component.

response to a positive cash flow shock.³⁷ An alternative possible explanation is that the less constrained firms overinvest: managers like projects, and financing is readily obtained for positive NPV projects. However, it may be difficult to convince lenders to lend when projects are not positive NPV, and these projects can only be financed with internal cash. Thus, higher cash flow leads to higher investment in pet projects, with some cash saved away for future pet projects. More constrained firms do not have enough funds to invest in all good projects anyway, so they do not overinvest today as the cash is valuable for future good projects.

E. The Cycle Component and Mismeasured Growth Opportunities

The orthogonality of the cycle component with respect to mismeasured growth opportunities that are part of the error term is crucial for the validity of our interpretation. As discussed above, the logic of the BN decomposition suggests that the cycle component should reflect little else than short-term momentum, with the trend component capturing shocks to future cash flow growth. Here, we provide further evidence that the cycle component contains little information about future growth.

First, we find that the cycle component of cash flows is uncorrelated with the contemporaneous trend component of market-to-book ratio; however, the trend component of cash flow is strongly correlated with the contemporaneous trend component of the market-to-book ratio (the correlation coefficient is 0.34 and the significance is at 1% level). This correlation again support that cycle components of cash flow contain little information about future growth prospects. We also run a regression of contemporaneous trend component of cash flow on the lag three periods of trend component of cash flows and adjusted R-squared is 0.68. Whereas the adjusted R-squared obtained is 0 if the contemporaneous trend component of cash

³⁷ See Dasgupta and Sengupta (2007) for a model along these lines.

flow is regressed on the lag three periods of cycle component of cash flows.³⁸ This latter finding is consistent with Nelson (2008) that the cycle component contains little information about future cash flow growth.

In order to confirm that the trend component contains more information compared to the cycle component, we estimate the valuation impact of an additional dollar of each component of cash flow following the methodology of Faulkender and Wang (2006) with necessary modifications as discussed in Section II.D, and report the results in Table VIII. The results reported in columns (1) and (2) confirm that cash flow and the change in cash holding have the same valuation impact in this framework. In column (3), we include cycle and trend components together in regressions to examine their respective valuation impact. The results show that the coefficient of the trend component is about 50% higher than that of the cycle component, consistent with the former having more information content about future growth.³⁹ Moreover, the coefficient of the latter is not far from 1, consistent with the notion that an additional dollar of cash flow is roughly worth that amount. The results also suggest that studies that examine the value of cash would benefit from focusing on the temporary component of cash flow, rather than that of change in cash holding, for a cleaner interpretation, as the former is less contaminated by information content. Results for the case in which we deflate both the change in equity value on the left hand side and components of cash flows on the right hand side by lagged market value of equity yield qualitatively similar results: the coefficient on the cycle component is 0.8 while that on the trend component is 1.10.

³⁸ Running a regression of contemporaneous cycle component of cash flow on its lag three periods, adjusted R-squared obtained is 0.

³⁹ Another explanation is permanent component is more sustainable in the long run because of a permanent shift in the firm's production technology and cost structure.

V. Conclusions

We examine how firms allocate cash flow to corporate investment, cash holdings, dividends and financing activities. In contrast to Gatchev, Pulvino, and Tarhan (2010), we show that under OLS, when the cash flow identity holds and all variables are consistently defined, OLS (for a group of standalone equations) and SUR (seemingly unrelated regressions for a system of equations) produce numerically equivalent and equally efficient estimates of cash flow sensitivities. We show that Gatchev, Pulvino, and Tarhan (2010) find different results because the cash flow identity is frequently violated in their sample due to inconsistent definition of variables.

OLS, however, has been criticized because of its apparent failure to address the measurement error problem associated with imperfect proxies for growth opportunities. To address this problem, high-order GMM methods have been proposed (Erickson and Whited (2000)). However, the reliability of these methods have also been debated (e.g., Almeida, Campello and Galvao (2010), Erickson and Whited (2012)). We contribute to this debate by showing that interpretation of coefficient estimates from these higher-order methods is problematic because the aggregate restrictions implied by the cash flow identity are frequently violated when these equations are estimated individually (e.g. the investment equation that has attracted the most attention). In particular, unlike OLS methods, the sum of Q -coefficients is far from zero, and the sum of cash flow coefficients is about 0.8.

We argue that one way to deal with the measurement error problem so that the cash flow coefficients under OLS can be interpreted to represent the allocation of cash flow across its various uses is to focus on the “temporary” component of cash flow that does not contain information about future growth. We show that the “cycle” component of cash flows obtained

from a Beveridge-Nelson decomposition of cash flows into a trend and a cycle component has several desirable properties towards this end. In particular, the cycle component is uncorrelated with the market-to-book ratio, to future cash flows, and has a coefficient much smaller than that of the trend component in the investment equation, as well as in regressions that capture the value of cash from cash flow coefficients. In addition, the cycle component satisfies the adding-up constraint. Thus, we provide a way in which the allocation of cash flow can be meaningfully studied in an OLS framework.

Our main findings are as follows. Firms allocate a substantial part of an additional dollar of cyclical or temporary cash flow to reduce external financing, suggesting that the “deleveraging” incentive is strong when profitability improves. They also tend to add a significant part of the additional dollar of cash flow to their cash holding. Very little is paid out as dividends. The resulting impact on investment impact is small – to the extent of about 20 cents to a dollar of additional cash flow. The effect on capital expenditure is very small. A very robust pattern is that, the financially more constrained firms invest less and accumulate more in cash holdings than the financially less constrained firms. This result is consistent with the idea that financially more constrained firms expect to face tighter financial constraints in the future, which increases the value of additional cash holdings for these firms.

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Table I. Variables Defined using the Flow-of-Funds Data

Variables are defined using flow-of-funds data of Compustat. The variable definitions vary according to the format code (*scf*) a firm follows in reporting flow-of-funds data. Effective for fiscal years ending July 15, 1988, SFAS #95 requires U.S. companies to report the Statement of Cash Flows (*scf* = 7). Prior to adoption of SFAS #95, companies may have reported one of the following statements: Working Capital Statement (*scf* = 1), Cash Statement by Source and Use of Funds (*scf* = 2), and Cash Statement by Activity (*scf* = 3). Variables include the change in cash holdings ($\Delta Cash$), investment (*Inv*), the change in working capital (ΔWC), cash dividends (*Div*), cash flows (*CF*), net debt issued (ΔD), and net equity issued (ΔE). We include in parentheses the Compustat XPF variable names in italics. PPE denotes property, plant, and equipment.

Variables	<i>scf</i> = 1	<i>scf</i> = 2	<i>scf</i> = 3	<i>scf</i> = 7
<i>Inv</i>	capital expenditure(<i>capx</i>) + increase in investment(<i>ivch</i>) + acquisition(<i>aqc</i>) + other uses of funds(<i>fuseo</i>) - sale of PPE(<i>sppe</i>) - sale of investment(<i>siv</i>)	same as <i>scf</i> = 1	same as <i>scf</i> = 1	capital expenditure (<i>capx</i>) + increase in investment(<i>ivch</i>) + acquisition(<i>aqc</i>) - sale of PPE(<i>sppe</i>) - sale of investment(<i>siv</i>) - change in short-term investment(<i>ivstch</i>) - other investing activities(<i>ivaco</i>)
$\Delta Cash$	cash and cash equivalents increase/decrease (<i>chech</i>)	same as <i>scf</i> = 1	same as <i>scf</i> = 1	same as <i>scf</i> = 1
<i>Div</i>	cash dividends (<i>dv</i>)	same as <i>scf</i> = 1	same as <i>scf</i> = 1	same as <i>scf</i> = 1
ΔD	long-term debt issuance(<i>dltis</i>) - long-term debt reduction(<i>dltr</i>) - changes in current debt(<i>dlcch</i>)	long-term debt issuance(<i>dltis</i>) - long-term debt reduction(<i>dltr</i>) + changes in current debt(<i>dlcch</i>)	same as <i>scf</i> = 2	same as <i>scf</i> = 2
ΔE	sale of common and preferred stock (<i>sstk</i>) - purchase of common and preferred stock(<i>prstk</i>)	same as <i>scf</i> = 1	same as <i>scf</i> = 1	same as <i>scf</i> = 1
ΔWC	change in working capital(<i>wcapc</i>)	- change in working capital(<i>wcapc</i>)	same as <i>scf</i> = 2	-change in account receivable(<i>recch</i>) - change in inventory(<i>invch</i>) - change in account payable(<i>apalch</i>) - accrued income taxes(<i>txach</i>) - other changes in assets and liabilities (<i>aoloch</i>) - other financing activities(<i>fiao</i>)
<i>CF</i>	income before extra items(<i>ibc</i>) + extra items & discontinued operation(<i>xidoc</i>) + depreciation & amortization(<i>dpc</i>) + deferred taxes(<i>txdc</i>) + equity in net loss(<i>esubc</i>) + gains in sale of PPE & investment(<i>sppiv</i>) + other funds from operation(<i>fopo</i>) + other sources of funds(<i>fsrco</i>) - ΔWC	same as <i>scf</i> = 1	same as <i>scf</i> = 1	income before extra items(<i>ibc</i>) + extra items & discontinued operation(<i>xidoc</i>) + depreciation & amortization(<i>dpc</i>) + deferred taxes(<i>txdc</i>) + equity in net loss(<i>esubc</i>) + gains in sale of PPE & investment(<i>sppiv</i>) + other funds from operation(<i>fopo</i>) + exchange rate effect(<i>exre</i>) - ΔWC

Table II. Summary Statistics

The data for Panels A are from Compustat for 1971–2011. Panel A reports summary statistics for variables defined in Table I, including the change in cash holdings ($\Delta Cash$), investment (Inv), cash dividends (Div), cash flows (CF), net debt issued (ΔD), and net equity issued (ΔE). $DIF^{Equation\ 1}$ is the difference between the left-hand and right-hand sides of equation (1). Panel B contains the firms in GPT's sample. The variables in Panel B are defined following GPT's Table III. $DIF^{Equation\ 27}$ is the difference between the left-hand and right-hand sides of equation (27). The terms SD, Q1, and Q3 stand for the standard deviation and the 25th and 75th percentiles of the distribution, respectively. In Panels A and B, all variables are deflated by the beginning-of-period total assets and winsorized at the top and bottom 1% of their distributions.

Variables	N	Mean	SD	Min	Q1	Median	Q3	Max
<i>Panel A: Cash flow statement variables in equation (1) for 1971–2011</i>								
<i>Inv</i>	73,366	0.099	0.163	-0.373	0.022	0.064	0.135	2.313
$\Delta Cash$	73,366	0.010	0.124	-0.478	-0.021	0.001	0.029	2.215
<i>Div</i>	73,366	0.010	0.020	0	0	0	0.014	0.175
ΔD	73,366	0.021	0.130	-0.550	-0.021	0	0.032	1.730
ΔE	73,366	0.032	0.179	-0.146	0	0	0.008	4.638
<i>CF</i>	73,366	0.066	0.165	-2.727	0.014	0.082	0.145	0.705
$DIF^{Equation\ 1}$	73,366	0	0.003	-0.010	0	0	0	0.010
<i>Panel B: GPT's (2010) variables in equation (27) for 1952–2007</i>								
<i>CAPX</i>	221,119	0.093	0.139	0	0.020	0.050	0.105	0.913
<i>ACQUIS</i>	221,119	0.024	0.092	-0.004	0	0	0	0.698
<i>SALES</i>	221,119	0.006	0.024	0	0	0	0.002	0.198
$\Delta Cash$	221,119	0.069	0.382	-0.457	-0.023	0	0.041	2.636
<i>Div</i>	221,119	0.008	0.021	0	0	0	0.007	0.173
ΔLTD	221,119	0.033	0.183	-0.442	-0.015	0	0.034	1.104
ΔSTD	221,119	0.012	0.124	-0.445	-0.007	0	0.018	0.725
<i>EQISSU</i>	221,119	0.182	0.711	0	0	0.001	0.020	5.461
<i>RP</i>	221,119	0.008	0.028	0	0	0	0	0.198
<i>CF</i>	221,119	-0.045	0.473	-3.269	-0.039	0.052	0.126	0.585
$DIF^{Equation\ 27}$	221,119	0.013	0.396	-7.620	-0.031	0.001	0.035	7.517

Table III. Impact of Cash Flows and Firm Valuation on Corporate Policies (Baseline Model)

The data are from Compustat and CRSP for 1971–2011. The dependent variables and cash flow (CF) are defined in Table I. *Tangibility* is the net PPE over total assets; *SalesG* is the change in net sales scaled by lagged net sales; *Leverage* is defined as total debt (the sum of short-term and long-term debt) divided by total assets; and $\ln(Assets)$ is the natural log of the total book value of assets. To estimate regressions with firm fixed effects in both panels, we demean the dependent and all independent variables in the equations. The constant term and year dummies are included in regressions but not reported. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The t -statistics are presented in parentheses. Panel A estimates equations separately, without linear constraints. Panel B reports the results obtained using system of equations with the linear constraint that sources equal uses of cash.

Dependent Variables	Panel A: <u>Standalone equations without constraints</u>					Panel B: <u>System of equations with linear constraints</u>				
	(1) Inv_t	(2) $\Delta Cash_t$	(3) Div_t	(4) ΔD_t	(5) ΔE_t	(6) Inv_t	(7) $\Delta Cash_t$	(8) Div_t	(9) ΔD_t	(10) ΔE_t
CF_t	0.17*** (39.7)	0.21*** (59.5)	0.01*** (23.0)	-0.28*** (-79.7)	-0.33*** (-76.8)	0.17*** (39.9)	0.21*** (59.9)	0.01*** (22.2)	-0.27*** (-79.4)	-0.33*** (-77.0)
MB_{t-1}	0.03*** (47.2)	0.01*** (25.6)	0.00*** (20.8)	0.01*** (14.9)	0.03*** (57.1)	0.03*** (47.3)	0.01*** (25.8)	0.00*** (19.3)	0.01*** (14.6)	0.03*** (57.1)
$SaleG_{t-1}$	0.02*** (15.2)	-0.00 (-0.3)	-0.00*** (-6.0)	0.01*** (11.7)	0.01*** (4.9)	0.02*** (15.2)	-0.00 (-0.4)	-0.00*** (-5.9)	0.01*** (11.6)	0.01*** (4.9)
$\ln(Assets)_{t-1}$	-0.03*** (-31.0)	-0.02*** (-29.1)	0.00*** (4.8)	-0.01*** (-13.4)	-0.04*** (-43.5)	-0.03*** (-31.1)	-0.02*** (-29.3)	0.00*** (6.8)	-0.01*** (-13.3)	-0.04*** (-43.5)
$Leverage_{t-1}$	-0.16*** (-34.6)	0.02*** (5.8)	-0.01*** (-44.6)	-0.25*** (-65.8)	0.09*** (19.9)	-0.16*** (-34.6)	0.02*** (5.8)	-0.01*** (-44.5)	-0.24*** (-65.4)	0.09*** (19.9)
$Tangibility_{t-1}$	0.04*** (6.6)	0.11*** (20.1)	0.00** (2.3)	0.08*** (15.3)	0.07*** (10.8)	0.04*** (6.5)	0.11*** (20.1)	0.00*** (3.3)	0.08*** (15.3)	0.07*** (10.9)
N	73,366	73,366	73,366	73,366	73,366	73,366	73,366	73,366	73,366	73,366
R-squared	0.11	0.07	0.05	0.15	0.15	0.11	0.07	0.05	0.15	0.15

Table IV. System of Equations with Linear Constraints and Lagged Dependent Variables

The data are from Compustat and CRSP for 1971–2011. The dependent variables and cash flow (CF) are defined in Table I. All explanatory variables except cash flow (CF) are lagged one period. To estimate regressions with firm fixed effects in both panels, we demean the dependent and all independent variables in the equations. The constant term and year dummies are included in regressions but not reported. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The t -statistics are presented in parentheses. Panel A estimates equations separately, without linear constraints. Panel B reports the results obtained using system of equations with the linear constraint that sources equal uses of cash.

Dependent Variables	Panel A: Standalone equations without constraints					Panel B: System of equations with linear constraints				
	(1) Inv_t	(2) $\Delta Cash_t$	(3) Div_t	(4) ΔD_t	(5) ΔE_t	(6) Inv_t	(7) $\Delta Cash_t$	(8) Div_t	(9) ΔD_t	(10) ΔE_t
CF_t	0.16*** (36.6)	0.22*** (61.7)	0.01*** (18.6)	-0.28*** (-80.9)	-0.34*** (-76.2)	0.16*** (36.8)	0.22*** (62.0)	0.00*** (18.0)	-0.28*** (-80.5)	-0.34*** (-76.3)
MB_{t-1}	0.03*** (44.1)	0.02*** (34.3)	0.00*** (13.5)	0.01*** (14.2)	0.04*** (60.4)	0.03*** (44.2)	0.02*** (34.4)	0.00*** (12.5)	0.01*** (14.0)	0.04*** (60.4)
$SaleG_{t-1}$	0.02*** (11.9)	0.01*** (8.2)	-0.00*** (-3.3)	0.01*** (10.5)	0.01*** (9.6)	0.02*** (11.9)	0.01*** (8.1)	-0.00*** (-3.4)	0.01*** (10.3)	0.01*** (9.6)
$Ln(Assets)_{t-1}$	-0.03*** (-32.5)	-0.02*** (-28.6)	0.00*** (4.8)	-0.01*** (-14.0)	-0.04*** (-43.4)	-0.03*** (-32.6)	-0.02*** (-28.7)	0.00*** (6.6)	-0.01*** (-14.0)	-0.04*** (-43.4)
$Leverage_{t-1}$	-0.16*** (-33.3)	0.02*** (4.3)	-0.01*** (-36.6)	-0.24*** (-60.6)	0.08*** (16.8)	-0.16*** (-33.3)	0.02*** (4.4)	-0.01*** (-37.0)	-0.24*** (-60.4)	0.08*** (16.8)
$Tangibility_{t-1}$	0.06*** (9.6)	0.07*** (12.6)	0.00* (1.9)	0.07*** (13.6)	0.06*** (8.6)	0.06*** (9.5)	0.07*** (12.5)	0.00*** (2.9)	0.07*** (13.6)	0.06*** (8.6)
Inv_{t-1}	0.04*** (11.2)	-0.02*** (-5.4)	0.00 (1.6)	0.05*** (14.9)	-0.02*** (-5.1)	0.04*** (11.2)	-0.02*** (-5.4)	0.00* (1.8)	0.05*** (14.9)	-0.02*** (-5.1)
$\Delta Cash_{t-1}$	0.11*** (28.7)	-0.15*** (-46.2)	0.00*** (3.2)	0.01** (2.0)	-0.04*** (-10.4)	0.11*** (28.7)	-0.15*** (-46.2)	0.00*** (3.4)	0.01** (2.0)	-0.04*** (-10.3)
Div_{t-1}	0.07** (2.2)	-0.23*** (-8.7)	0.28*** (134.7)	0.16*** (5.9)	-0.00 (-0.1)	0.08** (2.5)	-0.22*** (-8.2)	0.26*** (130.0)	0.13*** (4.8)	-0.01 (-0.2)
ΔD_{t-1}	-0.02*** (-3.7)	0.01* (1.8)	-0.00 (-0.7)	-0.03*** (-8.8)	0.02*** (4.8)	-0.02*** (-3.7)	0.01* (1.8)	-0.00 (-0.7)	-0.03*** (-8.8)	0.02*** (4.8)
ΔE_{t-1}	-0.05*** (-18.6)	0.02*** (9.2)	-0.00*** (-12.7)	-0.02*** (-10.6)	-0.01*** (-3.2)	-0.05*** (-18.6)	0.02*** (9.2)	-0.00*** (-12.6)	-0.02*** (-10.5)	-0.01*** (-3.3)
Observations	73,366	73,366	73,366	73,366	73,366	73,366	73,366	73,366	73,366	73,366
R-squared	0.12	0.12	0.24	0.15	0.16	0.12	0.12	0.24	0.15	0.16

Table V. Sum of Coefficients of *CF* and *MB* across Different Equations

The data are from Compustat and CRSP for 1971–2011. Each year we estimate five equations with dependent variables being (*Inv*, $\Delta Cash$, *Div*, ΔD , and ΔE). Coefficients of cash flow (*CF*) and Tobin's *Q* (*MB*), which are estimated using the OLS, GMM3, GMM4, and GMM5, respectively, are reported. Other control variables, which are the same as those reported in Table III, are included but not reported. To aggregate yearly coefficient estimates, we use Fama-MacBeth for OLS and minimum distance method (Erickson and Whited (2012)) for GMM estimators. The numbers reported in this table are aggregated results. More detailed yearly coefficients can be found at the Appendix C. Standard errors are included in parentheses. Panel A reports the coefficients estimated with firm fixed effect (within transformation form, transforming the observations for each firm into deviations from firm-specific average). Panel B shows the coefficients estimated using level form. *Sum* is the sum of the coefficients of *MB* or *CF* across five equations.

	Coefficients of <i>MB</i>						Coefficients of <i>CF</i>					
	<i>Inv</i>	$\Delta Cash$	<i>Div</i>	ΔD	ΔE	<i>Sum</i>	<i>Inv</i>	$\Delta Cash$	<i>Div</i>	ΔD	ΔE	<i>Sum</i>
Panel A: within transformation form												
OLS	0.03 (0.00)	0.01 (0.00)	0.00 (0.00)	0.01 (0.00)	0.03 (0.00)	0	0.25 (0.02)	0.18 (0.01)	0.01 (0.00)	-0.29 (0.01)	-0.25 (0.02)	1
GMM3	0.14 (0.01)	-31.91 (0.00)	0.01 (0.00)	0.06 (0.01)	108.33 (0.00)	-140.15	0.21 (0.02)	0.17 (0.01)	0.01 (0.00)	-0.26 (0.01)	-0.15 (0.02)	0.81
GMM4	-5.39 (0.00)	0.03 (0.00)	-0.81 (0.00)	-4.79 (0.00)	-2.38 (0.00)	1.01	0.19 (0.01)	0.17 (0.01)	0.01 (0.00)	-0.29 (0.01)	-0.18 (0.02)	0.84
GMM5	0.09 (0.00)	0.00 (0.00)	0.10 (0.00)	-2.18 (0.00)	0.00 (0.00)	2.37	0.18 (0.01)	0.19 (0.01)	0.01 (0.00)	-0.29 (0.01)	-0.17 (0.01)	0.84
Panel B: level form												
OLS	0.03 (0.00)	0.01 (0.00)	0.00 (0.00)	0.01 (0.00)	0.03 (0.00)	0	0.29 (0.03)	0.14 (0.01)	0.02 (0.00)	-0.24 (0.01)	-0.31 (0.03)	1
GMM3	-7.81 (0.00)	0.14 (0.01)	0.02 (0.00)	0.00 (0.00)	0.23 (0.01)	-7.88	0.26 (0.01)	0.19 (0.01)	0.02 (0.00)	-0.21 (0.02)	-0.26 (0.02)	0.94
GMM4	0.20 (0.00)	2.56 (0.00)	0.02 (0.00)	0.03 (0.00)	-2.04 (0.00)	4.79	0.25 (0.01)	0.17 (0.01)	0.02 (0.00)	-0.24 (0.01)	-0.18 (0.01)	0.86
GMM5	0.12 (0.00)	0.06 (0.00)	-0.51 (0.00)	0.00 (0.00)	-1.31 (0.00)	0.99	0.23 (0.01)	0.16 (0.01)	0.02 (0.00)	-0.26 (0.01)	-0.18 (0.01)	0.87

Table VI. The Effects of Beveridge-Nelson Cash Flow Components on Corporate Policies

The data are from Compustat and CRSP for 1971–2011. To implement Beveridge and Nelson decomposition, we restrict the sample to the firms having at least consecutive 15 years of annual cash flows. As a result, the sample size is reduced to 46,991 and number of firms is 4,869 for this test. We decompose unscaled cash flows into trend and cycle components and then scale both by the beginning-of-period book value of assets. To estimate regressions with firm fixed effects in both panels, we demean the dependent and all independent variables in the equations. The constant term and year dummies are included in regressions but not reported. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The *t*-statistics are presented in parentheses. Panel A reports regression results for the restricted sample. Panel B shows results obtained using two components of cash flows.

Dependent Variables	Panel A: Reproduce Panel A of Table III using the reduced sample					Panel B: The effects of Beveridge-Nelson cash flow components				
	(1) <i>Inv_t</i>	(2) $\Delta Cash_t$	(3) <i>Div_t</i>	(4) ΔD_t	(5) ΔE_t	(6) <i>Inv_t</i>	(7) $\Delta Cash_t$	(8) <i>Div_t</i>	(9) ΔD_t	(10) ΔE_t
<i>CF_t</i>	0.28*** (45.1)	0.33*** (69.8)	0.01*** (21.5)	-0.28*** (-55.4)	-0.10*** (-20.0)					
<i>CF_{Cycle}_t</i>						0.23*** (30.0)	0.36*** (61.8)	0.01*** (10.9)	-0.32*** (-50.5)	-0.09*** (-13.5)
<i>CF_{Trend}_t</i>						0.34*** (40.6)	0.29*** (45.4)	0.01*** (23.2)	-0.23*** (-34.4)	-0.12*** (-17.9)
<i>MB_{t-1}</i>	0.02*** (31.6)	0.01*** (11.9)	0.00*** (17.9)	0.01*** (13.4)	0.02*** (37.2)	0.02*** (31.4)	0.01*** (12.1)	0.00*** (17.7)	0.01*** (13.2)	0.02*** (37.3)
<i>SaleG_{t-1}</i>	0.03*** (14.5)	0.00 (1.1)	-0.00*** (-5.8)	0.02*** (11.4)	0.01*** (6.7)	0.03*** (14.8)	0.00 (0.8)	-0.00*** (-5.5)	0.02*** (11.7)	0.01*** (6.6)
<i>Ln(Assets)_{t-1}</i>	-0.02*** (-20.2)	-0.01*** (-17.6)	0.00*** (3.5)	-0.01*** (-8.3)	-0.03*** (-32.2)	-0.02*** (-19.0)	-0.01*** (-18.5)	0.00*** (4.6)	-0.01*** (-7.2)	-0.03*** (-32.5)
<i>Leverage_{t-1}</i>	-0.15*** (-29.6)	0.01** (2.3)	-0.02*** (-40.7)	-0.22*** (-52.8)	0.06*** (14.8)	-0.15*** (-28.4)	0.01 (1.3)	-0.02*** (-39.5)	-0.22*** (-51.6)	0.06*** (14.2)
<i>Tangibility_{t-1}</i>	0.04*** (5.4)	0.07*** (13.3)	0.00*** (3.7)	0.07*** (12.0)	0.04*** (7.4)	0.03*** (4.9)	0.08*** (13.8)	0.00*** (3.2)	0.07*** (11.5)	0.04*** (7.6)
N	46,991	46,991	46,991	46,991	46,991	46,991	46,991	46,991	46,991	46,991
R-squared	0.13	0.11	0.07	0.13	0.07	0.13	0.12	0.07	0.13	0.07

Table VII. The Effects of Beveridge-Nelson Cash Flow Components on Corporate Policies under Various Financial Constraint Partitions

The data are from Compustat and CRSP for 1971–2011. The table reports the effects of cash flow (*CF*) and the Beveridge-Nelson cash flow components on corporate policies for the subsamples defined using various financial constraint measures. Each year a firm is classified as financially more constrained if its $\ln(\text{Assets})$ is below the 30th percentile, its *HP* index or the *WW* index is above the 70th percentile, pays no dividends, or has no credit rating. A firm is classified as financially less constrained if its $\ln(\text{Assets})$ is above the 70th percentile, its *HP* index or the *WW* index is below the 30th percentile, pays dividends, or has a credit rating. The *HP* index is defined as $-0.737 \times \ln(\text{Assets}) + 0.043 \times \ln(\text{Assets})^2 + 0.04 \times \text{Firm age}$. *Firm age* is the number of years the firm has been on Compustat with a non-missing stock price. The *WW* index is defined as $-0.091 \times \text{Cash Flows/Assets} - 0.062 \times \text{Dividend Payer} + 0.021 \times \text{long-term debt/Assets} - 0.044 \times \ln(\text{Assets}) + 0.102 \times \text{industry median Sale Growth} - 0.035 \times \text{Sale Growth}$. The models in Table VI are estimated separately for more and less constrained subsamples. Only the coefficients on level, cycle, and trend components of cash flow are reported. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The *t*-statistics are presented in parentheses.

		Dependent Variables:				
		(1) <i>Inv_t</i>	(2) ΔCash_t	(3) <i>Div_t</i>	(4) ΔD_t	(5) ΔE_t
Panel A: Coefficients of <i>CF</i> for subsamples						
Constraint Measure: <i>Ln(Assets)</i>						
More constrained	<i>CF_t</i>	0.21*** (24.2)	0.38*** (46.6)	0.01*** (10.0)	-0.28*** (-41.4)	-0.12*** (-14.0)
Less constrained	<i>CF_t</i>	0.45*** (27.3)	0.24*** (29.3)	0.02*** (13.9)	-0.25*** (-17.7)	-0.04*** (-5.4)
Constraint Measure: <i>HP Index</i>						
More constrained	<i>CF_t</i>	0.24*** (24.1)	0.37*** (41.0)	0.01*** (9.3)	-0.27*** (-35.9)	-0.12*** (-10.7)
Less constrained	<i>CF_t</i>	0.38*** (27.0)	0.26*** (33.6)	0.02*** (15.4)	-0.29*** (-23.1)	-0.05*** (-8.8)
Constraint Measure: <i>WW Index</i>						
More constrained	<i>CF_t</i>	0.20*** (22.7)	0.36*** (43.9)	0.00*** (8.7)	-0.29*** (-41.2)	-0.15*** (-16.2)
Less constrained	<i>CF_t</i>	0.45*** (26.9)	0.26*** (32.6)	0.02*** (15.3)	-0.23*** (-16.4)	-0.04*** (-5.1)
Constraint Measure: <i>Dividend Payout</i>						
More constrained	<i>CF_t</i>	0.26*** (34.2)	0.35*** (52.4)	0.00*** (9.0)	-0.27*** (-44.5)	-0.11*** (-14.3)
Less constrained	<i>CF_t</i>	0.32*** (29.0)	0.30*** (49.6)	0.02*** (20.6)	-0.31*** (-31.9)	-0.05*** (-9.3)
Constraint Measure: <i>Credit Rating</i>						
More constrained	<i>CF_t</i>	0.26*** (38.7)	0.35*** (63.4)	0.01*** (17.1)	-0.28*** (-54.8)	-0.10*** (-17.2)
Less constrained	<i>CF_t</i>	0.43*** (24.1)	0.23*** (23.4)	0.02*** (12.4)	-0.27*** (-16.6)	-0.04*** (-5.3)
Panel B: Coefficients of <i>CF_Cycle</i> and <i>CF_Trend</i> for subsamples						
Constraint Measure: <i>Ln(Assets)</i>						
More constrained	<i>CF_Cycle_t</i>	0.18***	0.41***	0.00***	-0.30***	-0.10***

		(16.9)	(41.2)	(5.9)	(-36.5)	(-9.5)
	<i>CF_Trend_t</i>	0.26***	0.33***	0.01***	-0.25***	-0.15***
		(20.8)	(29.3)	(9.9)	(-26.2)	(-12.3)
Less constrained	<i>CF_Cycle_t</i>	0.35***	0.27***	0.01***	-0.33***	-0.04***
		(16.5)	(25.7)	(6.3)	(-18.0)	(-4.0)
	<i>CF_Trend_t</i>	0.54***	0.21***	0.02***	-0.19***	-0.04***
		(26.6)	(21.0)	(15.4)	(-10.5)	(-4.6)
Constraint Measure: <i>HP Index</i>						
More constrained	<i>CF_Cycle_t</i>	0.20***	0.40***	0.00***	-0.29***	-0.10***
		(16.5)	(35.1)	(5.9)	(-30.9)	(-7.6)
	<i>CF_Trend_t</i>	0.28***	0.34***	0.01***	-0.24***	-0.13***
		(20.9)	(27.6)	(8.6)	(-23.9)	(-9.0)
Less constrained	<i>CF_Cycle_t</i>	0.29***	0.30***	0.01***	-0.36***	-0.04***
		(16.5)	(31.9)	(7.5)	(-23.4)	(-5.2)
	<i>CF_Trend_t</i>	0.49***	0.21***	0.03***	-0.20***	-0.07***
		(26.6)	(20.6)	(17.2)	(-12.5)	(-8.9)
Constraint Measure: <i>WW Index</i>						
More constrained	<i>CF_Cycle_t</i>	0.17***	0.39***	0.00***	-0.32***	-0.12***
		(16.2)	(39.4)	(5.3)	(-36.9)	(-10.8)
	<i>CF_Trend_t</i>	0.24***	0.31***	0.01***	-0.26***	-0.18***
		(19.3)	(27.3)	(8.5)	(-25.7)	(-14.6)
Less constrained	<i>CF_Cycle_t</i>	0.35***	0.29***	0.01***	-0.31***	-0.03***
		(16.2)	(27.8)	(7.9)	(-16.9)	(-3.8)
	<i>CF_Trend_t</i>	0.53***	0.24***	0.03***	-0.17***	-0.04***
		(26.2)	(24.6)	(16.1)	(-9.7)	(-4.4)
Constraint Measure: <i>Dividend Payout</i>						
More constrained	<i>CF_Cycle_t</i>	0.22***	0.38***	0.00***	-0.30***	-0.09***
		(23.2)	(45.9)	(4.9)	(-39.8)	(-10.1)
	<i>CF_Trend_t</i>	0.32***	0.31***	0.00***	-0.24***	-0.13***
		(30.2)	(34.2)	(9.4)	(-28.0)	(-12.1)
Less constrained	<i>CF_Cycle_t</i>	0.26***	0.33***	0.01***	-0.36***	-0.03***
		(18.7)	(43.9)	(10.5)	(-30.6)	(-5.7)
	<i>CF_Trend_t</i>	0.40***	0.27***	0.03***	-0.24***	-0.06***
		(27.5)	(33.8)	(22.5)	(-19.2)	(-9.2)
Constraint Measure: <i>Credit Rating</i>						
More constrained	<i>CF_Cycle_t</i>	0.21***	0.38***	0.01***	-0.32***	-0.09***
		(26.1)	(55.5)	(8.9)	(-49.4)	(-11.9)
	<i>CF_Trend_t</i>	0.31***	0.31***	0.01***	-0.24***	-0.12***
		(34.5)	(41.6)	(18.2)	(-34.3)	(-15.0)
Less constrained	<i>CF_Cycle_t</i>	0.36***	0.27***	0.01***	-0.32***	-0.04***
		(16.0)	(21.6)	(6.2)	(-15.2)	(-3.9)
	<i>CF_Trend_t</i>	0.51***	0.19***	0.02***	-0.23***	-0.05***
		(22.2)	(15.3)	(13.4)	(-11.0)	(-4.5)

Table VIII. The Value of Temporary and Permanent Components of Cash Flow

The data are from Compustat and CRSP for 1971–2011. The dependent variable is the change in market value of equity scaled by lagged book value of assets ($\Delta MVE/Assets$). The independent variables are also deflated by beginning-of-period book value of assets. To deal with estimation biases introduced by unobserved heterogeneity, we include fixed effects at the level of year, size and book-to-market quintile in our regressions. We use the change in cash and cash flow as key independent variables in the regressions and report the results in columns (1) and (2) respectively. In column (3), we include cycle and trend components in regressions to examine their respective valuation impact. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The t-statistics are presented in parentheses.

	Dependent Variable: $\Delta MVE/Assets$		
	(1)	(2)	(3)
$\Delta Cash_t$	1.20*** (25.8)		
CF_t		1.20*** (25.8)	
CF_Cycle_t			0.93*** (17.6)
CF_Trend_t			1.42*** (25.9)
Inv_t	1.05*** (26.4)	-0.15*** (-3.4)	-0.18*** (-4.0)
Div	2.40*** (13.6)	1.19*** (6.6)	1.03*** (5.7)
ΔD_t	-0.87*** (-21.6)	0.33*** (6.6)	0.33*** (6.7)
ΔE_t	-0.45*** (-8.3)	0.75*** (13.7)	0.78*** (13.9)
MB_{t-1}	-0.04*** (-4.6)	-0.04*** (-4.6)	-0.04*** (-4.6)
$SaleG_{t-1}$	-0.03* (-1.9)	-0.03* (-1.9)	-0.03* (-1.9)
$Ln(Assets)_{t-1}$	0.00 (0.5)	0.00 (0.5)	0.00 (0.2)
$Leverage_{t-1}$	-0.07*** (-5.4)	-0.07*** (-5.4)	-0.05*** (-4.0)
$Tangibility_{t-1}$	-0.13*** (-11.0)	-0.13*** (-11.0)	-0.15*** (-12.6)
Observations	31,505	31,505	31,505
R-squared	0.18	0.18	0.18

Appendix A. The Equivalence of SUR and OLS Estimates when the Regressors Are Identical across Different Equations

Theorem:

Consider the following equations:

$$\begin{bmatrix} y_1 \\ y_2 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ y_M \end{bmatrix} = \begin{bmatrix} X_1 & 0 & \cdot & \cdot & \cdot & 0 \\ 0 & X_2 & 0 & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & \cdot & \cdot & 0 & X_M \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \beta_M \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ \varepsilon_M \end{bmatrix} = X\beta + \varepsilon$$

$E(\varepsilon\varepsilon') = \Omega$, where $\Omega = \Sigma \otimes I_T$ and $\Sigma = [\sigma_{ij}]$, $i, j = 1, 2, \dots, M$. When the regressors are identical across different equations, SUR estimates $\tilde{\beta}$ (system of equations) and OLS estimates $\hat{\beta}$ are numerically equivalent and equally efficient.

Proof:

$$X = \begin{bmatrix} X_1 & 0 & \cdot & \cdot & \cdot & 0 \\ 0 & X_2 & 0 & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & \cdot & \cdot & 0 & X_M \end{bmatrix} = \begin{bmatrix} X^* & 0 & \cdot & \cdot & \cdot & 0 \\ 0 & X^* & 0 & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & \cdot & \cdot & 0 & X^* \end{bmatrix} = I_M \otimes X^*$$

and

$$\begin{aligned} X'\Omega^{-1}X &= (I_M \otimes X^*)'(\Sigma \otimes I_T)^{-1}(I_M \otimes X^*) \\ &= (I_M \otimes X'^*)(\Sigma^{-1} \otimes I_T)(I_M \otimes X^*) \\ &= (\Sigma^{-1} \otimes X'^*)(I_M \otimes X^*) \\ &= \Sigma^{-1} \otimes (X'^*X^*) \end{aligned}$$

$$\begin{aligned} X'\Omega^{-1}y &= (I_M \otimes X^*)'(\Sigma \otimes I_T)^{-1}y \\ &= (I_M \otimes X'^*)(\Sigma^{-1} \otimes I_T)y \\ &= (\Sigma^{-1} \otimes X'^*)y \end{aligned}$$

The SUR estimator is therefore

$$\begin{aligned}
\tilde{\beta} &= (X' \Omega^{-1} X)^{-1} X' \Omega^{-1} y \\
&= [\Sigma^{-1} \otimes (X'^* X^*)]^{-1} [(\Sigma^{-1} \otimes X'^*) y] \\
&= (\Sigma \otimes (X'^* X^*)^{-1}) (\Sigma^{-1} \otimes X'^*) y \\
&= (\Sigma \otimes (X'^* X^*)^{-1} X'^*) y \\
&= \begin{bmatrix} (X'^* X^*)^{-1} X'^* & 0 & \cdot & \cdot & \cdot & 0 \\ 0 & (X'^* X^*)^{-1} X'^* & 0 & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & \cdot & \cdot & \cdot & 0 & (X'^* X^*)^{-1} X'^* \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ \cdot \\ \cdot \\ \cdot \\ y_M \end{bmatrix} \\
&= \begin{bmatrix} (X'^* X^*)^{-1} X'^* y_1 \\ (X'^* X^*)^{-1} X'^* y_2 \\ \cdot \\ \cdot \\ \cdot \\ (X'^* X^*)^{-1} X'^* y_M \end{bmatrix} = \begin{bmatrix} \hat{\beta}_1 \\ \hat{\beta}_2 \\ \cdot \\ \cdot \\ \cdot \\ \hat{\beta}_M \end{bmatrix} = \hat{\beta}
\end{aligned}$$

Note that this theorem holds regardless of the correlation among the disturbances across different equations.

Appendix B. The BN Decomposition

To implement the BN decomposition, Δy_t is fitted using an $ARMA(p, q)$ model. Then the trend/cycle components are calculated using (23) and (25). However, the calculation process of trend and cycle is often complicated as the limiting forecast in equation (23) contains infinite sums. Morley (2002) simplifies the calculation of BN decomposition by applying the state-space approach to the forecasting model for $(\Delta y_t - \mu)$.⁴⁰ Specifically, suppose $(\Delta y_t - \mu)$ is a liner combination of the elements of a $k \times 1$ state vector X_t :

$$(\Delta y_t - \mu) = [h_1, h_2 \dots h_k] X_t \quad (B1)$$

where X_t is modeled as the first order stochastic difference equation: $X_t = FX_{t-1} + \eta_t$ and $\eta_t \sim N(0, \Omega)$. All of the eigenvalues of F are less than unity and F is invertible. Then, the expected j -period-ahead forecast of the $(\Delta y_t - \mu)$ is:

$$E_t[(\Delta y_{t+j} - \mu)] = [h_1, h_2 \dots h_k] F^j E_t[X_t] \quad (B2)$$

$E_t[X_t]$ can be obtained via Kalman filter and the filtered estimate is denoted as $X_{t|t}$. Applying (B2) directly into the definition of trend component (23), we can have the general form of BN trend as:

$$\tau_t = y_t + [h_1, h_2 \dots h_k] F(1 - F)^{-1} X_{t|t} \quad (B3)$$

Thus, the general form of BN cycle is written as:

$$c_t = y_t - \tau_t = -[h_1, h_2 \dots h_k] F(1 - F)^{-1} X_{t|t} \quad (B4)$$

Following Morley, Nelson, and Zivot (2003), we calculate the BN decomposition of the first difference of unscaled cash flow series by fitting a $ARMA(2, 2)$ model

$$(\Delta y_t - \mu) = \phi_1(\Delta y_{t-1} - \mu) + \phi_2(\Delta y_{t-2} - \mu) + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2}, \quad \varepsilon_t \sim iidN(0, \sigma^2) \quad (B5)$$

The calculation of $ARMA(2, 2)$ is convenient because it has $(\Delta y_t - \mu)$ as the first element of the state vector X_t :

$$\begin{bmatrix} \Delta y_t - \mu \\ \Delta y_{t-1} - \mu \\ \varepsilon_t \\ \varepsilon_{t-1} \end{bmatrix} = \begin{bmatrix} \phi_1 & \phi_2 & \theta_1 & \theta_2 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} \Delta y_{t-1} - \mu \\ \Delta y_{t-2} - \mu \\ \varepsilon_{t-1} \\ \varepsilon_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_t \\ 0 \\ \varepsilon_t \\ 0 \end{bmatrix} \quad (B6)$$

Then, the BN trend of unscaled cash flow y_t is:

$$\tau_t = y_t + [1 \quad 0 \quad 0 \quad 0] F(1 - F)^{-1} X_{t|t} \quad (B7)$$

Thus, the corresponding BN cycle is:

$$c_t = y_t - \tau_t = -[1 \quad 0 \quad 0 \quad 0] F(1 - F)^{-1} X_{t|t} \quad (B8)$$

It is not necessarily the case that the trend and cycle are made up of orthogonal components.

⁴⁰ Morley (2002)'s state-space approach can be generalized by applying multivariate forecasting models for Δy_t . In Cochrane (1994), a VECM forecasting model of aggregate income and consumption is utilized to calculate trend and cycle of observed aggregate income. The simple state-space representation of Cochrane's (1994) model also can be found in Morley (2002).

Appendix C. OLS and GMM Coefficients for Investment Equation (Within Transformation)

We transform the observations for each firm into deviations from firm-specific average (within transformation). Then, each year we estimate the investment equation and obtain coefficients (marked in bold) using the OLS, GMM3, GMM4, and GMM5. To aggregate yearly coefficient estimates, we use Fama-MacBeth for OLS and minimum distance method (Erickson and Whited (2012)) for GMM estimators. The numbers reported at the end of the Appendix are those can be found in the investment equation of the Panel A (within transformation form) in Table V. The instances in which both identification and over-identification are satisfied are highlighted in grey. The test statistics for Identification tests and J tests are reported with their P-values. Standard errors are included in parentheses under the estimated parameters.

Year	ID	J Test		Coefficients of <i>MB</i>				Coefficients of <i>CF</i>			
	Test	GMM4	GMM5	OLS	GMM3	GMM4	GMM5	OLS	GMM3	GMM4	GMM5
1972	1.68 (0.43)	0.05 (0.97)	3.79 (0.58)	0.00 (0.00)	1.44 (7.58)	-5.39 (0.00)	0.04 (0.02)	0.48 (0.07)	-3.69 (22.12)	16.14 (5.72)	0.39 (0.10)
1973	0.07 (0.96)	2.65 (0.27)	4.35 (0.50)	0.01 (0.00)	-0.01 (0.30)	0.06 (0.06)	0.05 (0.03)	0.39 (0.07)	0.44 (0.58)	0.30 (0.14)	0.31 (0.11)
1974	0.35 (0.84)	0.59 (0.75)	1.48 (0.91)	0.02 (0.01)	-0.12 (0.37)	-0.03 (0.06)	0.08 (0.03)	0.50 (0.06)	0.82 (0.86)	0.61 (0.16)	0.36 (0.12)
1975	0.37 (0.83)	2.14 (0.34)	5.51 (0.36)	0.00 (0.01)	-0.03 (0.15)	-0.01 (0.02)	0.11 (0.08)	0.33 (0.06)	0.33 (0.08)	0.33 (0.08)	0.32 (0.09)
1976	0.01 (0.99)	0.03 (0.99)	5.37 (0.37)	0.01 (0.01)	0.40 (4.19)	0.14 (0.20)	0.36 (0.14)	0.49 (0.05)	0.41 (0.95)	0.47 (0.13)	0.42 (0.20)
1977	1.12 (0.57)	1.02 (0.60)	3.74 (0.59)	0.02 (0.01)	-0.07 (0.33)	0.28 (0.14)	0.28 (0.14)	0.38 (0.05)	0.45 (0.27)	0.18 (0.15)	0.18 (0.17)
1978	5.82 (0.05)	1.91 (0.38)	5.26 (0.38)	0.05 (0.01)	0.07 (0.02)	0.97 (1.49)	0.40 (0.09)	0.51 (0.06)	0.50 (0.10)	0.01 (0.77)	0.32 (0.16)
1979	6.36 (0.04)	2.01 (0.37)	2.28 (0.81)	0.01 (0.01)	-0.14 (0.09)	-0.05 (0.02)	-0.06 (0.01)	0.47 (0.05)	0.50 (0.11)	0.48 (0.10)	0.48 (0.10)
1980	1.92 (0.38)	1.62 (0.44)	5.66 (0.34)	0.06 (0.01)	0.43 (0.87)	0.45 (0.25)	0.39 (0.11)	0.36 (0.07)	0.11 (0.67)	0.10 (0.30)	0.14 (0.22)
1981	9.41 (0.01)	2.37 (0.31)	7.13 (0.21)	0.03 (0.01)	-0.21 (0.28)	0.66 (0.57)	0.40 (0.16)	0.53 (0.06)	1.19 (0.83)	-1.21 (1.51)	-0.50 (0.46)
1982	1.52 (0.47)	0.35 (0.84)	2.37 (0.80)	0.03 (0.01)	0.30 (0.10)	0.36 (0.04)	-0.26 (0.66)	0.45 (0.05)	0.43 (0.14)	0.43 (0.16)	0.47 (0.19)
1983	2.59 (0.27)	3.00 (0.22)	5.65 (0.34)	0.05 (0.01)	0.36 (0.12)	-0.19 (0.23)	0.09 (0.03)	0.23 (0.05)	0.04 (0.13)	0.37 (0.24)	0.20 (0.12)
1984	0.54 (0.77)	0.76 (0.68)	3.95 (0.56)	0.02 (0.00)	0.06 (0.13)	0.11 (0.08)	0.72 (0.59)	0.14 (0.02)	0.15 (0.03)	0.16 (0.04)	0.26 (0.17)
1985	1.33 (0.51)	1.38 (0.50)	2.41 (0.79)	0.03 (0.00)	0.28 (0.41)	0.10 (0.03)	0.11 (0.02)	0.12 (0.02)	0.17 (0.10)	0.14 (0.03)	0.14 (0.03)
1986	7.35 (0.03)	3.62 (0.16)	8.91 (0.11)	0.03 (0.00)	0.63 (0.56)	6.48 (23.57)	0.33 (0.11)	0.12 (0.02)	0.16 (0.12)	0.56 (1.89)	0.14 (0.06)
1987	8.06 (0.02)	6.47 (0.04)	11.95 (0.04)	0.02 (0.00)	0.36 (0.23)	0.03 (0.02)	0.10 (0.03)	0.15 (0.02)	0.42 (0.19)	0.16 (0.04)	0.22 (0.04)
1988	0.56 (0.76)	0.68 (0.71)	1.67 (0.89)	0.03 (0.00)	-0.14 (0.53)	0.07 (0.03)	0.07 (0.04)	0.18 (0.02)	0.14 (0.15)	0.20 (0.03)	0.19 (0.03)
1989	0.61 (0.74)	4.82 (0.09)	8.63 (0.12)	0.02 (0.00)	0.29 (0.38)	-0.12 (0.14)	-0.11 (0.11)	0.18 (0.02)	0.30 (0.17)	0.11 (0.08)	0.12 (0.08)
1990	2.78 (0.25)	0.44 (0.80)	3.06 (0.69)	0.02 (0.00)	0.30 (0.21)	0.39 (0.14)	0.17 (0.06)	0.18 (0.02)	0.29 (0.11)	0.32 (0.12)	0.24 (0.06)
1991	2.59 (0.27)	1.72 (0.42)	6.68 (0.25)	0.01 (0.00)	2.02 (12.62)	0.33 (0.11)	-0.09 (0.02)	0.09 (0.02)	1.39 (8.24)	0.29 (0.12)	0.03 (0.05)

1992	10.34 (0.01)	0.51 (0.78)	5.05 (0.41)	0.02 (0.00)	0.41 (0.22)	0.58 (0.21)	0.24 (0.06)	0.16 (0.03)	0.04 (0.14)	-0.01 (0.15)	0.10 (0.08)
1993	8.12 (0.02)	2.39 (0.30)	5.19 (0.39)	0.04 (0.00)	0.34 (0.10)	0.41 (0.07)	0.23 (0.05)	0.10 (0.02)	0.19 (0.08)	0.21 (0.10)	0.16 (0.06)
1994	5.02 (0.08)	4.44 (0.11)	5.47 (0.36)	0.02 (0.00)	0.23 (0.15)	0.11 (0.04)	0.13 (0.03)	0.21 (0.02)	0.19 (0.06)	0.20 (0.04)	0.20 (0.04)
1995	2.52 (0.28)	0.90 (0.64)	3.68 (0.60)	0.03 (0.00)	0.43 (0.25)	0.45 (0.15)	0.16 (0.03)	0.11 (0.02)	0.00 (0.12)	0.00 (0.10)	0.07 (0.06)
1996	11.82 (0.00)	2.02 (0.36)	5.70 (0.34)	0.04 (0.00)	0.32 (0.06)	0.28 (0.04)	0.19 (0.03)	0.18 (0.02)	0.34 (0.08)	0.31 (0.07)	0.27 (0.05)
1997	2.34 (0.31)	1.63 (0.44)	6.17 (0.29)	0.03 (0.00)	0.31 (0.10)	0.26 (0.04)	0.15 (0.05)	0.10 (0.02)	0.26 (0.10)	0.23 (0.08)	0.17 (0.07)
1998	5.82 (0.05)	4.77 (0.09)	12.46 (0.03)	0.03 (0.00)	-0.67 (1.28)	-0.01 (0.06)	0.18 (0.04)	0.13 (0.02)	0.20 (0.20)	0.14 (0.03)	0.12 (0.04)
1999	11.04 (0.00)	3.27 (0.19)	6.07 (0.30)	0.04 (0.00)	0.33 (0.09)	0.48 (0.11)	0.30 (0.06)	0.11 (0.02)	0.02 (0.09)	-0.03 (0.13)	0.03 (0.08)
2000	22.69 (0.00)	5.70 (0.06)	10.44 (0.06)	0.04 (0.00)	0.21 (0.03)	0.14 (0.02)	0.13 (0.02)	0.20 (0.03)	0.30 (0.07)	0.26 (0.05)	0.26 (0.05)
2001	1.41 (0.49)	1.46 (0.48)	3.76 (0.58)	0.02 (0.00)	0.55 (0.44)	0.09 (0.04)	0.12 (0.02)	0.22 (0.02)	-0.05 (0.29)	0.18 (0.05)	0.17 (0.05)
2002	6.78 (0.03)	2.39 (0.30)	6.24 (0.28)	0.02 (0.00)	0.53 (0.85)	0.17 (0.04)	0.13 (0.02)	0.21 (0.02)	0.27 (0.18)	0.23 (0.04)	0.22 (0.04)
2003	0.09 (0.95)	1.32 (0.52)	3.09 (0.69)	0.03 (0.00)	-0.04 (0.95)	0.16 (0.05)	0.16 (0.03)	0.20 (0.02)	0.19 (0.05)	0.20 (0.05)	0.20 (0.05)
2004	7.00 (0.03)	3.31 (0.19)	7.68 (0.18)	0.03 (0.00)	0.30 (0.12)	0.19 (0.04)	0.17 (0.01)	0.19 (0.02)	0.09 (0.10)	0.14 (0.07)	0.14 (0.06)
2005	5.87 (0.05)	2.18 (0.34)	4.33 (0.50)	0.03 (0.00)	0.28 (0.11)	0.12 (0.03)	0.10 (0.03)	0.23 (0.03)	0.09 (0.11)	0.18 (0.05)	0.19 (0.05)
2006	3.63 (0.16)	0.99 (0.61)	7.48 (0.19)	0.03 (0.00)	0.48 (0.30)	0.49 (0.13)	0.25 (0.08)	0.36 (0.03)	0.16 (0.20)	0.16 (0.15)	0.26 (0.10)
2007	0.59 (0.74)	3.66 (0.16)	6.88 (0.23)	0.02 (0.00)	0.05 (0.20)	-0.26 (0.44)	0.16 (0.06)	0.16 (0.03)	0.15 (0.06)	0.22 (0.14)	0.12 (0.05)
2008	5.11 (0.08)	3.90 (0.14)	5.12 (0.40)	0.02 (0.00)	-0.04 (0.06)	0.12 (0.08)	0.18 (0.06)	0.26 (0.03)	0.32 (0.08)	0.17 (0.09)	0.11 (0.08)
2009	1.68 (0.43)	0.05 (0.97)	3.79 (0.58)	0.00 (0.00)	1.44 (7.58)	-5.39 (0.00)	0.04 (0.02)	0.48 (0.07)	-3.69 (22.12)	16.14 (5.72)	0.39 (0.10)
2010	0.07 (0.96)	2.65 (0.27)	4.35 (0.50)	0.01 (0.00)	-0.01 (0.30)	0.06 (0.06)	0.05 (0.03)	0.39 (0.07)	0.44 (0.58)	0.30 (0.14)	0.31 (0.11)
2011	0.35 (0.84)	0.59 (0.75)	1.48 (0.91)	0.02 (0.01)	-0.12 (0.37)	-0.03 (0.06)	0.08 (0.03)	0.50 (0.06)	0.82 (0.86)	0.61 (0.16)	0.36 (0.12)
Fama-MacBeth/Minimum distance				0.03 (0.00)	0.14 (0.01)	-5.39 (0.00)	0.09 (0.00)	0.25 (0.02)	0.21 (0.02)	0.19 (0.01)	0.18 (0.01)
Standard errors											

Essay Two:

**Firm Misvaluation, Costly External Finance, and
the Uses of Cash Flow**

ABSTRACT

We model the impact of firm misvaluation on the allocation of internal cash flow across its various uses, including investment, cash holdings, and financing activities. Our model predicts that when firms are undervalued, they allocate additional cash flow towards investment and cash holdings, away from substituting costly external finance. Conversely, when overvalued, firms shift additional cash flow from investment and cash holdings to reductions in external financing. Our empirical results confirm these predictions. Furthermore, consistent with the premise that debt is less mispriced than equity, firms reduce more equity than debt using additional cash flows as they become more overvalued. Taken together, our results imply that (1) overvaluation (undervaluation) alleviates (exacerbates) financial constraints; (2) firms dampen the effects of misvaluation on corporate policies via altering the allocation of internal cash flow across different uses.

JEL classification: G31, G32

Keywords: Cash flow, misvaluation, financial constraints, investment, cash holdings, external finance

I. Introduction

Firms allocate internally generated cash flow to several basic uses: investment, cash holdings, dividends, and reduction in external finance. These uses of cash flow are interrelated and determined *jointly* and *simultaneously* by firms (Tobin, 1988). How do firms allocate internal cash flow when they face costly external finance (i.e., financial constraints) and misvaluation?⁴¹

This question deserves attention since it has important implications for economic policy. For instance, facing costly external finance, if firms use cash flow to primarily build up cash balances or reduce the amount of debt and equity outstanding, then the effect of economic policy, such as tax and interest rate cuts, which aim at improving firms' profitability and spurring investment, may be muted. In addition, economic policy is often formulated in response to perceived misvaluation in asset markets: for example, monetary tightening to deal with asset bubbles or monetary easing to alleviate depressed stock market conditions. Understanding how capital market misvaluation affects the allocation of cash flow across various uses may improve the effectiveness of economic policy in influencing firm investment and saving decisions.

In this paper we model the interdependence and simultaneity of basic uses of cash flow, and show how the uses jointly respond to cash flow shocks and misvaluation. Our model requires that investment, cash holdings, and financing decisions are simultaneously made by managers who maximize existing shareholders' value. These decisions are interdependent through the cash flow identity, which

⁴¹ Kaplan and Zingales (1997) define financially constrained firms as those facing a wedge between the internal and external costs of funds. The costs of external finance may arise from market imperfections, which include agency problems, informational asymmetries, contracting imperfections, lack of collateral, and flotation costs when accessing external markets (Almeida and Campello, 2010). The cost differential between the internal and external funds can create a potential relevance of the availability of internal cash flow for corporate decisions (e.g., Fazzari, Hubbard, and Petersen, 1988). By firm misvaluation, we mean mispricings of debt and equity caused by capital market inefficiencies.

stipulates that uses of cash (investment and increase in cash holdings) must equal sources of cash (internally generated cash flow and externally raised funds) in every period. The model assumes deadweight costs of external finance caused by market imperfections and assumes that both equity and debt can be misvalued by investors because of capital market inefficiencies. Furthermore, we allow misvaluation to affect the wedge between the costs of internal and external financing. Firms can take advantage of misvaluation by issuing overpriced or retiring underpriced external capital. Finally, our model has an intertemporal element arising from firms' need to carry cash forward to safeguard future investment when facing uncertain future cash flows and costly external financing.

The model predicts that in response to an increase in internal cash flow, firms increase investment and cash holdings but decrease the use of external finance. Moreover, as firms become more overvalued, they increase investment, cash holdings, and external financing. These first-order effects of cash flow and misvaluation on firm decisions are generally consistent with the empirical findings in previous studies.⁴²

More importantly, the novel predictions of the model focus on the cross-effects, namely, how misvaluation affects the allocation of cash flow across its various uses. In particular, we show that as firms become more undervalued, for an additional dollar of internally generated cash flow, firms allocate a smaller portion of it to reducing their use of external financing, and plough a larger portion into investment and cash holdings. Conversely, as firms become more overvalued, firms channel additional cash flow from investment and cash holdings towards reductions in external financing. In other words, overvaluation reduces firms' reliance on internal

⁴² See, among others, Fazzari, Hubbard, and Petersen (1988), Kaplan and Zingales (1997), Almeida, Campello, and Weisbach (2004), Almeida and Campello (2010), Baker, Stein, and Wurgler (2003), Polk and Sapienza (2009), Baker and Wurgler (2002), and Campello and Graham (2013).

cash flow for investment and cash holding, but strengthens the substitution between internal and external funds.

The predictions that undervalued (overvalued) firms channel less (more) cash flow to substitute external finance may appear counter-intuitive, because the standard market timing arguments would suggest that undervalued firms should be more likely to retire underpriced external capital using additional internal funds, and that overvalued firms should take advantage of misvaluation by increasing external financing instead of decreasing it using additional cash flow.⁴³ We argue, however, these seemingly counter-intuitive predictions highlight the importance of the interdependent nature of investment, cash holdings, and external financing decisions. To wit, in response to undervaluation (overvaluation), firms would decrease (increase) external financing. Given that firm decisions are interdependent through the cash flow identity, the optimal levels of investment and cash holdings would decrease (increase) accordingly to absorb the changes in external financing, thereby leading to an increase (a decrease) in the marginal benefit of investment and a decrease (an increase) in the marginal cost of cash holdings. As a result, for each additional dollar of cash flow, a larger (smaller) portion is directed to investment and cash reserves, and a smaller (larger) portion is left for reducing external financing.

We then extend the analysis by dividing external financing into debt and equity financing, and allow equity to be more mispriced than debt.⁴⁴ The results show that as firms became more undervalued (overvalued), their marginal cost of equity financing becomes larger (smaller) for a given level of equity financing. Thus, they

⁴³ See, among others, Dittmar (2000), Loughran and Ritter (1997), and Baker and Wurgler (2002).

⁴⁴ Previous studies (e.g., Flannery, 1986; and Wittenberg-Moerman, 2009) have suggested that long-term debt is subject to information asymmetry, implying that debt can be mispriced. In a recent paper, Gao and Lou (2013) show that both equity and debt prices are affected by the same non-fundamental shocks, but to different degrees. In particular, the effect of non-fundamental shocks on bond prices is weaker than on equity prices.

need to substitute less (more) equity using additional cash flows to equate the marginal benefits of reducing debt and equity. In contrast, the debt-cash flow substitution is less responsive than the equity-cash flow substitution to the change in misvaluation because debt is less affected by mispricing.

Using a large panel of the U.S. firms from 1971 to 2011, we empirically test our model predictions. Following Chang et al. (2013), we estimate the allocation of cash flow across its various uses in terms of the coefficients of cash flow in a regression framework, in which various uses of cash are regressed on cash flow and other controls.⁴⁵ We measure the uses and sources of cash flow using the cash flow (flow-of-funds) statement to ensure that the cash flow identity holds in the data. As a result, the cash flow sensitivities of various uses of cash flow add up to unity.⁴⁶

A challenging part of our empirical analysis is to measure firm misvaluation, or equivalently, the nonfundamental component of asset prices. Following Baker, Stein, and Wurgler (2003), we first use the market-to-book assets ratio (*MB*) and future realized stock returns to capture misvaluation. Since *MB* contains both fundamental and nonfundamental components of asset prices (Baker, Stein, and Wurgler, 2003), we further isolate the nonfundamental component of asset prices from *MB* using the methods of Rhodes-Kropf, Robinson, and Viswanathan (2005) and Dong et al. (2006), respectively.

The empirical results confirm our model predictions. Specifically, we document that the allocation of cash flow significantly differs between overvalued and undervalued firms. After we partition firm-years into three groups using the market-to-book ratio, we find that firms with low *MB*, which are likely to be undervalued, on

⁴⁵ Essentially this is an extension of existing approaches that examine the so-called “cash flow sensitivities” of investment, change in cash holdings, or external finance (e.g., Fazzari, Hubbard, and Petersen, 1988; Almeida, Campello, and Weisbach, 2004).

⁴⁶ In other words, if internal cash flow increases by one dollar, then the changes in all uses of cash flow (e.g., investment, additions to cash holdings, and equity and debt reductions) must sum to one dollar.

average spend about 21 cents out of each additional dollar of cash flow on investment and add about 32 cents to cash balances. In contrast, firms with high *MB* (overvalued firms) invest 10 cents and increase cash holdings by 16 cents in response to a one-dollar increase in cash flow. These results indicate that undervaluation (overvaluation) increases (decreases) firms' reliance on internal cash flow for investment and cash holdings. In the meantime, undervalued firms allocate cash flow away from another use, namely, reducing external financing. Undervalued firms use 10 cents out of every additional dollar of cash flow to reduce external financing, compared to 49 cents for overvalued firms, suggesting that undervaluation (overvaluation) weakens (strengthens) the substitution between internal and external funds. Further analysis shows that with an extra dollar of cash flow, undervalued firms substitute more debt than equity, while overvalued firms reduce equity more than debt, consistent with our model predictions when debt is less mispriced than equity. We draw similar inferences based on alternative proxies for misvaluation, which include future realized stock returns and the nonfundamental components of the market-to-book assets ratio.

By examining how misvaluation affects the allocation of cash flow, we bring together two strands of the literature. First, our paper contributes to the literature on financial constraints and cash flow sensitivities. However, unlike prior studies that mainly examine the response of a particular use of cash flow to cash flow innovations in isolation (for example, the sensitivity of investment or additions to cash holdings to cash flow),⁴⁷ we simultaneously track all uses of cash flow to provide a complete picture as to what firms do with cash flow when facing costly external finance.⁴⁸ By

⁴⁷ Previous studies show that in presence of financial constraints (i.e., costly external finance), firms exhibit positive investment-cash flow (e.g., Fazzari, Hubbard, and Petersen, 1988; Kaplan and Zingales, 1997), positive cash-cash flow (Almeida, Campello, and Weisbach, 2004), and negative external finance-cash flow (Almeida and Campello, 2010) sensitivities.

⁴⁸ Three recent papers that investigate the allocation of cash flow across various uses in an integrated framework are Gatchev, Pulvino, and Tarhan (2010) and Lewellen and Lewellen (2013), and Chang et

doing so, our paper addresses Tobin's (1988) comment that "*... the firm jointly determines investment, dividend payments, and other ways of allocating its cash flow. Therefore, the authors (should) model investment and dividends as depending on the same set of explanatory variables.*" Moreover, by showing that overvalued (undervalued) firms rely less (more) on internal cash flow for investment and cash holdings, and direct more (less) cash flow to reducing external finance, our analysis suggests that overvaluation (undervaluation) alleviates (exacerbates) financial constraints that firms face.⁴⁹

The second strand of literature focuses on whether capital market inefficiencies spill over to the real economy by influencing firm investment and financing decisions. Previous studies have documented that misvaluation affects firm decisions directly (Polk and Sapienza, 2009) or through an "equity-financing" channel (e.g., Baker, Stein, and Wurgler, 2003; Campello and Graham, 2013). Our results reveal that misvaluation can also impact firm corporate investment, issuance, and saving policies through an "internal-financing" channel. Specifically, although firms issue more debt or equity when they are overvalued and use the proceeds to increase investment and cash holdings, they also allocate less internal cash flow to investment and cash holdings, and substitute more external finance with additional cash flow. That is, firms can dampen the effects of misvaluation on corporate policies via altering the allocation of internal cash flow across different uses.

The rest of this paper is organized as follows. Section II models how firm misvaluation and costly external finance jointly impact the allocation of internally generated cash flow. Our sample and empirical methodology are described in Section

al. (2013). However, none of these papers considers the effect of misvaluation on the allocation of cash flow.

⁴⁹ This is consistent with the recent findings of Campello and Graham (2013) who study the investment and financing behavior of non-tech firms during the 1990s technology bubble. Warusawitharana and Whited (2013) draw similar inferences based on a dynamic neoclassical investment model.

III. Empirical results are reported Section IV. Robustness checks are performed in Section V. Section VI concludes the paper.

II. Model

The model we outline below is similar to the reduced form models of Froot, Scharfstein, and Stein (1993), Kaplan and Zingales (1997) and Stein (2003). We extend the model in three ways. First, we allow for firm misvaluation. Misvaluation affects the deadweight costs of external financing and firm can take advantage of misvaluation through market timing. Second, we extend the model to a two periods model. Since the state of future cash flow is uncertain and future external financing is costly, firm would carry cash forward to safeguard future investment when the opportunity arises. Third, we distinguish between debt and equity financing. We assume that both current debt and equity can be misvalued but misvaluation influences the cost of debt to a lesser extent. We illustrate how firms can adjust their internal and external sources of financing for corporate liquidity and investment in response to financial market mispricing.

A. Structure

We consider a two-dated model where the dates are indexed by time 0 and 1. A firm is endowed with assets in place that generate cash flows c_0 and c_1 net of dividend at time 0 and 1, respectively.⁵⁰ c_0 is known at time 0 and the value of c_1 reveals at time 1. Specifically, $c_1 = c_H$, with probability p , and $c_1 = c_L < c_H$, with probability $1 - p$.

⁵⁰ For simplicity, our model does not include dividend payouts and assumes cash flow to be after dividend payment. Our empirical analysis does not find dividends to be very sensitive to cash flows or misvaluation measures.

The firm can choose a level of investment I_0 at time 0. The present value of cash flow from the time 0 investment is given by $f(I_0)$, where f_0 is an increasing and concave function of I_0 .⁵¹ We assume that any profits from investment at time 0 are only realized after time 1. In addition to the time 0 investment opportunity, the firm also has an investment opportunity at time 1 with probability q . Upon its arrival, the time 1 investment opportunity requires a fixed level of investment $\bar{I}$ and generates a present value of cash flow $g(\bar{I})$. We assume $c_L < \bar{I} < c_H$ so that, there is at least one state of the world, the firm cannot finance its time 1 investment opportunity solely by its internally generated cash flow at time 1. We also assume that the firm will invest in the time 1 investment opportunity upon its arrival.

The firm has access to external capital markets. It can raise additional external financing by issuing securities or it can repurchase securities in capital market at time 0. The dollar amount of the external funds raised or reduced at time 0 is given by X_0 , where $X_0 > 0$ ($X_0 < 0$) denotes the amount of external financing raised (reduced). For brevity, we do not distinguish here between debt and equity financing so that X_0 can be considered as outside equity. Section II.D considers debt and equity financing separately.

Raising (reducing) external financing imposes (alleviates) deadweight costs.⁵² The deadweight costs of external finance at time 0 is represented by the function $h(\theta, X_0)$. We assume h is increasing and convex in X (i.e. $h_X > 0$ and $h_{XX} > 0$).⁵³

⁵¹ Net working capital investment can be easily accommodated by assuming that it is proportional to capital investment. Moreover, without loss of generality and for notational simplicity, we assume the risk-adjusted discount rate to be equal to zero, so that f represents the present value of the project.

⁵² The deadweight costs include agency costs arise due to information asymmetry and other transaction costs. See e.g., Myers and Majluf (1984), Myers (1984), Krasker (1986), and Greenwald, Stiglitz and Weiss (1984) for the deadweight cost of equity and Myers (1977) for the deadweight cost of debt.

⁵³ Following the convention, we use a function x with subscript y to represent the partial derivative of x with respect to y . For notational simplicity, we use the subscript X to represent X_0 . A convex cost function may be considered intuitive and is widely used in the literature (see e.g. Froot, Scharstein, and Stein, 1993; Froot and Stein, 1998; Kaplan and Zingales, 1997; Stein 1997; and Stein, 2003). Altinkilic

The value of external capital can be mispriced by the capital markets at time 0. Yet, such mispricing will be corrected before time 1. We denote θ as the net per dollar unit of mispricing at time 0, with positive (negative) values of θ corresponding to overvaluation (undervaluation).⁵⁴ θ can influence the firm's financial policy in two ways. First, the firm can take advantage through market timing by issuing overpriced (repurchasing underpriced) external capital (Stein, 1996; and Baker, Stein, and Wurgler, 2003). This impact is captured by θX_0 . Second, θ can affect the deadweight cost of external finance which is captured by $h(\theta, X_0)$. Intuitively, overvaluation (undervaluation) may alleviate (aggravate) the deadweight cost of external capital (Baker and Wurgler, 2002). Therefore, we assume $h_\theta < 0$, $h_{\theta X} < 0$ and $h_{\theta XX} < 0$.⁵⁵ Note that a firm would not always issue (repurchase) external capital when it is overpriced (underpriced) in this setting. A firm with good projects but not enough cash flow may issue securities even when it is undervalued, just as a firm with high deadweight costs may decide to retire overvalued external capital in the absence of good projects.

The firm also has access to external capital markets at time 1. We denote X_1 and $h_1(X_1)$ as the amount of external financing at time 1 and its corresponding increasing and convex deadweight cost function, respectively. Since mispricing cannot last until time 1, it does not have any direct impact on h_1 .

and Hansen (2000) show that external costs of financing consist of both a fixed cost and a convex variable cost. Leary and Roberts (2005) show that the observed dynamics of leverage ratios is consistent with a cost function of external finance that has a fixed and an increasing and weakly convex component.

⁵⁴ Note that the issuance or retirement of external funds can lead to the price-pressure effect and the effect is greater for larger transactions (Stein, 1996). We denote θ as the gross per dollar unit of mispricing and δ as the per dollar price pressure. $\delta > 0$ ($\delta < 0$) for $X_0 > 0$ ($X_0 < 0$). The net per dollar unit of mispricing is given by $\theta = \theta - \delta$. For brevity, we do not distinguish here between debt and equity mispricing. Section II.D considers debt and equity mispricing separately and allows equity to be more mispriced than debt.

⁵⁵ This assumption implies that overvaluation can alleviate the deadweight costs of external financing by "flattening" the deadweight costs curve – i.e. holding other things constant, the increase in deadweight costs given an increase in external financing of an overvalued firm is always lower than that of an undervalued firm.

In order to facilitate the time 1 investment $\bar{I}$, the firm can carry a cash balance C forward from time 0 to 1. However, carrying a cash balance is costly (Jensen 1986; and Gamba and Traintis, 2008). The cost of carrying a cash balance is represented by a cost function $\pi(C)$. We assume that π is an increasing and convex function of C . Moreover, we assume that the firm will distribute all the unused cash to its shareholders.⁵⁶

B. Analysis

We consider the optimal financial decisions of a firm's manager. At time 0, the firm's manager, acting in the interest of existing shareholders, chooses the level of investment I_0 , the amount of external financing X_0 , and the cash balance C to carry forward from time 0 to 1. At time 1, if the investment opportunity does not arrive, the firm will distribute all the unused cash to its shareholders. Otherwise, if the investment opportunity arrives and if $c_1 = c_L$, given the cash balance C carry forward from time 0, the manager will raise external financing $X_1 = \bar{I} - c_L - C$ to support the investment.⁵⁷ On the other hand, if $c_1 = c_H$, the manager will invest and distribute all the unused cash $c_H + C - \bar{I}$ to its shareholders.

The manager makes optimal investment and financial decisions (I_0, X_0, C, X_1) that maximize the following objective function:

$$\max_{I_0, X_0, C, X_1} f(I_0) - h(\theta, X_0) + \theta X_0 - I_0 + E_q(\hat{g}(\bar{I})) - E_p(\hat{h}_1(X_1)) - \pi(C), \quad (1a)$$

s.t.,

⁵⁶ This assumption is merely for simplicity and it is without the lost of generality. Our results will not change if we assume the firm reduces its external financing at time 1 using the unused cash.

⁵⁷ There are two points to note. First, since carrying cash forward from time 0 to time 1 is costly and the value of c_L is known by the manager, the manager will not carry a cash balance more than the firm is actually needed (i.e. $C \leq \bar{I} - c_L$). Second, it is assumed that the firm will invest in the time 1 investment opportunity upon its arrival. This assumption implies $g(\bar{I}) \geq k(\bar{I} - c_L)$.

$$I_0 + C = c_0 + X_0, \quad (1b)$$

and,

$$X_1 = \bar{I} - c_L - C \text{ for } c_1 = c_L, \quad (1c)$$

$$X_1 = 0 \quad \text{for } c_1 = c_H, \quad (1d)$$

where,

$$\bar{c}_1 = pc_H + (1 - p)c_L, \quad (1e)$$

$$E_p(\hat{h}_1(X_1)) = q((1 - p)h_1(X_1) + p(\bar{I} - c_H - C)), \quad (1f)$$

$$E_q(\hat{g}(\bar{I})) = (1 - q)(\bar{c}_1 + C) + q(g(\bar{I}) - \bar{I}). \quad (1g)$$

Equation (1a) represents the expected total (time 0 plus time 1) payoffs of the firm. Equation (1b) is the cash flow identity that uses of cash equals to sources of cash. Note that one-dollar increase in cash flow c_0 can be used to either increase the current investment I_0 or cash carried over to the next period, or reduce external finance X_0 . Equations (1c) and (1d) indicate the optimal amount of future external financing for different states of the world. Equations (1e)-(1g) are, respectively, the expected time 1 value of: (1) cash flow, (2) net cost of external financing, and (3) total payoffs of shareholders.⁵⁸

The first-order conditions (FOCs) of equation (1) are:

$$f'(I_0^*) = h_X(\theta, X_0^*) + 1 - \theta, \quad (2)$$

and

$$h_X(\theta, X_0^*) - \theta = -\pi'(C^*) + q(1 - p)h_1'(X_1^*) + 1 - q(1 - p). \quad (3)$$

⁵⁸ If the time 1 investment opportunity arises (with probability q), the firm will need to seek for external financing if the state of time 1 cash flow is low (with probability $1 - p$), otherwise the firm can self-finance the time 1 investment. The expected net cost of external financing is therefore represented by equation (1f). The expected time 1 total payoffs of shareholders is given by equation (1g), that is, with probability q the firm will invest $\bar{I}$ and get $g(\bar{I})$, and with probability $1 - q$ the firm will keep the cash which has an expected value of $\bar{c}_1 + C$.

Note from equation (2) that the marginal benefit (the left-hand side term) from a one-dollar increase in current investment is equated to the net marginal cost (the right-hand side terms) of external finance.⁵⁹

Using equations (2) and (3), we have:

$$f'(I_0^*) - 1 + \pi'(C^*) = q(1 - p)h_1'(X_1^*) + 1 - q(1 - p), \quad (4)$$

Equation (4) indicates that the firm allocates funds across time by choosing the optimal level of cash holdings C , which equates the marginal costs (the left-hand side terms) of cash savings at time 0 and the expected marginal benefits (the right-hand side terms) at time 1. The marginal costs of cash savings include the marginal time 0 investment profits foregone and the cost of carrying cash forward from time 0. The expected marginal benefits include the reduction in the marginal cost of external financing at time 1 when both investment opportunity and unfavorable financial condition (i.e. $c_1 = c_L$) arises, and the expected marginal residual value of cash return at time 1.

C. Misvaluation, Corporate Policies, and Cash Flow Sensitivities

In this section, we derive a proposition illustrates how a firm adjusts the allocation of its internal cash flow for various uses in response to capital market mispricing. It is worth highlighting that the proposition are derived under the constraint that sources of cash equal uses of cash constraint (1b) and that all time 0 corporate policies (I_0, X_0, C) are determined simultaneously. For simplicity and model tractability, we approximate the functions $f(I_0)$, $h(\theta, X_0)$, $\pi(C)$ and $h_1(X_1)$ using a

⁵⁹ For $X_0 < 0$, we have analogous interpretations with the right-hand side terms of equation (2) representing the marginal benefit of security repurchase and the left-hand side term representing foregone marginal profits. To facilitate discussion of the subsequent results, we focus on the case of $X_0 > 0$, but analogous arguments apply for $X_0 < 0$.

second order Taylor series expansion near the optimal corporate policies $(I_0^*, X_0^*, C^*, X_1^*)$ at a given set of values: $(\theta, c_0, c_1, q, p$ and $\bar{I})$.⁶⁰

Numerous studies document external financing costs arising from capital market frictions create potential relevance of internal funds for various corporate policies. Using *FOCs* (2) and (3), we can derive the following properties of cash flow sensitivities:⁶¹

$$(a) \frac{dX_0^*}{dc_0} < 0, (b) \frac{dI_0^*}{dc_0} > 0, \text{ and } (c) \frac{dC^*}{dc_0} > 0. \quad (5)$$

In facing deadweight costs of external financing, a firm would respond to an increase in cash flow by substituting for external finance (equation 5(a)), increasing investment (equation 5(b)), and saving more cash out of cash flow (equation 5(c)). These results are a consequence of optimal allocation of cash flow to equate the marginal return from its uses.

There is also a growing literature documenting that firm misvaluations have independent effect on various corporate policies. The following properties of mispricing sensitivities can be derived using *FOCs* (2) and (3):⁶²

$$(a) \frac{dX_0^*}{d\theta} > 0, (b) \frac{dI_0^*}{d\theta} > 0, \text{ and } (c) \frac{dC^*}{d\theta} > 0. \quad (6)$$

Equation 6(a) suggests that a firm would raise additional external financing when securities are more overvalued. Overvaluation of securities also induces investment through securities issuance channel (equation 6(b)). A firm would also hoard more cash when securities are more overvalued (equation 6(c)).

Firm misvaluation, to the extent that it relates to the wedge between the cost of internal and external finance, should not only influence a firm's external financing decision but also affect its reliance on internal funds for various uses. We now

⁶⁰ This assumption assumes away all third order effects driven by the change in optimal policies.

⁶¹ See Appendix A.1. for proofs.

⁶² See Appendix A.2. for proofs.

illustrate how misvaluation affects the allocation of internal cash flow across its various uses. Market timing theory suggests that when a firm is perceived to be undervalued (overvalued), it should have a stronger (weaker) incentive to reduce its dependence on external funds, leading to a stronger (weaker) substitution, or equivalently, more (less) negative relation between internal and external funds. However, the following proposition show that firms may not follow market timing prediction to take advantage of capital market misvaluation. Instead, firms may utilize their financial flexibility to make interdependence financial decisions in response to capital market misvaluation to ensure funding is available when profitable opportunities arise.

Proposition 1. *Suppose the functions $f(I_0)$, $h(\theta, X_0)$, $\pi(C)$ and $h_1(X_1)$ are approximated by a second order Taylor series expansion near the optimal corporate policies $(I_0^*, X_0^*, C^*, X_1^*)$. Then the impact of mispricing on the cash flow sensitivity has the following properties:*

$$(a) \frac{d}{d\theta} \left(\frac{dX_0^*}{dc_0} \right) < 0, (b) \frac{d}{d\theta} \left(\frac{dI_0^*}{dc_0} \right) < 0, \text{ and } (c) \frac{d}{d\theta} \left(\frac{dC^*}{dc_0} \right) < 0.$$

Proof: See Appendix A.3.

Proposition 1 suggests that in periods of undervaluation (overvaluation) when external funds are more costly (cheaper), firms would rely more (less) on internal funds for current investment and for cash carry forward to safeguard their future investment opportunity (Proposition 1(b) and (c)). Therefore, more (less) internal cash flow is allocated to these uses and less is left for the reduction of external finance, leading to a weaker (stronger) cash flow sensitivity of external finance (Proposition 1(a)).

D. Separating Debt and Equity Financing

So far, we have ignored the difference between debt and equity as external capital and assumed that both debt and equity can be mispriced. There is extensive literature on equity misvaluation, but the research on debt misvaluation is more limited. Previous studies (e.g., Flannery, 1986; and Wittenberg-Moerman, 2009) have suggested that long-term debt is subject to information asymmetry, which leaves the possibility that debt can be mispriced. However, it can be argued that debt is less likely to be mispriced than equity, because debt is generally easier to price than equity (i.e., the main uncertainty regarding the future cash flows is the probability of default) and because participants in the debt markets are usually sophisticated institutional investors.⁶³ We now distinguish between debt and equity and assume that both debt and equity can be misvalued. Yet, the influence of mispricing on the cost of debt is less pronounced.

We denote E_i and D_i , for $i = 0$ or 1 , as the level of time i equity and debt finance, and $h(\theta, E_0)$, $h_1(E_1)$, $r(\theta, D_0)$, and $r_1(D_1)$ as the time 0 and 1 equity and debt cost functions, respectively. Following the equity cost functions, we assume r and r_1 are increasing and convex in D .⁶⁴

In this subsection, we denote θ as the net per dollar unit of time 0 equity mispricing and, to the extent that it influences a firm's value, it also affects the cost of debt issuance. Following the equity cost function, we assume $r_\theta < 0$, $r_{\theta D} < 0$, and $r_{\theta DD} < 0$. Under these assumptions, we derive the following proposition.

⁶³ Consistent with this prediction, Chang, Chen, and Hilary (2010) find that the benefits of timing equity issuance are more pronounced than the benefits of timing debt issuance.

⁶⁴ The increasing and convex features of r and r_1 capture the idea that the marginal effect of the expected cost of default increases with the level of debt. Moreover, Altinkilic and Hansen (2000) show that debt and equity issuance costs consist of both a fixed cost and a convex variable cost, though the convexity of debt issuance cost is much weaker than that of equity issuance cost.

Proposition 2. *Suppose all production and cost functions are approximated by a second order Taylor series expansion near the optimal corporate policies. Then the impact of mispricing on the cash flow sensitivity of investment and cash has the following properties:*

$$(a) \frac{d}{d\theta} \left(\frac{dI_0^*}{dc_0} \right) < 0, \text{ and } (b) \frac{d}{d\theta} \left(\frac{dC^*}{dc_0} \right) < 0.$$

If the influence of equity mispricing on the marginal cost of debt is sufficiently small (specifically, if $r_{\theta DD}$ approaches zero), then the impact of mispricing on the cash flow sensitivity of equity and debt issuance has the following properties:

$$(c) \frac{d}{d\theta} \left(\frac{dE_0^*}{dc_0} \right) < 0, \text{ and } (d) \frac{d}{d\theta} \left(\frac{dD_0^*}{dc_0} \right) > 0.$$

Proof: See Appendix A.4.

Intuition suggests that the cost of debt is less likely to be influenced by mispricing because debt is generally easier to price than equity and participants in the debt markets are usually sophisticated institutional investors. Proposition 2 suggests that, if this is the case, then the substitution between debt (equity) financing and internal cash flow can be weaker (stronger) as equity becomes more overvalued.

III. Data, Variables and Methodology

A. Data

The sample selection is similar to that of Baker, Stein, and Wurgler (2003), and Almeida and Campello (2010). The sample period covers from 1971 to 2011. This paper mainly uses flow-of-funds data to define the cash flow identity, thus we set the starting point of our sample at 1971, in which flow-of-funds data began to be extensively reported in Compustat. The accounting data is from Compustat Industrial

Annual files and the data on stock prices and returns are retrieved from the Center for Research on Security Prices (CRSP) files.

We discard observations from financial institutions (SIC codes 6000-6999), utilities (SIC codes 4900-4999), not-for-profit organizations, and government enterprises (SIC codes greater than 8000). We require firms to provide valid information on their total assets, sales growth, market capitalization, changes in cash holdings, investment, cash dividends, cash flow, and external financing. We also exclude firm-years for which the market value of assets is less than \$1 million, those displaying asset growth exceeding 100%, and those with annual sales lower than \$1 million to minimize the sampling of financially distressed firms. These screens leave us with an unbalanced sample panel that consists of 73,366 firm-year observations (11,818 firms).

Our empirical analysis critically hinges upon the following cash flow identity defined using flow-of-funds (the cash flow statement) data of Compustat:

$$\Delta Cash_t + Div_t + Inv_t - \Delta X_t = CF_t, \quad (7)$$

where the uses of funds include investment (Inv), the change in cash holdings ($\Delta Cash$), and cash dividends (Div). The sources of funds comprise the internally generated cash flows (CF) and external financing (ΔX). Note that $-\Delta X$ can be regarded as a reduction in external financing, or a use of funds. External financing can be further decomposed into the net debt issuance (ΔD) and the net equity issuance (ΔE):

$$\Delta X_t = \Delta D_t + \Delta E_t.$$

It's worth emphasizing that, according to Compustat data manuals, the variable definitions vary depending on which format code a firm follows in reporting flow-of-funds data. We follow Chang et al. (2013) to construct variables in equation (7) based

on different format codes of flow-of-funds data.⁶⁵ It is worth noting that, following recent studies on cash flow sensitivities (e.g., Bushman, Smith, and Zhang, 2011; Dasgupta, Noe, and Wang, 2011; and Gatchev, Pulvino, and Tarhan, 2010), we define cash flow (*CF*) as the operating cash flows, net of the change in working capital. Panel A of Table I reports summary statistics for cash flow statement variables in equation (7) for our sample. All variables are deflated by the beginning-of-period total assets and have been winsorized at the top and bottom 1% of their distributions.

[Insert Table I here]

B. Empirical Methodology

In our models, we regress various corporate policies on cash flow (*CF*), mispricing proxy (*MP*), the interaction term of cash flow and mispricing proxy and other control variables (*Y*). All the explanatory variables except cash flow are lagged one period. The regression equations are estimated with firm and year fixed effects. To estimate regressions with firm fixed effects, we demean the dependent and all explanatory variables in the equations. The regressions are shown as follows:

$$Inv_{it} = \alpha^{Inv} CF_{it} + \beta^{Inv} MP_{it-1} + \delta^{Inv} CF_{it} \times MP_{it-1} + \gamma^{Inv} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{Inv}, \quad (8)$$

$$\Delta Cash_{it} = \alpha^{\Delta Cash} CF_{it} + \beta^{\Delta Cash} MP_{it-1} + \delta^{\Delta Cash} CF_{it} \times MP_{it-1} + \gamma^{\Delta Cash} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{\Delta Cash}, \quad (9)$$

$$Div_{it} = \alpha^{Div} CF_{it} + \beta^{Div} MP_{it-1} + \delta^{Div} CF_{it} \times MP_{it-1} + \gamma^{Div} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{Div}, \quad (10)$$

$$\Delta X_{it} = \alpha^{\Delta X} CF_{it} + \beta^{\Delta X} MP_{it-1} + \delta^{\Delta X} CF_{it} \times MP_{it-1} + \gamma^{\Delta X} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{\Delta X}, \quad (11)$$

where the superscripts of the coefficients (α , β , δ , and γ) denote different equations.

⁶⁵ The definitions of variables in equation (7) with different format codes of flow-of-funds data are detailed in Table I of Chang et al. (2013).

We also decompose external finance (ΔX) into ΔD and ΔE and estimate the impact of cash flow and firm misvaluation on net debt and equity issued separately:

$$\Delta D_{it} = \alpha^{\Delta D} CF_{it} + \beta^{\Delta D} MP_{it-1} + \delta^{\Delta D} CF_{it} \times MP_{it-1} + \gamma^{\Delta D} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{\Delta D}, \quad (12)$$

$$\Delta E_{it} = \alpha^{\Delta E} CF_{it} + \beta^{\Delta E} MP_{it-1} + \delta^{\Delta E} CF_{it} \times MP_{it-1} + \gamma^{\Delta E} Y_{it-1} + f_i + y_t + \varepsilon_{it}^{\Delta E}. \quad (13)$$

With a few exceptions, the literature mainly examines the response of a particular use of cash flow to cash flow innovations (for example, the sensitivity of investment or additions to cash holdings to cash flow) in isolation. Gatchev, Pulvino, and Tarhan (2010) take issue with this approach and argue that since investment and financing decisions are made jointly, subject to the constraint that cash flow must equal uses of cash flow, the cash flow sensitivities of various uses of cash flow must add up to unity.⁶⁶ Failure to impose the constraint and estimate all the cash flow sensitivities simultaneously leads to erroneous coefficient estimates. The authors show that forcing the constraint to hold leads to substantially different coefficient estimates than those obtained if the equations for various uses of cash flow are estimated as standalone equations.

Chang et al. (2013) show that Gatchev, Pulvino, and Tarhan (2010)'s claim is false from both theoretical and empirical perspectives. Chang et al. (2013) test models both with the restriction that the cash flow sensitivity coefficients across various uses of cash flow should add up to unity, and without it. In contrast to Gatchev, Pulvino, and Tarhan (2010), Chang et al. (2013) find that imposing the constraint makes no difference. The reason is simple: When variables are consistently defined and satisfy the cash flow identity that cash flow must equal the sum of all uses of cash flow, the constraint is redundant under ordinary least squares (OLS) estimation, as long as the

⁶⁶ In other words, if internal cash flows increase by one dollar, then the change in all uses of cash flow (e.g., investment, additions to cash holdings, and equity and debt reductions) must sum to one dollar.

specifications incorporate the same set of independent variables.⁶⁷ The crucial difference between these two studies is their data sources to define the uses and sources of cash flow. Chang et al. (2013) define the uses and sources of cash flow solely from cash flow statement (flow-of-funds) data and thus cash flow identity automatically holds. However, Gatchev, Pulvino, and Tarhan (2010) define cash flow and various uses of cash flow using data from different sources, including the balance sheet, the income statements, and the cash flow statement. As a result, their sources-equal-uses identity is severely violated in the data.

Following Chang et al. (2013), we use OLS to estimate how cash flow is allocated across its various uses and how this allocation is affected by misvaluation under single-equation model without linear constraint that cash flow must equal the sum of all uses of cash flow.

C. Measures of Misvaluation

A challenging part of our analysis is to find a good proxy for misvaluation, especially the mispricing component or the nonfundamental component of stock prices. Following Baker, Stein, and Wurgler (2003), we start by using Q to capture mispricing. We measure Q using the market-to-book assets ratio (MB), defined as

$$MB = \frac{E^m - E^b + A^b}{A^b},$$

where E and A stand for equity and assets, respectively, and superscripts b and m denote book and market values.

As pointed out by Baker, Stein, and Wurgler (2003), MB (or Q) potentially contains three sources of variation: (1) mispricing, (2) information about the

⁶⁷ See Appendix A in Chang et al. (2013) or Greene (2008) (page 256-258) for a detailed econometric proof.

profitability of investment, and (3) measurement errors arising from accounting discrepancies between book capital and economic replacement costs. Our focus is on the first of these components, but the other two can color our inferences.

To get around the abovementioned problems, we follow Baker, Stein, and Wurgler (2003) and Baker, Taliaferro, and Wurgler (2006) by using future realized stock returns ($FRet$), defined as stock returns over the next three years multiplied by -1, as an alternative proxy for stock misvaluation. The motivation behind the use of this measure is that future realized returns, as noisy estimates of future expected returns, should be at least partly determined by the extent to which stock prices currently deviate from intrinsic stock values. We multiply the return by -1 to ease the interpretation. As a result, the high (low) value of $FRet$ suggests a stock is currently overvalued (undervalued), similar to the interpretation of the market-to-book ratio (MB).

In Section V, as a robustness check, we test the hypotheses derived from our model by extracting the nonfundamental component from MB following two empirical methodologies, developed by Rhodes-Kropf, Robinson, and Viswanathan (2005) and Dong et al. (2006).

D. Control Variables

We incorporate the following control variables (lagged one period) in regressions. We include the log of the book value of assets, $Ln(Assets)$, as a proxy for firm size. The sales growth ($SalesG$) is included to capture a firm growth prospects. Companies with more tangible assets are expected to invest more in fixed assets and support more debt, since tangible assets can be pledged as collateral. The net PPE-to-asset ratio ($Tangibility$) is used to measure the tangibility of the firm's assets. We also

include the leverage ratio (*Leverage*), defined as total debt (the sum of short-term and long-term debt) divided by total assets. The importance of controlling for firm leverage is suggested by Lang, Ofek, and Stulz (1996), who find that investment is negatively related to leverage, particularly for highly leveraged firms and firms with low Tobin's Q . Panel B of Table I reports the descriptive statistics for these control variables and proxies for misvaluation. Dollar values are adjusted to the 2000 dollar value using a GDP deflator.

Table II reports the correlation coefficients between our key variables of interest. Univariate correlations indicate that investment is positively correlated with cash flow (CF) and external financing (ΔD and ΔE). In addition, Table II indicates a significant positive correlation between our two main proxies for misvaluation, MB and $FRet$ (the correlation coefficient = 0.12). Both proxies are positively correlated with the uses of funds (Inv , $\Delta Cash$, and Div) and the amount of external financing (ΔX), and negatively related to internal cash flow.

[Insert Table II here]

IV. Empirical Results

A. Nonparametric Analysis

Table III illustrates how firm valuation and cash flow jointly affect corporate policies. In Panel A of Table III, firms are sorted into five groups according to MB and CF , respectively (independent sorts). The average values of the variables are reported for each MB – CF group. In Panel B, firms are sorted into five groups according to $FRet$ and CF , respectively (independent sorts). The average values of the variables are reported for each $FRet$ – CF group.⁶⁸

⁶⁸ We obtain similar findings using other misvaluation proxies defined in Section V to sort firms. The results are not tabulated but available upon request.

[Insert Table III here]

Table III suggests that investment and cash holdings increase with both stock valuation and cash flow, whereas external financing increases with stock valuation and decreases as cash flow increases. These findings are consistent with the first-order effects implied by our model (equations (5) and (6)). More importantly, we find that the impact of cash flow on investment (external financing) is more (less) pronounced for firms with low equity valuation.⁶⁹ These findings are consistent with Proposition 1, which predicts that firms rely more on their internal cash flow to finance investment and the substitution between internal funds and external financing is weaker for firms with low equity valuation. However, the impact of cash flow on cash holdings does not display a stark difference between firms with low and high equity valuation in this nonparametric analysis.⁷⁰

B. Independent Effects of Cash Flow and Stock Valuation on Corporate Policies

Table IV reports the results obtained by estimating standalone equations without the linear constraint that sources equal uses of cash to study the Independent Effects of Cash Flow and Stock Valuation on Corporate Policies.⁷¹ Gatchev, Pulvino, and Tarhan (2010) argue that it is indispensable to take into account the intertemporal dependencies within and across corporate decision variables. Thus, to account for the interdependent nature of corporate policies, we include lagged dependent variables (Inv_{t-1} , $\Delta Casht_{t-1}$, Div_{t-1} , ΔDt_{t-1} , and ΔEt_{t-1}) in all the equations. The regression

⁶⁹ Investment experiences a 13-fold increase (from 1% to 13% of the beginning-of-period assets) when we move from the lowest *CF* group to the highest when stock valuation is low (*MB* group = 1), while the increase is roughly 100% when stock valuation is high (*MB* group = 5). External financing decreases by 10% of the beginning-of-period assets from the lowest *CF* group to the highest when stock valuation is low (*MB* group = 1), whereas it decreases by 34% of the beginning-of-period assets when stock valuation is high (*MB* group = 5).

⁷⁰ For both low and high equity valuation firms, cash holdings roughly increase by 9% of the beginning-of-period assets when we move from the lowest *CF* group to the highest.

⁷¹ Table IV is exactly the same as the Panel A of Table IV in Chang et al. (2013). We include it here to make our reasoning more fluently.

equations are estimated with firm and year fixed effects. To estimate regressions with firm fixed effects, we demean the dependent and all explanatory variables in the equations.

[Insert Table IV here]

We document in Table IV positive investment-cash flow and cash-cash flow sensitivities and a negative external finance-cash flow sensitivity. More specifically, in response to a one-dollar increase in cash flow, investment increases by 16 cents, cash holdings increases by 22 cents, dividends increase by 1 cent, the use of debt reduces by 28 cents and the use of equity lowers by 34 cents. We also find that investment, cash holdings and external financing increase with stock valuation. These findings are implied by first order effects in our model (equations (5) and (6)).

It is important to highlight that these results are obtained without simultaneously estimating the equations and without imposing any linear constraints on the estimation. As pointed out by Chang et al. (2013), as long as the cash flow identity holds (equation (7)) in the data, simultaneous-equation and single-equation estimates are identical, even for dynamic models, if the right-hand-side exogenous (e.g., CF) or predetermined variables (e.g., MB and lagged dependent variables) in all equations are the same. Thus, for the following regressions, we only reports the results using standalone equations without the linear constraint that sources equal uses of cash.

C. Joint Impact of Cash Flow and Stock Valuation on Corporate Policies

This section presents the results concerning the joint impact of cash flow and firm valuation on various corporate policies. We interact internal cash flows (*CF*) with our first proxy for firm valuation, the market-to-book ratio (*MB*), and add this interaction term to all the equations.

[Insert Table V here]

Consistent with Proposition 1 developed in Section II, we find that the coefficient of $CF \times MB$ is negative and significant in the investment equation (column (1) of Table V), suggesting that the investment-cash flow sensitivity increases as firms become more undervalued. This result indicates that when firm valuation decreases (increases), firms tend to rely more (less) on internal funds to finance their investment. The negative coefficient of $CF \times MB$ in column (2) of Table V reveals that when firm valuation decreases (increases), firms save more (less) cash out of internal cash flows.

In addition, we document in column (4) of Table V that the substitution between internal funds and external financing becomes weaker (stronger) as firm valuation decreases (increases). Intuitively, a decrease in firm valuation makes external financing more costly, and thus should strengthen firms' incentive to substitute internal funds for external finance. In other words, the negative relation between internal funds and external finance are expected to become more pronounced as stock valuation decreases. However, the results in column (4) of Table V suggest that internal funds and external finance may display a weaker negative relation as firm valuation decreases.

When we break up external finance into net debt issues and net equity issues in columns (5) and (6) of Table V, an interesting result emerges. The coefficient of CF (-0.36) is negative and significant, while that of $CF \times MB$ (0.02) is positive and statistically significant for debt financing, implying that firms substitute internal funds for debt financing when stock valuation is low and issue debt when firm valuation and cash flows are high. In contrast, firms are found to substitute internal funds for equity financing mainly when stock valuation is high. This is consistent with Proposition 2.

To better interpret the coefficients corresponding to the impact of firm valuation on the allocation of cash flow, in Table VI we partition all firm-years into three groups (low, intermediate, and high) using *MB* and define, accordingly, three indicator variables for the level of misvaluation. The indicator for intermediate-level *MB* values represents the base case, and we introduce interactions of cash flow with a *High MB* indicator and a *Low MB* indicator. When misvaluation is low, firms allocate 21 cents (coefficient of *CF* + coefficient of $CF \times Low\ MB = 0.22 - 0.01 = 0.21$) out of each additional dollar of cash flow to investment, 32 cents to additional cash holdings, 35 cents to reducing debt financing, and only 10 cents to reducing equity financing.

[Insert Table VI here]

To address the concern that *MB* is a noisy measure of misvaluation, we employ a direct proxy for mispricing, namely, future stock returns (*FRet*). Table VII examines the joint impact of cash flow and future stock returns on corporate policies.⁷² Note that apart from *FRet*, we also control for *MB* as an additional proxy for stock valuation in all regression equations.⁷³ To the extent that *MB* contains a component of misvaluation, this design works against us finding any independent effect of *FRet* on corporate financial decisions.

[Insert Table VII here]

The results in Table VII are generally consistent with those in Table V. The cash flow sensitivities of investment, cash, and external finance decrease with the extent of misvaluation. In other words, in response to a decrease in misvaluation, firms rely more on internal cash flow to finance their investment and cash holdings, so that the substitution between internal fund and external finance becomes weaker.

⁷² The number of observations is reduced to 50,202, since this test requires firms to have non-missing stock returns for the next three years.

⁷³ As a robustness check, we also tried to include $CF \times MB$ in all regression equations reported in Table VII and found that the coefficients of *FRet* and $CF \times FRet$ are essentially unaffected by the inclusion of $CF \times MB$.

Polk and Sapienza (2009) use discretionary accruals as a proxy for stock mispricing in examining the catering channel through which stock mispricing affects investment.⁷⁴ As a robustness check, we define discretionary accruals based on the methodology used by Polk and Sapienza (2009) and use it to replace $FRet$ in the regressions reported in Table VII. Untabulated results indicate that coefficients of discretionary accruals and the interaction of discretionary accruals with cash flow are generally consistent with those in Table VII.

V. Robustness Checks

Our analysis hinges critically upon identifying situations where firms are mispriced. Baker, Stein, and Wurgler (2003) suggest that Q (MB) contains both a nonfundamental component and a fundamental component. Our interest is the former, but the latter can create problems for our inferences. This section carries out a more focused test of the hypotheses derived from our model by extracting the nonfundamental component from Tobin's Q following two empirical methodologies, developed by Rhodes-Kropf, Robinson, and Viswanathan (2005) and Dong et al. (2006). Generally, the market-to-book ratio can be decomposed as

$$MB = \frac{E^m - E^b + A^b}{A^b} = \frac{(E^m - v) + (v - E^b + A^b)}{A^b} = \frac{(E^m - v)}{A^b} + \frac{(v - E^b + A^b)}{A^b} \\ = MP + VA,$$

where v stands for the fundamental value of equity, E and A stand for equity and assets, respectively, and the superscripts b and m denote book and market values.

Here $MP = \frac{(E^m - v)}{A^b}$ stands for the firm-level mispricing deflated by the book value

⁷⁴ Accruals are defined as the difference between a firm's accounting earnings and its underlying cash flows. Discretionary accruals capture the unusual part of accruals given the underlying timing of cash flows, and so are deemed to be under managerial discretions. A large body of empirical evidence (e.g., Teoh, Welch, and Wong, 1998; and Chan et al., 2006) documents a negative relation between discretionary accruals and subsequent stock returns, suggesting that firms with high discretionary accruals are overpriced relative to otherwise similar firms.

of total assets, and $VA = \frac{(v - E^b + A^b)}{A^b}$ denotes the fundamental-value-to-assets ratio,

which can be viewed as a proxy for investment opportunities.

To obtain the fundamental value of equity (v), we first follow the methodology proposed by Rhodes-Kropf, Robinson, and Viswanathan (2005) and regress the logarithm of the market value of equity on the logarithm of the book value of equity, the absolute value of net income, an indicator function for negative net income observations, and the book leverage ratio. We group the firms according to the 12 Fama and French industries and run annual cross-sectional regressions for each industry. The fundamental value of equity is then the exponential of the fitted value from the regression equation. The resulting measures of mispricing and the fundamental-value-to-assets ratio are denoted MP_{RKR} and VA_{RKR} , respectively. Appendix B describes Rhodes-Kropf, Robinson, and Viswanathan's (2005) decomposition in detail.

Alternatively, we use the residual income model as in Dong et al. (2006) to compute the fundamental value of equity. In particular, we employ the Edwards-Bell-Ohlson valuation model, which calculates the fundamental value of equity by anchoring its price at the current book value of equity and adding a premium to the book value based on future residual earnings.⁷⁵ Penman and Sougiannis (1998) show that the valuation error using the residual income model is lower than both the discounted cash flow and dividend discount models. Appendix C details the residual income model we use. The resulting measures of misvaluation and the fundamental-value-to-assets ratio obtained using the residual income model are denoted MP_{RIM} and

⁷⁵ Frankel and Lee (1998) attribute the term Edwards-Bell-Ohlson to Bernard (1994). This technique has been used extensively to calculate fundamental values in previous studies (e.g., Frankel and Lee, 1998; Lee, Myers and Swaminathan, 1999; and Ritter and Warr, 2002). In addition, Feltham and Ohlson (1995) show that the model is equivalent to the theoretically sound dividend discount model under clean surplus accounting, which describes the situation where the change in book value is equal simply to earnings minus dividends for the given period.

VA_{RIM} , respectively. The following identity holds according to the two decomposition methods described above:

$$MB = MP_{RKR} + VA_{RKR} = MP_{RIM} + VA_{RIM}$$

Panel A of Table VIII presents the results obtained using the decomposition proposed by Rhodes-Kropf, Robinson, and Viswanathan (2005). In Panel B of Table VIII, we consider the measures constructed based on the methodology of Dong et al. (2006). Apart from the key explanatory variables reported in Table VIII, in both panels we have also included in all regressions the same control variables as those reported in Table V. However, for brevity, the coefficients of the control variables are not tabulated, since they are very similar to those reported in Table V.

[Insert Table VIII here]

We find that the fundamental value-to-assets ratios (VA_{RKR} and VA_{RIM}) are positive and statistically significant in all regressions, suggesting that external finance and various uses of cash are positively associated with companies' investment opportunities. Two proxies for mispricing, MP_{RKR} and MP_{RIM} , are found to be positively related to investment, the change in cash holdings, and net debt and equity issuances. The signs of the coefficients of the interaction terms between cash flow and mispricing proxies are in line with those in Table V. Our results indicate that overvaluation mitigates the impact of financial constraints, resulting in lower investment-cash flow and cash-cash flow sensitivities. In addition, the negative relation between internal funds and external finance is weaker for firms that are more likely to be undervalued.

VI. Conclusions

We examine how firm misvaluation affects corporate policies directly as well as via its interactions with cash flow shocks. A model is presented to study the independent and joint impacts of cash flow and firm valuation on corporate policies.

We find that firms use additional cash flows to substitute for external finance and increase investment and cash holdings. Overvalued firms increase investment, cash holdings, and external finance. In addition, misvaluation has important effects on the allocation of cash flow to its various uses. Our results suggest that firms allocate a higher fraction of their incremental cash flows to investment when they are more undervalued. This, in turn, implies that the balance sheet effects of monetary policy are likely to be more important under depressed stock market conditions. In contrast, undervalued firms are found to use less cash flow to replace external finance compared to overvalued firms.

Equity misvaluation, which is directly related to the wedge between the cost of internal and external finance, is arguably a better financial constraint measure compared to others commonly used in literature. All of our findings are consistent with this direction.

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Appendix A. Proofs

A.1. Proof of equation (5)

Differentiating *FOCs* (2) and (3) with respect to c_0 yields:

$$f'' \frac{dI_0^*}{dc_0} = h_{XX} \frac{dX_0^*}{dc_0} = \hat{f}'' \frac{dC^*}{dc_0}, \quad (A1)$$

$$\text{where,} \quad \hat{f}'' = -\pi'' - q(1-p)h_1''.$$

Since $f'' < 0$, $h_{XX} > 0$, and $\hat{f}'' < 0$, equation (A1) implies $\frac{dI_0^*}{dc_0}$ and $\frac{dC^*}{dc_0}$ are the same in sign, whereas, $\frac{dI_0^*}{dc_0}$ and $\frac{dX_0^*}{dc_0}$ are opposite in sign.

Substituting $X_0^* = I_0^* + C^* - c_0$ into *FOC* (2), differentiating it with respect to c_0 and substituting $\frac{dC^*}{dc_0}$ in terms of $\frac{dI_0^*}{dc_0}$ using equation (A1) yield:

$$f'' \frac{dI_0^*}{dc_0} = h_{XX} \left(\frac{dI_0^*}{dc_0} + \frac{f''}{\hat{f}''} \frac{dI_0^*}{dc_0} - 1 \right). \quad (A2)$$

Rearranging equation (A2) yields:

$$\frac{dI_0^*}{dc_0} = \frac{-h_{XX}}{f'' - h_{XX} - \frac{f'' h_{XX}}{\hat{f}''}} > 0. \quad (A3)$$

Equations (A1) and (A3) imply equation (5). ■

A.2. Proof of equation (6)

Differentiating *FOCs* (2) and (3) with respect to θ yields:

$$f'' \frac{dI_0^*}{d\theta} = h_{\theta X} - 1 + h_{XX} \frac{dX_0^*}{d\theta} = \hat{f}'' \frac{dC^*}{d\theta}. \quad (A4)$$

Equation (A4) implies that $\frac{dI_0^*}{d\theta}$ and $\frac{dC^*}{d\theta}$ are the same in sign.

Substituting $X_0^* = I_0^* + C^* - c_0$ into *FOC* (2), differentiating it with respect to θ , substituting $\frac{dC^*}{d\theta}$ in terms of $\frac{dI_0^*}{d\theta}$ using equation (A4), and rearranging yield:

$$\frac{dI_0^*}{d\theta} = \frac{h_{\theta X} - 1}{f'' - h_{XX} - \frac{f'' h_{XX}}{\hat{f}''}} > 0, \text{ since } h_{\theta X} < 0. \quad (A5)$$

Equations (A4) and (A5) imply $\frac{dC^*}{d\theta} > 0$.

By equations (A4) and (A5):

$$\frac{f''(h_{\theta X} - 1)}{f'' - h_{XX} - \frac{f'' h_{XX}}{\hat{f}''}} = h_{\theta X} - 1 + h_{XX} \frac{dX_0^*}{d\theta}. \quad (A6)$$

Rearranging equation (A6) and simplifying yield:

$$\frac{dX_0^*}{d\theta} = \frac{(h_{\theta X} - 1) \left(h_{XX} + \frac{f'' h_{XX}}{\hat{f}''} \right)}{h_{XX} \left(f'' - h_{XX} - \frac{f'' h_{XX}}{\hat{f}''} \right)} > 0. \blacksquare$$

A.3. Proof of Proposition 1

Differentiating equation (A3) with respect to θ and simplifying yield:

$$\frac{d}{d\theta} \left(\frac{dI_0^*}{dc_0} \right) = \frac{-h_{\theta XX} f''}{\left(f'' - h_{XX} - \frac{f'' h_{XX}}{\hat{f}''} \right)^2} < 0, \text{ since } h_{\theta XX} < 0. \quad (A7)$$

Since by differentiating (A1) with respect to θ , one can show that $f'' \frac{d}{d\theta} \left(\frac{dI_0^*}{dc_0} \right) = \hat{f}'' \frac{d}{d\theta} \left(\frac{dC^*}{dc_0} \right)$, $\frac{d}{d\theta} \left(\frac{dI_0^*}{dc_0} \right)$ and $\frac{d}{d\theta} \left(\frac{dC^*}{dc_0} \right)$ are the same in sign.

Using equations (A1) and (A3), we can write:

$$\frac{dX_0^*}{dc_0} = \frac{-f''}{f'' - h_{XX} - \frac{f'' h_{XX}}{\hat{f}''}}. \quad (A8)$$

Differentiating equation (A8) with respect to θ yields:

$$\frac{d}{d\theta} \left(\frac{dX_0^*}{dc_0} \right) = \frac{\left(-h_{\theta XX} - \frac{f'' h_{\theta XX}}{\hat{f}''} \right) f''}{\left(f'' - h_{XX} - \frac{f'' h_{XX}}{\hat{f}''} \right)^2} < 0. \blacksquare$$

A.4. Proof of Proposition 2

The manager makes optimal investment and financial decisions $(I_0, E_0, D_0, C, E_1, D_1)$ that maximize the following objective function:

$$\max_{I_0, E_0, D_0, C, D_1, E_1} f(I_0) - h(\theta, E_0) + \theta E_0 - r(\theta, D_0) - I_0 + E_q(\hat{g}(\bar{I})) - E_p(\hat{k}(E_1, D_1)) - \pi(C), \quad (\text{A9a})$$

s.t.,

$$I_0 + C = c_0 + E_0 + D_0, \quad (\text{A9b})$$

and,

$$E_1 + D_1 = \bar{I} - c_L - C \quad \text{for } c_1 = c_L, \quad (\text{A9c})$$

$$E_1 = D_1 = 0 \quad \text{for } c_1 = c_H, \quad (\text{A9d})$$

where,

$$\bar{c}_1 = pc_H + (1-p)c_L, \quad (\text{A9e})$$

$$E_p(\hat{k}(E_1, D_1)) = q((1-p)(h_1(E_1) + r_1(D_1)) + p(c_H + C - \bar{I})), \quad (\text{A9f})$$

$$E_q(\hat{g}(\bar{I})) = (1-q)(\bar{c}_1 + C) + q(g(\bar{I}) - \bar{I}). \quad (\text{A9g})$$

We can interpret equations (A9a)-(A9g) in the same way as equations (1a)-(1g). The only different between problems (1) and (A9) is that problem (A9) includes the choice of both equity and debt financing.

At time 1, if the investment opportunity arrives and the cash flow is at the low state, the firm will need to raise external capital. The optimal level of E_1^* and D_1^* are given by:

$$h_1'(E_1^*) = r_1'(D_1^*), \quad (\text{A10})$$

$$\text{s.t. } \bar{I} = c_L + C + E_1^* + D_1^*. \quad (\text{A11})$$

The first-order conditions (FOCs) of problem (A9) are:

$$f'(I_0^*) = h_E(\theta, E_0^*) + 1 - \theta, \quad (\text{A12})$$

$$h_E(\theta, E_0^*) - \theta = r_D(\theta, D_0^*), \quad (\text{A13})$$

and

$$h_E(\theta, E_0^*) - \theta = -\pi'(C^*) + q(1-p)\left(h_1'(E_1^*)\frac{dE_1^*}{dC^*} + r_1'(D_1^*)\frac{dD_1^*}{dC^*}\right) + 1 - q(1-p). \quad (\text{A14})$$

Using equations (A10) and (A11), and by the implicit function theorem, we have:

$$\frac{dE_1^*}{dC^*} = -\frac{r_1''}{h_1'' + r_1''}, \text{ and } \frac{dD_1^*}{dC^*} = -\frac{h_1''}{h_1'' + r_1''}. \quad (\text{A15})$$

Differentiating FOCs (A12) and (A14) with respect to c_0 yields:

$$f''\frac{dI_0^*}{dc_0} = h_{EE}\frac{dE_0^*}{dc_0} = r_{DD}\frac{dD_0^*}{dc_0} = \bar{f}''\frac{dC^*}{dc_0}, \quad (\text{A16})$$

$$\text{where, } \bar{f}'' = -\pi'' - q(1-p)\left(h_1''\left(\frac{dE_1^*}{dC^*}\right)^2 + r_1''\left(\frac{dD_1^*}{dC^*}\right)^2\right).$$

Substituting $E_0^* = I_0^* + C^* - c_0 - D_0^*$ into FOC (A12), differentiating it with respect to c_0 and substituting $\frac{dC^*}{dc_0}$ and $\frac{dD_1^*}{dc_0}$ in terms of $\frac{dI_0^*}{dc_0}$ using equation (A16) yields:

$$f''\frac{dI_0^*}{dc_0} = h_{EE}\left(\frac{dI_0^*}{dc_0} + \frac{f''}{\bar{f}''}\frac{dI_0^*}{dc_0} - 1 - \frac{f''}{r_{DD}}\frac{dI_0^*}{dc_0}\right). \quad (\text{A17})$$

Rearranging equation (A17) yields:

$$\frac{dI_0^*}{dc_0} = \frac{-h_{EE}}{f'' - h_{EE} - \frac{f''h_{EE}}{\bar{f}''} + \frac{f''h_{EE}}{r_{DD}}}. \quad (\text{A18})$$

Using equations (A16) and (A18), we have the followings:

$$\frac{dE_0^*}{dc_0} = \frac{-f''}{f'' - h_{EE} - \frac{f''h_{EE}}{\bar{f}''} + \frac{f''h_{EE}}{r_{DD}}}, \quad (\text{A19})$$

and

$$\frac{dD_0^*}{dc_0} = \frac{-\frac{f''h_{EE}}{r_{DD}}}{f'' - h_{XX} - \frac{f''h_{EE}}{\bar{f}''} + \frac{f''h_{EE}}{r_{DD}}}. \quad (\text{A20})$$

Differentiating equations (A18)-(A20) with respect to θ and simplifying yield:

$$\frac{d}{d\theta}\left(\frac{dI_0^*}{dc_0}\right) = \frac{-h_{\theta EE}f'' - \frac{r_{\theta DD}f''h_{EE}^2}{r_{DD}^2}}{\left(f'' - h_{EE} - \frac{f''h_{EE}}{\bar{f}''} + \frac{f''h_{EE}}{r_{DD}}\right)^2}, \quad (\text{A21})$$

$$\frac{d}{d\theta}\left(\frac{dE_0^*}{dc_0}\right) = \frac{\left(-h_{\theta EE} - \frac{f''h_{\theta EE}}{\bar{f}''} + \frac{f''h_{\theta EE}r_{DD} - f''r_{\theta DD}h_{EE}}{(r_{DD})^2}\right)f''}{\left(f'' - h_{EE} - \frac{f''h_{EE}}{\bar{f}''} + \frac{f''h_{EE}}{r_{DD}}\right)^2}, \quad (\text{A22})$$

and

$$\frac{d}{d\theta}\left(\frac{dD_0^*}{dc_0}\right) = \frac{\frac{f''^2h_{\theta EE}}{r_{DD}} + \frac{r_{\theta DD}f''h_{EE}}{(r_{DD})^2}\left(f'' - h_{EE} - \frac{f''h_{EE}}{\bar{f}''}\right)}{\left(f'' - h_{EE} - \frac{f''h_{EE}}{\bar{f}''} + \frac{f''h_{EE}}{r_{DD}}\right)^2}. \quad (\text{A23})$$

Note that equation (A21) is positive and by differentiating (A16) with respect to θ , one can show that $f'' \frac{d}{d\theta} \left(\frac{dl_0^*}{dc_0} \right) = \bar{f}'' \frac{d}{d\theta} \left(\frac{dc^*}{dc_0} \right)$, therefore $\frac{d}{d\theta} \left(\frac{dc^*}{dc_0} \right)$ is also positive.

Moreover, equation (A22) is negative and equation (A23) is positive if $r_{\theta DD}$ is sufficiently small. ■

Appendix B. Decomposition of the Market-to-Book Ratio

Specifically, Rhodes-Kropf, Robinson, and Viswanathan (2005) decompose the logarithm of the market-to-book *equity* ratio (E^m/E^b) as follows:

$$\begin{aligned} \ln(E^m / E^b)_{it} &= \ln(E_{it}^m) - \ln(E_{it}^b) \\ &= \underbrace{\ln(E_{it}^m) - v(\theta_{it}, \alpha_{jt})}_{FSE} + \underbrace{v(\theta_{it}, \alpha_{jt}) - v(\theta_{it}, \alpha_j)}_{TSE} + \underbrace{v(\theta_{it}, \alpha_j) - \ln(E_{it}^b)}_{LRV} \end{aligned} \quad (B1)$$

where $\ln$ stands for the natural logarithm function. The first term, firm-specific error (FSE), is the difference between the market value and the fundamental value as implied by its accounting multiples θ_{jt} and its sector j multiple α_{jt} measured at the valuation year t . If the market is overheated at time t , this will show up in α_{jt} and therefore $v(\theta_{jt}, \alpha_{jt})$. Similarly, if industry j is overvalued relative to other industries at time t , this too will appear in α_{jt} . Thus FSE captures purely firm-specific deviations from fundamental values, because the v term captures all deviations common to a sector at a point in time. The second term, the time series sector error (TSE), measures the difference between the firm's fundamental value conditional on contemporaneous accounting principles and its value implied by its accounting information and long-run multiples. This term captures the misvaluation of the whole sector at time t since $v(\theta_{jt}, \alpha_j)$ measures sector-specific valuation that does not vary over time. The third term, LRV , concerns the difference between the firm's valuation based on long-run multiples and its book value. This term captures the firm's set of investment prospect at time t .

To obtain $v(\theta_{jt}, \alpha_{jt})$ and $v(\theta_{jt}, \alpha_j)$, RKRK estimate the following model:

$$\ln(E_{it}^m) = \alpha_{0jt} + \alpha_{1jt} \ln(E_{it}^b) + \alpha_{2jt} \ln(NI)^+ + \alpha_{3jt} I_{(<0)} \ln(NI)_{it}^+ + \alpha_{4jt} (D/A)_{it} + \varepsilon_{it},$$

where NI^+ stands for the absolute value of net income and $I_{(<0)} \ln(NI)^+$ is an indicator function for negative operating income observations. Because the equation is estimated in logarithms and operating income can be negative, this specification allows for operating income to enter into the estimation without discarding all the firms with negative operating income at a point in time. The leverage ratio, D/A , is included to allow for the fact that firms with leverage higher or lower than the industry average have a different value of the multiple. Firms are grouped according to the 12 Fama and French industries. We then run annual cross-sectional regressions for each industry. Here $v(\theta_{jt}, \alpha_{jt})$ is the fitted value from the regression equation, which proxies for the fundamental value for a firm i in a sector j and at time t . The fundamental value of equity in equation (B1) is then equal to the exponential value of $v(\theta_{jt}, \alpha_{jt})$. Since our focus is on firm-level equity mispricing only, we do not decompose $v(\theta_{jt}, \alpha_{jt}) - \ln(E_{it}^b)$ further into TSE and LRV in this paper.

Appendix C. Mechanics of the Residual Income Model

Residual earnings are essentially earnings in excess of what would be generated if book equity were to earn the investors' required rate of return. This paper follows the method used by Frankel and Lee (1998) whereby the fundamental value (v) is calculated by estimating a two-period version of the residual income model as follows:

$$v = BPS_t + \frac{FROE_t - r_e}{1 + r_e} BPS_t + \frac{FROE_{t+1} - r_e}{(1 + r_e)^2} BPS_{t+1} + \frac{FROE_{t+2} - r_e}{(1 + r_e)^2 r_e} BPS_{t+2}, \quad (C1)$$

where BPS_{t+i} is the book value per share for fiscal year-end $t + i$, $FROE_{t+i}$ is the forecast return on equity for year $t + i$, and r_e is the firm's estimated cost of equity, the difference between these two measures being the firm's forecast residual earnings. All residual earnings from $t + 2$ onward are assumed to be constant in perpetuity and are captured in the final term of model (C1). The value of $FROE_{t+2}$ for this terminal value is estimated using I/B/E/S consensus long-term growth forecasts (LTG), while $FROE_t$ and $FROE_{t+1}$ utilize I/B/E/S consensus earnings per share forecasts over one- and two-year forecast horizons, respectively. For missing observations of LTG , $FROE_{t+2}$ is replaced with $FROE_{t+1}$. Book values of equity per share (BPS_{t-1} and BPS_{t-2}) are calculated using the most recent book value of common equity from Compustat prior to the announcement month and adjusting for the number of shares outstanding. Future fiscal year-end book values (BPS_{t+i}) are calculated by applying clean surplus accounting to the previous year's BPS values. This is done by deflating future earnings by dividends paid using an estimate of the dividend payout ratio (k).

The cost of equity, r_e is measured using the Fama and French three-factor model. This model segregates firms into 48 industry classifications and creates replicating portfolios based on size and book-to-market characteristics. Explicitly, the risk premiums reported for each industry on a monthly basis are combined with the effective annual risk-free rate, based on the current monthly risk-free rate, to generate an industry cost of equity for that given month. Specifically, Cost of equity = (Fama–French risk premium + 12×monthly risk-free rate)/100.

The payout ratio, k , is calculated using Compustat items as dividends divided by net income. For negative observations of net income, k is approximated as dividends divided by 6% of total assets. Thus we can calculate $FROE$ and future values of BPS as follows:

$$\begin{aligned} FROE_t &= \frac{2 \times EPS_{t+1}}{BPS_{t-1} + BPS_{t-2}}, \\ BPS_t &= BPS_{t-1} \times [1 + FROE_t(1 - k)], \\ FROE_{t+1} &= \frac{2 \times EPS_{t+2}}{BPS_t + BPS_{t-1}}, \\ BPS_{t+1} &= BPS_t \times [1 + FROE_{t+1}(1 - k)], \\ FROE_{t+2} &= \frac{2 \times EPS_{t+2} \times (1 + LTG)}{BPS_{t+1} + BPS_t}, \\ BPS_{t+2} &= BPS_{t+1} \times [1 + FROE_{t+2}(1 - k)]. \end{aligned}$$

Table I. Summary Statistics

The data for Panels A and B are from Compustat and CRSP for 1971–2011. Panel A reports summary statistics for variables in equation (7), including the change in cash holdings ($\Delta Cash$), investment (Inv), cash dividends (Div), cash flows (CF), and external financing (ΔX), which equals the sum of net debt issued (ΔD) and net equity issued (ΔE). $DIF^{Equation\ 7}$ is the difference between the left-hand and right-hand sides of equation (7). In Panel B, MB is defined as the market value of assets divided by the book value of assets. Future realized stock returns ($FRet$) are defined as returns over the next three years multiplied by -1. The variable $Tangibility$ is the net PPE over total assets; $Sales\ Growth$ is the change in net sales scaled by lagged net sales; $Leverage$ is defined as total debt (the sum of short-term and long-term debt) divided by total assets; and $Ln(Assets)$ is the natural log of the total book value of assets. Dollar values are adjusted to the 2000 dollar value using the gross domestic product (GDP) deflator.

Variables	N	Mean	SD	Min	Q1	Median	Q3	Max
<i>Panel A: Cash flow statement variables in equation (7) for 1971–2011</i>								
<i>Inv</i>	73,366	0.099	0.163	-0.373	0.022	0.064	0.135	2.313
$\Delta Cash$	73,366	0.010	0.124	-0.478	-0.021	0.001	0.029	2.215
<i>Div</i>	73,366	0.010	0.018	0.000	0.000	0.000	0.014	0.096
ΔX	73,366	0.053	0.222	-0.391	-0.027	0.001	0.056	4.628
ΔD	73,366	0.021	0.130	-0.550	-0.021	0.000	0.032	1.730
ΔE	73,366	0.032	0.179	-0.146	0.000	0.000	0.008	4.638
<i>CF</i>	73,366	0.066	0.165	-2.727	0.014	0.082	0.145	0.705
$DIF^{Equation\ 7}$	73,366	0	0.005	-0.088	0	0	0.000	0.010
<i>Panel B: Key explanatory variables for 1971–2011</i>								
<i>MB</i>	73,366	1.782	1.309	0.549	1.031	1.353	1.995	8.471
<i>FRet</i>	50,202	-0.479	1.267	-6.672	-0.824	-0.175	0.310	0.952
$Ln(Assets)$	73,366	5.233	2.176	0.980	3.624	5.079	6.669	10.745
<i>SaleG</i>	73,366	0.176	0.442	-0.542	-0.017	0.094	0.243	2.855
<i>Leverage</i>	73,366	0.215	0.196	0	0.028	0.185	0.338	0.797
<i>Tangibility</i>	73,366	0.298	0.227	0.009	0.115	0.241	0.428	0.896

Table II. Correlation Coefficients among Key Variables

The data are from Compustat and CRSP for 1971–2011. Variables in equation (7) include the change in cash holdings ($\Delta Cash$), investment (Inv), cash dividends (Div), cash flows (CF), and external financing (ΔX), which equals the sum of net debt issued (ΔD) and net equity issued (ΔE). MB is defined as the market value of assets divided by the book value of assets. Future realized stock returns ($FRet$) are defined as stock returns over the next three years multiplied by -1. $Tangibility$ is the net PPE over total assets; $Sales Growth$ is the change in net sales scaled by lagged net sales; $Leverage$ is defined as total debt (the sum of short-term and long-term debt) divided by total assets; and $Ln(Assets)$ is the natural log of the total book value of assets. The pairwise Pearson correlation coefficients between variables are reported. Correlation coefficients that are significant at the 1% level are marked with a superscript a .

	Inv	$\Delta Cash$	Div	ΔX	ΔD	ΔE	CF	MB	$FRet$	$Ln(Assets)$	$SaleG$	$Leverage$
$\Delta Cash$	-0.02 ^a											
Div	0.02 ^a	0										
ΔX	0.57 ^a	0.42 ^a	-0.07 ^a									
ΔD	0.51 ^a	0.06 ^a	0	0.59 ^a								
ΔE	0.34 ^a	0.47 ^a	-0.09 ^a	0.81 ^a	0							
CF	0.21 ^a	0.17 ^a	0.23 ^a	-0.48 ^a	-0.25 ^a	-0.41 ^a						
MB	0.11 ^a	0.12 ^a	0.03 ^a	0.23 ^a	0.02 ^a	0.27 ^a	-0.11 ^a					
$FRet$	0.05 ^a	0.02 ^a	0	0.09 ^a	0.06 ^a	0.07 ^a	-0.06 ^a	0.12 ^a				
$Ln(Assets)$	0.09 ^a	0.02 ^a	0.29 ^a	-0.11 ^a	0.02 ^a	-0.15 ^a	0.28 ^a	-0.12 ^a	0.01			
$SaleG$	0.30 ^a	0.11 ^a	0	0.20 ^a	0.17 ^a	0.12 ^a	0.11 ^a	0.15 ^a	0.04 ^a	0.07 ^a		
$Leverage$	0.07 ^a	-0.06 ^a	-0.09 ^a	0.08 ^a	0.25 ^a	-0.08 ^a	-0.10 ^a	-0.17 ^a	-0.01	0.15 ^a	-0.04 ^a	
$Tangibility$	0.20 ^a	-0.07 ^a	0.13 ^a	-0.04 ^a	0.04 ^a	-0.08 ^a	0.21 ^a	-0.13 ^a	-0.02 ^a	0.22 ^a	0.01	0.31 ^a

Table III. Misvaluation, Cash Flows, and Corporate Policies

The data are from Compustat and CRSP for 1971–2011. In Panel A, firms are sorted into five groups according to the market-to-book ratio (*MB*) and *CF*, respectively (independent sorts). Average values of variables are reported for each *MB–CF* group. In Panel B, firms are sorted into five groups according to *FRet* and *CF*, respectively (independent sorts). The average values of variables are reported for each *FRet–CF* group. Future realized stock returns (*FRet*) are defined as returns over the next three years multiplied by -1.

	MB groups	Panel A: MB–CF grouping					FRet groups	Panel B: FRet–CF grouping				
		Cash flow groups						Cash flow groups				
		1 (low)	2	3	4	5 (high)		1 (low)	2	3	4	5 (high)
Inv	1 (undervalued)	0.01	0.04	0.06	0.08	0.13	1(undervalued)	0.04	0.06	0.08	0.11	0.19
	2	0.03	0.05	0.07	0.10	0.16	2	0.06	0.06	0.08	0.11	0.18
	3	0.04	0.07	0.08	0.11	0.19	3	0.05	0.06	0.08	0.11	0.19
	4	0.06	0.08	0.09	0.13	0.20	4	0.07	0.07	0.09	0.12	0.20
	5 (overvalued)	0.10	0.12	0.13	0.14	0.21	5(overvalued)	0.08	0.09	0.12	0.15	0.24
ΔCash	1 (undervalued)	-0.04	-0.01	0.00	0.02	0.06	1(undervalued)	-0.02	0.00	0.01	0.02	0.06
	2	-0.03	-0.01	0.01	0.01	0.05	2	-0.03	0.00	0.01	0.01	0.05
	3	-0.03	-0.01	0.00	0.01	0.05	3	-0.03	0.00	0.00	0.01	0.05
	4	-0.04	-0.01	0.00	0.01	0.05	4	-0.02	0.00	0.01	0.02	0.06
	5 (overvalued)	-0.01	0.01	0.02	0.03	0.08	5(overvalued)	-0.01	0.00	0.01	0.03	0.09
Div	1 (undervalued)	0.00	0.00	0.01	0.01	0.01	1(undervalued)	0.00	0.01	0.01	0.01	0.02
	2	0.00	0.01	0.01	0.01	0.01	2	0.00	0.01	0.02	0.02	0.02
	3	0.00	0.01	0.01	0.02	0.01	3	0.00	0.01	0.01	0.02	0.02
	4	0.00	0.01	0.01	0.02	0.02	4	0.00	0.01	0.01	0.01	0.02
	5 (overvalued)	0.00	0.00	0.01	0.02	0.02	5(overvalued)	0.00	0.00	0.01	0.01	0.01
ΔX	1 (undervalued)	0.06	0.01	-0.01	-0.02	-0.04	1(undervalued)	0.12	0.02	0.00	0.00	0.01
	2	0.09	0.02	0.00	0.00	-0.02	2	0.13	0.02	0.01	0.00	0.01
	3	0.12	0.04	0.02	0.01	0.02	3	0.13	0.02	0.01	0.01	0.02
	4	0.18	0.06	0.03	0.03	0.03	4	0.16	0.03	0.02	0.02	0.03
	5 (overvalued)	0.37	0.10	0.07	0.05	0.05	5(overvalued)	0.23	0.06	0.05	0.05	0.07
ΔD	1 (undervalued)	0.04	0.00	-0.01	-0.02	-0.04	1(undervalued)	0.05	0.01	0.00	0.00	0.00
	2	0.07	0.01	0.00	-0.01	-0.02	2	0.06	0.01	0.01	0.00	0.00
	3	0.07	0.02	0.01	0.01	0.00	3	0.06	0.02	0.01	0.01	0.01
	4	0.08	0.03	0.02	0.02	0.02	4	0.07	0.02	0.01	0.01	0.01
	5 (overvalued)	0.08	0.04	0.02	0.02	0.01	5(overvalued)	0.07	0.03	0.02	0.02	0.02
ΔE	1 (undervalued)	0.02	0.00	0.00	0.00	0.00	1(undervalued)	0.07	0.01	0.01	0.00	0.01
	2	0.03	0.01	0.00	0.00	0.01	2	0.07	0.01	0.00	0.00	0.01
	3	0.05	0.01	0.00	0.00	0.01	3	0.07	0.01	0.00	0.00	0.01
	4	0.09	0.02	0.01	0.00	0.01	4	0.09	0.01	0.01	0.01	0.02
	5 (overvalued)	0.28	0.06	0.05	0.03	0.03	5(overvalued)	0.15	0.03	0.03	0.04	0.05

Table IV. Independent Effects of Cash Flow and Firm Valuation (measured by *MB*) on Corporate Policies

The data are from Compustat and CRSP for 1971–2011. The dependent variables and cash flow (*CF*) are included in the equation (7). *MB* is defined as the market value of assets divided by the book value of assets; *SalesG* is the change in net sales scaled by lagged net sales; *Ln(Assets)* is the natural log of the total book value of assets; *Leverage* is defined as total debt (the sum of short-term and long-term debt) divided by total assets; and *Tangibility* is the net PPE over total assets. All explanatory variables except cash flow (*CF*) are lagged one period. The regression equations are estimated with firm and year fixed effects. To estimate regressions with firm fixed effects, we demean the dependent and all explanatory variables in the equations. For brevity, constant term and year dummies are not reported. The t-statistics are presented in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. All equations are estimated using the single-equation model without the linear constraint that sources equal uses of cash.

VARIABLES	(1) Inv_t	(2) $\Delta Cash_t$	(3) Div_t	(4) ΔX_t	(5) ΔD_t	(6) ΔE_t
CF_t	0.16*** (36.6)	0.22*** (61.7)	0.01*** (18.6)	-0.62*** (-117.9)	-0.28*** (-80.9)	-0.34*** (-76.2)
MB_{t-1}	0.03*** (44.1)	0.02*** (34.3)	0.00*** (13.5)	0.04*** (60.2)	0.01*** (14.2)	0.04*** (60.4)
$SaleG_{t-1}$	0.02*** (11.9)	0.01*** (8.2)	-0.00*** (-3.3)	0.03*** (15.0)	0.01*** (10.5)	0.01*** (9.6)
$Ln(Assets)_{t-1}$	-0.03*** (-32.5)	-0.02*** (-28.6)	0.00*** (4.8)	-0.05*** (-45.9)	-0.01*** (-14.0)	-0.04*** (-43.4)
$Leverage_{t-1}$	-0.16*** (-33.3)	0.02*** (4.3)	-0.01*** (-36.6)	-0.16*** (-26.4)	-0.24*** (-60.6)	0.08*** (16.8)
$Tangibility_{t-1}$	0.06*** (9.6)	0.07*** (12.6)	0.00* (1.9)	0.13*** (16.3)	0.07*** (13.6)	0.06*** (8.6)
Inv_{t-1}	0.04*** (11.2)	-0.02*** (-5.4)	0.00 (1.6)	0.03*** (5.7)	0.05*** (14.9)	-0.02*** (-5.1)
$\Delta Cash_{t-1}$	0.11*** (28.7)	-0.15*** (-46.2)	0.00*** (3.2)	-0.03*** (-7.4)	0.01** (2.0)	-0.04*** (-10.4)
Div_{t-1}	0.07** (2.2)	-0.23*** (-8.7)	0.28*** (134.7)	0.15*** (3.8)	0.16*** (5.9)	-0.00 (-0.1)
ΔD_{t-1}	-0.02*** (-3.7)	0.01* (1.8)	-0.00 (-0.7)	-0.01* (-1.9)	-0.03*** (-8.8)	0.02*** (4.8)
ΔE_{t-1}	-0.05*** (-18.6)	0.02*** (9.2)	-0.00*** (-12.7)	-0.03*** (-9.8)	-0.02*** (-10.6)	-0.01*** (-3.2)
Observations	73366	73366	73366	73366	73366	73366
R-squared	0.12	0.12	0.24	0.25	0.15	0.16

Table V. Joint Impact of Cash Flow and Firm Valuation (measured by *MB*) on Corporate Policies

The data are from Compustat and CRSP for 1971–2011. The dependent variables and cash flow (*CF*) are included in the equation (7). *MB* is defined as the market value of assets divided by the book value of assets; *SalesG* is the change in net sales scaled by lagged net sales; *Ln(Assets)* is the natural log of the total book value of assets; *Leverage* is defined as total debt (the sum of short-term and long-term debt) divided by total assets; and *Tangibility* is the net PPE over total assets. All explanatory variables except cash flow (*CF*) are lagged one period. The regression equations are estimated with firm and year fixed effects. To estimate regressions with firm fixed effects, we demean the dependent and all explanatory variables in the equations. For brevity, constant term and year dummies are not reported. The t-statistics are presented in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. All equations are estimated using the single-equation model without the linear constraint that sources equal uses of cash.

VARIABLES	(1) <i>Inv_t</i>	(2) <i>ΔCash_t</i>	(3) <i>Div_t</i>	(4) <i>ΔX_t</i>	(5) <i>ΔD_t</i>	(6) <i>ΔE_t</i>
<i>CF_t</i>	0.27*** (40.9)	0.34*** (65.1)	0.01*** (17.6)	-0.38*** (-48.4)	-0.36*** (-68.3)	-0.02*** (-3.1)
<i>MB_{t-1}</i>	0.03*** (44.1)	0.02*** (34.3)	0.00*** (13.4)	0.04*** (60.6)	0.01*** (14.4)	0.04*** (61.6)
<i>CF_t × MB_{t-1}</i>	-0.03*** (-22.2)	-0.04*** (-32.0)	-0.00*** (-7.1)	-0.08*** (-40.5)	0.02*** (19.6)	-0.10*** (-64.9)
<i>SaleG_{t-1}</i>	0.02*** (11.9)	0.01*** (8.2)	-0.00*** (-3.4)	0.03*** (15.1)	0.01*** (10.5)	0.01*** (9.8)
<i>Ln(Assets)_{t-1}</i>	-0.03*** (-32.1)	-0.02*** (-28.0)	0.00*** (5.0)	-0.05*** (-45.4)	-0.01*** (-14.5)	-0.04*** (-43.0)
<i>Leverage_{t-1}</i>	-0.16*** (-33.9)	0.01*** (3.5)	-0.01*** (-36.8)	-0.16*** (-27.7)	-0.24*** (-60.3)	0.08*** (15.7)
<i>Tangibility_{t-1}</i>	0.06*** (9.0)	0.06*** (11.8)	0.00* (1.8)	0.12*** (15.4)	0.07*** (14.2)	0.05*** (7.1)
<i>Inv_{t-1}</i>	0.05*** (12.7)	-0.01*** (-3.3)	0.00** (2.1)	0.04*** (8.4)	0.04*** (13.6)	-0.00 (-1.0)
<i>ΔCash_{t-1}</i>	0.12*** (30.4)	-0.14*** (-43.9)	0.00*** (3.7)	-0.02*** (-4.4)	0.00 (0.5)	-0.02*** (-5.7)
<i>Div_{t-1}</i>	0.09*** (2.7)	-0.21*** (-8.0)	0.28*** (134.9)	0.19*** (4.8)	0.14*** (5.5)	0.05 (1.4)
<i>ΔD_{t-1}</i>	-0.02*** (-4.7)	0.00 (0.4)	-0.00 (-1.1)	-0.02*** (-3.7)	-0.03*** (-8.0)	0.01** (2.1)
<i>ΔE_{t-1}</i>	-0.06*** (-20.4)	0.02*** (6.6)	-0.00*** (-13.2)	-0.05*** (-13.2)	-0.02*** (-9.0)	-0.02*** (-8.7)
Observations	73366	73366	73366	73366	73366	73366
R-squared	0.12	0.13	0.24	0.26	0.15	0.21

Table VI. Joint Impact of Cash Flow and Firm Valuation (measured by *MB* indicator variables) on Corporate Policies

The data are from Compustat and CRSP for 1971–2011. The dependent variables and cash flow (*CF*) are included in the equation (7). *MB* is defined as the market value of assets divided by the book value of assets. Firms are evenly divided into three groups according to *MB*. Here *Low (High) MB* is a dummy variable that is equal to one if a firm's *MB* is in the group with the lowest (highest) *MB*, and zero otherwise; *SalesG* is the change in net sales scaled by lagged net sales; *Ln(Assets)* is the natural log of the total book value of assets; *Leverage* is defined as total debt (the sum of short-term and long-term debt) divided by total assets; and *Tangibility* is the net PPE over total assets. All explanatory variables except cash flow (*CF*) are lagged one period. The regression equations are estimated with firm and year fixed effects. To estimate regressions with firm fixed effects, we demean the dependent and all explanatory variables in the equations. For brevity, constant term and year dummies are not reported. The t-statistics are presented in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. All equations are estimated using the single-equation model without the linear constraint that sources equal uses of cash.

VARIABLES	(1) <i>Inv_t</i>	(2) <i>ΔCash_t</i>	(3) <i>Div_t</i>	(4) <i>ΔX_t</i>	(5) <i>ΔD_t</i>	(6) <i>ΔE_t</i>
<i>CF_t</i>	0.22*** (27.8)	0.27*** (41.6)	0.01*** (10.4)	-0.50*** (-50.7)	-0.34*** (-52.5)	-0.16*** (-19.3)
<i>Low MB</i>	-0.03*** (-16.6)	-0.01*** (-4.4)	-0.00*** (-11.5)	-0.03*** (-17.1)	-0.02*** (-15.6)	-0.01*** (-8.1)
<i>CF_t × Low MB</i>	-0.01 (-0.5)	0.05*** (5.4)	0.00 (0.2)	0.04*** (3.1)	-0.01 (-1.2)	0.06*** (4.8)
<i>High MB</i>	0.05*** (28.4)	0.02*** (16.3)	0.00*** (13.4)	0.07*** (34.9)	0.01*** (7.5)	0.06*** (35.6)
<i>CF_t × High MB</i>	-0.12*** (-13.2)	-0.11*** (-15.4)	-0.00 (-1.2)	-0.23*** (-21.2)	0.09*** (12.7)	-0.33*** (-35.3)
<i>SaleG_{t-1}</i>	0.02*** (13.9)	0.01*** (11.5)	-0.00*** (-4.0)	0.03*** (18.8)	0.01*** (10.0)	0.02*** (14.6)
<i>Ln(Assets)_{t-1}</i>	-0.03*** (-35.0)	-0.02*** (-31.0)	0.00*** (4.7)	-0.05*** (-49.3)	-0.01*** (-15.1)	-0.04*** (-46.9)
<i>Leverage_{t-1}</i>	-0.16*** (-33.7)	0.01*** (2.7)	-0.01*** (-36.2)	-0.16*** (-27.5)	-0.24*** (-59.7)	0.07*** (14.1)
<i>Tangibility_{t-1}</i>	0.06*** (9.6)	0.06*** (11.6)	0.00** (2.6)	0.12*** (15.7)	0.08*** (14.9)	0.05*** (7.0)
<i>Inv_{t-1}</i>	0.05*** (12.4)	-0.01** (-2.5)	0.00 (1.0)	0.04*** (8.6)	0.04*** (13.1)	-0.00 (-0.1)
<i>ΔCash_{t-1}</i>	0.12*** (30.1)	-0.14*** (-43.2)	0.00*** (2.8)	-0.02*** (-4.2)	0.00 (0.6)	-0.02*** (-5.5)
<i>Div_{t-1}</i>	0.09*** (2.7)	-0.17*** (-6.3)	0.28*** (133.8)	0.23*** (5.8)	0.11*** (4.2)	0.12*** (3.7)
<i>ΔD_{t-1}</i>	-0.02*** (-5.5)	-0.00 (-0.8)	-0.00 (-0.7)	-0.03*** (-5.1)	-0.03*** (-8.0)	0.00 (0.3)
<i>ΔE_{t-1}</i>	-0.05*** (-18.6)	0.02*** (7.6)	-0.00*** (-12.1)	-0.04*** (-10.7)	-0.02*** (-8.3)	-0.02*** (-6.2)
Observations	73366	73366	73366	73366	73366	73366
R-squared	0.11	0.12	0.25	0.24	0.16	0.15

Table VII. Joint Impact of Cash Flow and Future Stock Returns on Corporate Policies

The data are from Compustat and CRSP for 1971–2011. The dependent variables and cash flow (CF) are included in the equation (7). MB is defined as the market value of assets divided by the book value of assets; $SalesG$ is the change in net sales scaled by lagged net sales; $Ln(Assets)$ is the natural log of the total book value of assets; $Leverage$ is defined as total debt (the sum of short-term and long-term debt) divided by total assets; and $Tangibility$ is the net PPE over total assets. Future realized stock returns ($FRet$) are defined as stock returns over the next three years multiplied by -1. The regression equations are estimated with firm and year fixed effects. To estimate regressions with firm fixed effects, we demean the dependent and all explanatory variables in the equations. For brevity, constant term and year dummies are not reported. The t-statistics are presented in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. All equations are estimated using the single-equation model without the linear constraint that sources equal uses of cash.

VARIABLES	(1) Inv_t	(2) $\Delta Cash_t$	(3) Div_t	(4) ΔX_t	(5) ΔD_t	(6) ΔE_t
CF_t	0.18*** (30.8)	0.24*** (51.2)	0.01*** (16.6)	-0.58*** (-84.0)	-0.27*** (-58.8)	-0.31*** (-54.2)
MB_{t-1}	0.02*** (33.4)	0.01*** (24.0)	0.00*** (9.8)	0.04*** (44.7)	0.01*** (8.9)	0.03*** (46.3)
$FRet_t$	0.01*** (17.6)	0.01*** (14.5)	0.00*** (7.1)	0.02*** (25.0)	0.00*** (10.6)	0.01*** (21.4)
$CF_t \times FRet_t$	-0.02*** (-6.9)	-0.03*** (-10.7)	0.00 (1.3)	-0.05*** (-12.9)	0.00 (0.6)	-0.05*** (-15.9)
$SaleG_{t-1}$	0.02*** (8.5)	0.01*** (6.5)	-0.00*** (-3.5)	0.02*** (11.3)	0.01*** (7.6)	0.01*** (7.5)
$Ln(Assets)_{t-1}$	-0.04*** (-33.1)	-0.02*** (-26.8)	0.00 (0.7)	-0.06*** (-45.8)	-0.01*** (-14.0)	-0.05*** (-43.7)
$Leverage_{t-1}$	-0.17*** (-26.8)	0.02*** (4.8)	-0.01*** (-35.3)	-0.16*** (-20.9)	-0.27*** (-54.8)	0.11*** (18.0)
$Tangibility_{t-1}$	0.06*** (7.9)	0.07*** (11.2)	0.00*** (2.6)	0.14*** (14.2)	0.08*** (11.6)	0.07*** (7.9)
Inv_{t-1}	0.04*** (8.7)	-0.02*** (-5.8)	0.00* (1.7)	0.02*** (3.3)	0.05*** (11.9)	-0.03*** (-5.4)
$\Delta Cash_{t-1}$	0.13*** (26.3)	-0.15*** (-37.8)	0.00 (0.8)	-0.02*** (-3.9)	0.02*** (3.9)	-0.04*** (-7.7)
Div_{t-1}	-0.01 (-0.1)	-0.26*** (-8.0)	0.27*** (109.1)	0.03 (0.7)	0.07** (2.4)	-0.04 (-1.0)
ΔD_{t-1}	-0.02*** (-3.5)	0.01** (2.3)	-0.00 (-0.3)	-0.01 (-1.4)	-0.04*** (-8.2)	0.03*** (4.8)
ΔE_{t-1}	-0.06*** (-17.4)	0.02*** (7.5)	-0.00*** (-10.1)	-0.04*** (-9.9)	-0.03*** (-8.8)	-0.02*** (-4.9)
Observations	50202	50202	50202	50202	50202	50202
R-squared	0.13	0.13	0.25	0.22	0.15	0.15

Table VIII. Decomposition of the Market-to-Book Ratio and the Joint Impact of Cash Flow and Misvaluation on Corporate Policies

The data are from Compustat and CRSP for 1971–2011. The dependent variables and cash flow (CF) are included in the equation (7). In Panel A, we use the methodology proposed by Rhodes-Kropf, Robinson, and Viswanathan (2005) to decompose the market-to-book ratio. The resulting measures of misvaluation and the fundamental-value-to-assets ratio are denoted MP_{RKR} and VAR_{KR} , respectively. Appendix B describes RKR 's decomposition in detail. In Panel B, we use the residual income model as in Dong et al. (2006) to compute the fundamental value of equity. The resulting measures of misvaluation and the fundamental-value-to-assets ratio are denoted MP_{RIM} and VAR_{IM} , respectively. Appendix C describes the residual income model in detail. Apart from key explanatory variables reported here, we also include in all regressions the same control variables as those reported in Table V. For brevity, the coefficients of the control variables are not tabulated. The regression equations are estimated with firm and year fixed effects. To estimate regressions with firm fixed effects, we demean the dependent and all explanatory variables in the equations. For brevity, constant term and year dummies are not reported. The t-statistics are presented in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. All equations are estimated using the single-equation model without the linear constraint that sources equal uses of cash.

VARIABLES	(1) Inv_t	(2) $\Delta Cash_t$	(3) Div_t	(4) ΔX_t	(5) ΔD_t	(6) ΔE_t
Panel A: MP_{RKR} as the proxy for misvaluation						
CF_t	0.21*** (42.8)	0.28*** (71.3)	0.01*** (20.0)	-0.50*** (-86.1)	-0.29*** (-73.7)	-0.21*** (-44.8)
VA_{RKR}	0.03*** (24.6)	0.02*** (18.1)	0.00*** (12.7)	0.06*** (33.8)	0.01*** (9.5)	0.04*** (33.6)
MP_{RKR}	0.03*** (39.9)	0.02*** (30.2)	0.00*** (9.0)	0.04*** (54.6)	0.01*** (10.5)	0.04*** (58.4)
$CF \times MP_{RKR}$	-0.04*** (-18.4)	-0.04*** (-28.0)	-0.00*** (-5.1)	-0.08*** (-34.7)	0.02*** (13.5)	-0.10*** (-53.7)
Observations	71113	71113	71113	71113	71113	71113
R-squared	0.13	0.14	0.25	0.24	0.15	0.18
Panel B: MP_{RIM} as the proxy for misvaluation						
CF	0.24*** (31.4)	0.29*** (49.0)	0.01*** (12.5)	-0.46*** (-51.7)	-0.26*** (-44.0)	-0.20*** (-28.1)
VA_{RIM}	0.02*** (26.3)	0.01*** (19.6)	0.00*** (10.8)	0.04*** (36.1)	0.01*** (10.9)	0.03*** (36.1)
MP_{RIM}	0.02*** (26.7)	0.01*** (16.5)	0.00*** (7.8)	0.04*** (34.3)	0.00*** (6.1)	0.03*** (37.9)
$CF \times MP_{RIM}$	-0.02*** (-5.6)	-0.02*** (-7.7)	-0.00*** (-4.8)	-0.04*** (-10.1)	0.01*** (4.2)	-0.05*** (-16.1)
Observations	38469	38469	38469	38469	38469	38469
R-squared	0.15	0.14	0.23	0.17	0.14	0.11

Essay Three:

The Information Role of Advisors in Mergers and Acquisitions: Evidence from Acquirers Hiring Targets' Ex-advisors

ABSTRACT

We examine the information role of financial advisors by focusing on mergers and acquisitions in which acquiring firms hire target firms' ex-advisors. We document that by employing targets' ex-advisors, acquirers pay lower takeover premiums and secure a larger proportion of merger synergies. The corresponding targets exhibit lower announcement returns and are less likely to be propositioned by competing bidders. These results indicate that acquiring firms access and exploit value-relevant information about target firms through targets' ex-advisors, and achieve a bargaining advantage in deal negotiations. In contrast, when targets hire acquirers' ex-advisors, there are no discernible value effects on either firm, consistent with targets' weak ability to use the promise of future business to engage acquirers' ex-advisors.

JEL Classification: G24, G34, L11

Keywords: Mergers and acquisitions; Investment banking; Advisory services; Competition; Bargaining

I. Introduction

Mergers and acquisitions (M&A hereafter) are typically characterized by information asymmetry between the merging firms. The exchange and transmission of information between deal participants may therefore influence several aspects of the transaction such as premium paid for the transaction and cumulative abnormal returns around the announcement date. One of the main roles of investment banks is to produce and process information in the market for corporate control (Allen et al. 2004).⁷⁶ By evaluating merging firms and providing technical and tactical assistance to merger rivals throughout the takeover process, advisory banks can become privy to “inside” information about acquiring and target firms, which includes, for example, growth opportunities, profit margins, customer and supplier relationships, contingent liabilities, labor relations, firms’ merger-related experiences, existing governance practices, and the willingness of target management to be acquired.

In this paper, we empirically evaluate the materiality of information obtained by M&A advisors in the course of a prior firm-advisor relationship, and examine whether this information can be exploited or transferred in subsequent M&A transactions. In particular, we focus on M&A transactions in which acquiring firms hire target firms’ ex-advisors as M&A advisors, and propose the following two hypotheses regarding the information role of M&A advisors in these transactions.

First, the information advantage hypothesis contends that value-relevant information about target firms is conveyed from target firms’ ex-advisors to acquirers. As a result, targets’ ex-advisors enable acquiring firms to reduce the cost of acquiring information about target firms, and achieve better understanding of the true value of targets and more accurate estimation of potential synergies. This enhanced knowledge and information advantage enable acquirers to

⁷⁶ We use investment banks, financial advisors, advisory banks, and advisors interchangeably throughout the paper.

limit competition from outside bidders who are less informed and may have concerns of the winner's curse (Povel and Singh 2006), and therefore acquirers face less need to deter a competing bidder by a high premium. Furthermore, the acquirers hiring targets' ex-advisors may enjoy a bargaining advantage in deal negotiations between merging firms due to their better understanding of the target's firm value and outside options.

Second, the deal improvement hypothesis posits a more benign motive behind acquirers' decision to hire targets' ex-advisors. That is, employing an advisor with a prior relationship with the target firm may greatly facilitate information exchange between the target and acquiring firms. As information conduits, targets' ex-advisors can identify more valuable mergers and/or structure the deal to achieve better merger outcomes in terms of higher total synergies.⁷⁷ In addition, targets' ex-advisors may also be able to create more amicable atmosphere between merging firms, resulting in an orderly transfer of control and speedy deal completion.

The two hypotheses - information advantage and deal improvement - are not mutually exclusive. The information advantage view focuses more on the relative bargaining strength between merger counterparties and the wealth transfer from targets to acquiring firms, while the deal improvement view emphasizes more on the value creation caused by target's ex-advisors for both merging firms. Which view dominates the other is the primary empirical question that we aim to address in this paper.

While both hypotheses predict that acquiring firms to have strong incentives to hire targets' ex-advisors, it is important to note that target's ex-advisors may not always agree to advise the acquiring firm in the proposed merger transaction. Although there is no explicit law or regulation that prohibits ex-advisors from providing advisory services to the merger

⁷⁷ Higher synergies may arise from target's ex-advisors helping the acquiring firm on how to assimilate the target after the merger, optimally retain key target firm management, suggests efficient levels of autonomy for the target firm post-acquisition, and integrate possible differences in corporate cultures between the acquiring and target firms.

counterparty,⁷⁸ in hostile takeovers, if hiring merger-counterparty's ex-advisor is perceived as creating a channel for potentially transmitting firm-sensitive information, it may negatively affect the advisor's reputation in the market and even lead to litigation. For example in 2003 Dana Corp – who was the target of a hostile bid by ArvinMeritor – filed a lawsuit in New York against UBS (who advised the acquirer) and illustrates a circumstance when the acquirer engages the services of target's financial advisor –

According to the lawsuit, UBS has acted as an investment banker and financial adviser to Dana on a "significant corporate project" since "at least" March 2002. UBS provided "substantial financial and investment advice" to Dana with respect to the project from March 2002 through the end of May, the lawsuit said...As recently as May 23, Dana and UBS met to discuss "current material, non-public" information about Dana, the lawsuit said.(Dow Jones Corporate Filings Alert, August 5 2003)⁷⁹

The potential of being sued and consequent damages to its reputation may therefore limit an advisor's ability to accept mandates under such circumstances. Concurrently, acquirers would expect the managers and boards of some targets to rationally reject the merger negotiations as their hiring of target's ex-advisor may be considered as an unfriendly gesture to weaken the target's position by unveiling privy information. Thus, acquirers should rationally evaluate pros and cons before making the decision to hire targets' ex-advisors.⁸⁰ However, while anecdotal evidence suggests hiring merger counterparty's ex-advisor results in information transmission and conflicts of interests, it is an open empirical question whether or not such information

⁷⁸ The mandated disclosure requirements under current SEC rules require disclosure of material relationships only in the past two years between the financial advisor and the parties to the underlying transaction and any compensation received as a result of that relationship. See Item 1015(b)(4) of Regulation M-A under the Securities Exchange Act of 1934. This regulation has recently been used in *Art Technology Group Inc. Shareholders Litigation* (2010) whereby the Delaware Supreme Court enjoined the acquisition of Art Technology Group Inc. by Oracle Corporation, and required the financial advisor to Art Technology to disclose a description of the type of services the advisor had performed for Oracle and the aggregate compensation paid by Oracle to the financial advisor for the prior four years (Hughes and Austin, 2012).

⁷⁹ ArvinMeritor withdrew its offer on November 23, 2003 and Dana reached an out-of-court settlement (terms undisclosed) with UBS in December 2003.

⁸⁰ As discussed by Mehran and Stulz (2007) in an excellent review article, market participants appear to consider conflicts of interest when making their decisions.

transmission (or conflict of interests) is necessarily beneficial for the hiring firm and/or detrimental to the merger counterparty.⁸¹

Using a sample of 3,251 mergers and acquisitions undertaken between US-domiciled publicly listed firms during the period 1985-2008, we find that 9.6% of acquirers hire target's ex-advisor to advise on the deals, given that target firms have hired merger advisors in the past transactions.⁸² When the advisor choice is analysed in a multivariate setting, we find that the acquirer's propensity to hire target's ex-advisor is positively related to the number of M&A advisors hired by the target firm in the past five years and the strength of acquirer's bargaining power, but negatively associated with acquirer's merger expertise in target's industry. These results are generally consistent with the view that acquirers rationally balance the costs and benefits of hiring targets' ex-advisors when choosing advisors.

We then examine the consequences of acquirer hiring target's ex-advisors for acquiring and target firms by examining the likelihood of competing bids, the premium paid by the acquirer to the target firm, and the announcement returns. Our results show that acquirer's hiring of target's ex-advisors significantly reduces both the likelihood and the number of competing bids, indicating that this decision deters less informed bidders from entering the contest. Moreover, after controlling for known determinants of premiums and cumulative abnormal returns (*CAR*), the acquirer's decision to hire target's ex-advisor lowers both the premium paid to target and target's *CAR* by roughly 6%. Collectively, these results support the information advantage view

⁸¹ It is unclear whether hiring target's ex-advisors provides benefit to the acquiring firm *ex ante*, if the target foresees possible conflicts of interests and seeks extra terms and protections from the acquiring firm. For example, a target with strong bargaining power may demand a higher premium if conflicts of interests exist. Moreover, even if hiring counterparty's ex-advisor results in more favorable terms for the hiring firm, the consequential conflicts arising between acquirer and target may dissipate the benefits, resulting in an overall loss in value.

⁸² The frequency of targets hiring acquirers' ex-advisors is higher (12.9%), conditional on that acquirers have ex-advisors from past transactions. The conditional probabilities are higher if we consider banks that have served as underwriters in the past. Acquirers hire target's ex-underwriters in about 14.8% of the cases, whereas targets hire acquirer's ex-underwriters in about 19.6% of the cases.

that the hiring of target's ex-advisors provides the acquirer with a bargaining advantage and allows it to acquire the target at a more attractive price.

We do not find evidence in support of the deal improvement hypothesis, which predicts that the combined wealth gain and the likelihood of deal completion should be positively related to the hiring of target's ex-advisors. Specifically, we document that acquirer's decision to hire target's ex-advisors has no significant impact on the value of synergistic gains, which is measured as the combined abnormal announcement returns to bidders and targets, long-term post-acquisition stock performance of the combined firm, the likelihood of deal completion, and time to resolution. Although target's ex-advisors do not *increase* the value of total synergies, we find evidence that they do enable acquiring (target) firms to obtain a greater (smaller) fraction of synergies, which is consistent with acquirers' enhanced bargaining ability suggested by the information advantage hypothesis.

We perform a variety of checks to ensure that our main results are robust to alternative model specifications and variable definitions. In particular, all our results continue to hold after controlling for endogeneity using the two-stage Heckman (1979) procedure. Furthermore, we conduct simulation analysis to address the concern that our findings may be driven by the market share of target firms' ex-advisors. Taken together, our findings favor the interpretation that when target's ex-advisors are hired by an acquirer, valuable information is conveyed to the acquirer, leading the acquirer to possess greater bargaining power in merger negotiations and reducing the degree of competition from less informed bidders.

Last but not least, we also examine the advisor choice from target firms' perspective. Can target firms achieve information or bargaining advantage by hiring acquirer's ex-advisors? The short answer to this question is no. Our analysis reveals that the hiring of acquirer's ex-advisor does not influence target or acquiring firms' *CAR*, premiums paid by acquiring firms, the dollar

value of synergies, and target's share of total synergy gains. These results, although standing in sharp contrast to the above mentioned results regarding the wealth effects of acquirers hiring targets' ex-advisors, are not surprising if we take into account the unique asymmetric feature of M&A transactions: acquiring firms continue to survive after acquisitions, while targets normally cease to exist as standalone companies after successful mergers. As a result, target firms cannot use the promise of future businesses to lure acquirers' ex-advisors to accept the advisory mandate. Additionally, acquirer' ex-advisors may be less willing to accept such mandates as they may be concerned about getting future business from the acquirer if their involvement reduces the acquirer's overall gain from the merger. In contrast, acquirers can use the promise (or lure) of future business to motivate target's ex-advisors to work hard on their behalf.⁸³

Our paper contributes to the extant literature in three ways. First, we provide new evidence of the value effect of advisor choices in M&As. To the best of our knowledge, we are among the first to show that acquirers hiring targets' ex-advisors has a significant impact on merger outcomes.⁸⁴ Second, our analysis reveals that hiring target's ex-advisors can be used as an effective takeover strategy by a bidder to deter competition from other potential rival bidders. This economic function of ex-advisors is similar to that of a toehold in terms of increasing acquirers' bidding advantage and reducing takeover competition. Finally, prior studies have well documented that the bank-firm prior relationship is beneficial for both investment banks and firms.⁸⁵ Our results reveal that a prior bank-firm relationship can be exploited by potential bidders, putting targets in a disadvantageous position on the bargaining table.

⁸³ Roughly 58% of these banks (target's ex-advisors) are hired by acquirers in future transactions as M&A advisors.

⁸⁴ Calomiris and Singer (2004) analyze hostile takeovers with the market capitalization of the target firm exceeding \$1 billion in the period of 1993-2003, and find no difference in mean takeover premiums between acquirers hire target's ex-advisors and those who do not.

⁸⁵ James (1992) finds that the marginal cost of the repeated underwriting business with the same firm is lower. Ljungqvist, Marston, and Wilhelm (2006, 2009) examine U.S. debt and equity offerings completed between 1993

The rest of the paper proceeds as follows. Section II briefly reviews the relevant literature. Section III describes our sample and variable constructions. Main results are presented in Section IV, followed by robustness checks in Section V. Section VI concludes.

II. Literature Review

The role of investment banks has long been discussed in the literature. Early theoretical studies focus on the role of investment banks as an agent to collect information and as a mediator to resolve the problems of information asymmetry in financial markets (e.g. Beatty and Ritter 1986; Benvensite and Spindt 1989). Although investment banks may have incentives to collude with the clients they represent, they also have incentives to build up reputation by setting standards to evaluate their clients so as to gain a bigger market share (Chemmanur and Fulghieri, 1994). Empirical studies on initial public offerings, such as Carter and Manaster (1990), Carter, Dark and Singh (1998), and Benveniste et al. (2003), confirm the role of investment banks as information providers.

Empirical studies on mergers and acquisitions further suggest that investment banks facilitate information sharing among acquirers and targets. Ivashina et al. (2009) examine the influence of lending banks on the likelihood of a client firm becoming a takeover target, whereby the acquirer is also a client of the same bank. This effect is stronger the higher the number of same-industry clients served by the bank, further suggesting that lending banks play a significant role by transmitting target specific information (generated during normal course of lending) to acquirers. Agrawal et al. (2013) also examine the role of advisors as conduits for information

and 2002 for prior bank-firm relationships, and conclude that prior underwriting relationships increase the likelihood of winning a lead-underwriting mandate.

transmission by studying merger cases where the same advisor advises both the acquirer and the target.⁸⁶

Prior studies, however, agree less on the overall benefits from information sharing between acquirers and targets. Though information sharing may allow investment banks' to exercise better judgement and provide higher quality services, they may also abuse their market power and information advantage for private benefits. Bodnaruk, Massa, and Simonov (2009) document that financial advisors can take a direct stake in the targets (to generate a profit) and thus exploit the private information they are privy to. Agrawal et al. (2013) find that the presence of "common advisors", however, does not lead to better overall deal outcomes compared with deals advised by separate advisors. Besides, information sharing may shift the bargaining power between acquirers and targets. Asker and Ljungqvist (2010) argue that a firm's strategically sensitive information (e.g. operational efficiency, customer/supplier relationships, progress on research and development projects etc.) is valuable to a product-market rival and may inhibit sharing of underwriters between large firms in an industry. The same logic can be extended to mergers. On the bargaining table, if the ex-advisor of one company serves the other, the company losing its advisor may lose bargaining power and is thus less likely to achieve a favourable outcome. Indeed, Agrawal et al. (2013) find that common advisors generally lean toward the acquirers rather than the targets. As illustrated by the previously cited example of the lawsuit between Dana Corp. and UBS, concerns about information leakage may especially be valid in hostile deals whereby a merging firm engages the services of the merger counterparty's ex-bank. Calomiris and Singer (2004) document 52 instances of large (target value > \$1 billion) hostile

⁸⁶ Previous studies also suggest that other financial intermediaries can serve as information conduits to allow the acquirer to reduce information asymmetry about the target. For example, Gompers and Xuan (2009) show that common VC alleviate asymmetric information between public acquirers and private targets. The deals with common VC are associated with more positive acquirer CAR. Cai and Sevilir (2012) suggest that having a board connection may improve information flow and communications between the firms.

takeovers and suggest that buyers who are advised by banks with prior relationship with targets may be more discriminating in selecting their targets and in price offered. Relatedly, in a recent study Song et al. (2013) report that acquirers are more likely to choose boutique advisors (over traditional full service advisors) in complex deals, and this is associated with both longer duration and the payment of lower premiums.

III. Data, Variables, and Summary Statistics

A. Sample and Data

Our sample is retrieved from the SDC/Platinum database and includes mergers and acquisitions between U.S. firms between January 1985 and December 2008. We include both completed and withdrawn deals that involve publicly listed acquirers and targets. We exclude buybacks, exchange offers, and recapitalizations, and privatizations in which acquirers and targets have the same CUSIP. We require that acquirers own less than 50% of targets' shares before the announcement date and own 100% after deal completion. We exclude deals that are worth less than 1% of the acquiring firm's market value of equity. Also excluded are transactions with no deal value disclosed.

When collecting the advisor information from the SDC/Platinum database, the sample banks are selected by forming a union of two groups of banks: (1) the sample of Ljungqvist, Marston, and Wilhelm (2006); and (2) the sample of 50 most active banks in M&A activities by transaction value over the period 1985 to 2008. As SDC/Platinum sometimes reports multiple codes for the same bank, we manually check these codes and combine them into a single code if they belong to the same bank. To account for major bank mergers during the study period, we utilize the data provided in Corwin and Schultz (2005) and Ljungqvist, Marston, and Wilhelm (2006), and the data supplemented by SDC/Platinum and other financial news sources, which

include LexisNexis Newswires, Yahoo! Finance, Google, and ProQuest Newspapers. Appendix A lists the final set of survival banks, together with their predecessors, during the sample period. The number of candidate banks varies from 57 to 107 over time, depending on past mergers and the date a bank first appears in SDC/Platinum. We restrict our sample to deals in which each acquirer employs at least one advisor from the list in Appendix A. These sampling criteria yield a final sample of 3,251 M&A transactions, among which 760 targets have ex-advisors from past M&A transactions.

Furthermore, we retrieve financial data from the Compustat Industrial Annual database and obtain stock price data from the Center for Research in Security Prices (CRSP) files.

[INSERT TABLE I ABOUT HERE]

Table I reports the summary statistics for market shares of the twenty five most active financial advisors for acquiring firms in our sample. We rank them based on the total value of all transactions (column (1)) advised by the surviving bank and its predecessors. Following Golubov, Petmezas, and Travlos (2012), we refer to the top eight investment banks as top-tier, and all other advisors as non-top-tier.⁸⁷ Column (2) reports the total number of transactions. If there are multiple advisors for an acquirer in a merger, each advisor is allocated a $1/n$ share of value in column (1) or a count of $1/n$ in column (2), where n is the number of advisors hired by the acquirer for a transaction. Column (1) suggests that Bank of America Merrill Lynch is the most active M&A advisor for acquiring firms based on the total value of transactions advised over the period 1985-2008, followed by JP Morgan, and Citigroup. Column (3) reports the number of M&A transactions in which target firms hired advisors during the past five years (e.g.,

⁸⁷ Note that the ranking reported in Table I may be different from that given by the SDC league tables because when calculating the number of deals advised by an advisor, we include all deals advised by the bank and its predecessors. In addition, the top eight investment banks are slightly different from those of Golubov, Petmezas, and Travlos (2012). Lazard and UBS rank number 8 and 9 in their Table I, but rank number 9 and 8, respectively, in our sample. The discrepancy is caused by the difference in sample period between theirs (1996-2009) and ours (1985-2008).

$TargetHasEx = 1$). Column (4) shows the number of deals in which the acquiring firm's advisor advised the target firm in M&A transactions during the past five years (e.g., $HireTargetEx = 1$). In our sample, acquirers hire targets' ex-advisors in 73 deals, which account for 9.6% of 760 deals in which target firms have ex-advisors and 2.2% of all deals (3,251).⁸⁸ Among these 73 deals, 58 deals involve top eight banks.

B. Deal Characteristics

The key variable of our interest, $HireTargetEx$, is equal to one if the acquiring firm hires an advisor who advised the target firm in M&A transactions during the past five years, and zero otherwise. As an important control variable, $TargetHasEx$, is set equal to one if the target firm has ex-advisors during the past five years, and zero otherwise. We include $TargetHasEx$ as an explanatory variable in regressions to account for the fact that some targets may not have ex-advisors for acquirers to choose from.

In addition, we utilize the following variables to measure the deal outcomes. Cumulative abnormal returns ($CAR^{Acquirer}$ and CAR^{Target}) are defined for the acquirer and the target, respectively, from one day before to one day after the announcement date of the M&A. We employ a standard event study methodology to measure abnormal announcement day returns. To estimate the market model, we use 200 trading days of stock returns, beginning 205 days before and ending 6 days before the M&A announcement date. The CRSP value-weighted return is used as the market return. Using the CRSP equally-weighted returns yields qualitatively similar results.

Following Bates and Becher (2011), we measure the premium paid to the target by the acquirer ($Premium$) as the initial offer price (or final offer price if initial offer price unavailable)

⁸⁸ Among these 73 cases, in 49 of them target's ex-advisor is not acquirer's ex-advisor.

as reported by SDC, deflated by the share price of the target firm at five trading days preceding the announcement date, less one. Moreover, to minimize the impact of extreme values and misrecorded data, we follow Bates and Becher (2011) and eliminate the transactions where premium is less than -20% and then winsorize *Premium* at the top and bottom 5% of its distribution.

We follow Bates, Lemmon, and Linck (2006) and estimate the total dollar-denominated synergy (*Synergy*) as follows.

$$\text{Synergy} = MV^{\text{Acquirer}} \times CAR^{\text{Acquirer}} + (1 - \alpha)MV^{\text{Target}} \times CAR^{\text{Target}},$$

where MV^{Acquirer} is the market value of equity two days prior to the announcement, CAR^{Acquirer} and CAR^{Target} are the cumulative abnormal returns defined above, and α is the toehold of the acquirer. Following Kale, Kini, and Ryan (2003) and Golubov, Petmezas, and Travlos (2012), we calculate the acquirer's and target's share of synergies (*ASOS* and *TSOS*), respectively, as follows.

$$ASOS = \begin{cases} \frac{MV^{\text{Acquirer}} \times CAR^{\text{Acquirer}}}{\text{Synergy}}, & \text{if Synergy} > 0 \\ 1 - \frac{MV^{\text{Acquirer}} \times CAR^{\text{Acquirer}}}{\text{Synergy}}, & \text{if Synergy} < 0 \end{cases}$$

$$TSOS = \begin{cases} \frac{(1 - \alpha)MV^{\text{Target}} \times CAR^{\text{Target}}}{\text{Synergy}}, & \text{if Synergy} > 0 \\ 1 - \frac{(1 - \alpha)MV^{\text{Target}} \times CAR^{\text{Target}}}{\text{Synergy}}, & \text{if Synergy} < 0 \end{cases}$$

Bates, Lemmon, and Linck (2006) point out the importance of addressing the outliers as some deals with small synergies can produce extreme values in *ASOS* and *TSOS*. We thus follow Golubov, Petmezas, and Travlos (2012) and winsorize these three measures at the top and bottom 5% of their distributions. When used as a dependent variable in the regression analysis,

Synergy is deflated by acquirer's market value of equity two days prior to the merger announcement.

We control for several deal characteristics in regression analysis. Specifically, we include four indicators for tender offer, diversifying mergers, hostile transactions, and pure-cash transactions respectively and also include relative size. An acquisition is defined as a diversifying one if the acquirer and target have different 4-digit SIC codes. In addition, we include *Relative Size*, which is defined as the transaction value divided by acquirer's market capitalization at the end of the fiscal year prior to the acquisition announcement.

C. Summary Statistics

Panel A of Table II summarizes the deal characteristics for the whole sample in columns 1-3. In columns 4-7, we divide the transactions into two groups according to whether the acquirer's advisor advised the target firm in M&A transactions (*HireTargetEx* = 1) or not (*HireTargetEx* = 0) during the past five years. Comparing two subsamples, we find that deals in which acquirers hire targets' ex-advisor as advisors exhibit lower *CAR* for target firms, lower premium, lower synergy, and a lower likelihood of cash payment. However, it is worth emphasizing that target shareholders still earn a substantially positive (13%) abnormal announcement returns when acquirers hiring target firms' ex advisors.

[INSERT TABLE II ABOUT HERE]

Panel B reports summary statistics of firm characteristics that are included as control variables in regressions. Specially, we include leverage ratio, the natural logarithm of total assets ($\ln(Assets)$), the market to book ratio (M/B), and free cash flow (*CashFlow*) of both acquirers and targets. *Leverage* is defined as total debt/total assets. M/B is the market to book assets ratio. *CashFlow* is (Net Income + Depreciation - Capital Expenditure)/Assets. To mitigate the impact

of outliers or misrecorded data on the results, all firm characteristics are winsorized at the 0.5% level at both tails of the distribution. Compared with deals with $HireTargetEx = 0$, deals with $HireTargetEx = 1$ involves acquirers and target firms that are larger in terms of total assets. Target firms with ex-advisor being hired by acquirers have higher financial leverage, and lower market-to-book-ratios, and slightly higher free cash flow.

IV. Main Results

A. Determinants of Hiring Target's Ex-advisors

We first model acquiring firms' advisor choice as a function of deal, advisor, and firm characteristics. If the choice to hire target's ex-advisors is purely a random event, we should not expect the choice to be affected by such characteristics. Specifically, we estimate the following probit model.⁸⁹

$$\text{Prob.}[HireTargetEx = 1] = F(a_0 + a_1X), \quad (1)$$

where P stands for the probability of hiring target's ex-advisor, F denotes the normal cumulative distribution function, and X is a set of deal, advisor, and firm characteristics that have been shown by previous studies to affect the advisor choice. This analysis can also help us deal with the potential endogenous relation between the choice of hiring target's ex-advisors and deal outcomes analyzed in Section V. A.

We consider the following deal, advisor, and firm characteristics as explanatory variables in equation (1): (1) the number of M&A advisors hired by the target firm in the five years prior to

⁸⁹ A potential problem of using a probit model for the advisor choice is that the unconditional probability of acquirers hiring targets' ex-advisors is low (around 2.2%). In other words, hiring merger counterparty's ex-advisors is a rare event. King and Zeng (2001) argue that the use of traditional binary choices models will underestimate the probability of rare events. To correct for the bias, we use the rare event Logistic Regression developed by King and Zeng (2001) to re-estimate the regressions for Table III and column (1) of Table IV and find that our results are essentially the same.

the deal; (2) the number of advisors hired by the acquirer in the current deal; (3) acquirer's expertise in target's industry, which is defined as the number of mergers done by acquirer in target's four-digit SIC industry divided by the total number of mergers in the industry involved during the past five years; (4) relative bargaining power between acquirer and target, which is defined as the ratio of the natural logarithm of total assets of the acquirer to that of the target; (5) relative deal size, which is defined as the deal value divided by the acquirer's market value of equity at the end of the fiscal year prior to the acquisition announcement; and (6) four indicator variables for tender offer, diversifying mergers, hostile takeovers, and pure cash deals. We expect the likelihood of an acquirer hiring the target's ex-advisors to be lower if the acquirer is more experienced with mergers in the target's industries, or to be higher if the acquirer is more powerful than the target.

[INSERT TABLE III ABOUT HERE]

Table III presents the results from estimating equation (1) for acquiring firms. We find that the acquirer's probability of hiring target's ex-advisor is positively related to the number of advisors hired by the target firm in the past five years and the strength of acquirer's bargaining power, but negatively associated with acquirer's merger expertise in target's industry. We document that the possibility of hiring target's ex-advisor is higher if the acquirer and the target firms are from different industries. Other explanatory variables are statistically insignificant in the regression. The pseudo- R^2 indicates that the model explains up to 32% of the acquirer's choice to hire target's ex-advisors.⁹⁰ Note, however, that our main objective here is not to identify a complete list of determinants that affect acquirer's choice to hire target's ex-advisors,

⁹⁰ Note that the numbers of observations in Tables IV-VI are smaller than that in Table III because of the missing values of dependent and explanatory variables in Tables IV-VI. As a robustness check, we exclude observations with missing value of any dependent and explanatory variables in Tables IV-VI and find similar regression results (reported in Panel E of Table VII).

but rather to identify variables that are correlated with the advisor choice in order to address the endogeneity issues discussed in Section V.A.

B. The Effect of Hiring Target's Ex-advisors on Takeover Competition

Table IV examines whether hiring target's ex-advisors can reduce takeover competition. We employ two proxies for takeover competition: the likelihood of having competing bidders and the number of competing bidders. Specifically, in column (1) of Table IV, we estimate a probit model where the dependent variable (*MultiBidder*) is equal to one if any competing bidder exists, and zero otherwise. We report the marginal effects that measure the effect of a one unit change in the continuous explanatory variables (moving from zero to one for dummy variables) on the dependent variable. In column (2) of Table IV, we estimate the negative binomial regression model, in which the dependent variable is the number of competing bidders (*NBidders*).

[INSERT TABLE IV ABOUT HERE]

In addition to including *HireTargetEx* and *TargetHasEx*, we follow Jennings and Mazeo (1993) and Betton and Eckbo (2000) and choose the following explanatory variables in the regressions. Betton, Eckbo, and Thorburn (2009) suggest that a toehold can reduce takeover competition if it exceeds a certain threshold. We therefore incorporate a toehold dummy which is set equal to one if toehold is larger than 5%, zero otherwise.⁹¹ Jennings and Mazeo (1993) find that a higher premium can deter competing offers, we thus include *Premium* as a control variable. Also included is the percentage of cash paid to the target firm. Fishman (1989) argues that cash

⁹¹ Once a company purchases 5% or more of another company, it must file Form 13D with the SEC and explain to the target firm in writing the reason for the purchase of 5% or more of its stock. Filing form 13D additionally notifies the public as to what the company intends to do with the toehold purchase. Moeller, Schlingemann, and Stulz (2004) also use 5% as the cutoff when defining the toehold dummy.

payment pre-empts competing bids, while Jennings and Mazeo (1993) document that cash payment is positively related to takeover competition. Furthermore, we include target firm characteristics, including $\ln(\text{Assets})$, Leverage , M/B , and Cash Flow .

The result reported in column (1) of Table IV suggests that rival bidders are less likely to materialize if the acquirer hires the target's former advisor. The coefficient of HireTargetEx is negative and significant at the 5% level. It indicates that hiring target's ex-advisor can reduce the likelihood of having competing bidders by 3%. Given that the unconditional probability for any deal in our sample to involve multiple bidders is 9.2%, this magnitude represents an economically meaningful effect. Column (2) of Table IV reveals that hiring target's ex-advisor negatively affects the number of rival bidders. Taken together, the results in Table IV suggest that hiring target's ex-advisor improves the acquirer's information advantage and reduces takeover competition by deterring potential rival bidders from participating.⁹²

The coefficients of other explanatory variables are generally consistent with those documented by previous studies. Consistent with Jennings and Mazeo (1993), we find that the existence of toehold reduces the level of takeover competition, and that the percentage of cash payment is positively related to takeover competition. Additionally, the level of takeover competition is positively related to the firm size of target companies, and negatively associated with the leverage ratio and the market-to-book ratio of target firms.

C. The Effect of Hiring Target's Ex-advisors on Deal Outcomes

⁹² Due to missing values of dependent and explanatory variables, the number of observations in Table IV is 1,736. Among these 1,736 cases, acquirers hire targets' ex-advisors in 43 deals, which accounts for 9.8% of 441 deals in which target firms have ex-advisors.

In this subsection, we first examine the effect of hiring target's ex-advisor on the announcement returns for acquiring and target firms, respectively. We then investigate whether hiring target's ex-advisor affects the premium paid to target firms by acquirers. Finally, we study synergies created by mergers and acquisitions and how they are divided between acquirers and target firms.

In columns (1) and (2) of Table V, we regress separately target's and acquirer's *CAR* on *HireTargetEx*, deal characteristics, and firm characteristics.⁹³ We include a set of control variables that have been shown by previous studies to influence announcement returns. Specifically, to control for deal characteristics, we include *Tender Offer*, *Relative Size*, *Diversify*, *Hostility*, and *Pure Cash*. *Tender Offer* is included because Bates and Lemmon (2003) and Officer (2003) find that acquirers' *CAR* is higher for tender offer. We include *Relative Size* because Moeller, Schlingemann, and Stulz (2004) show that bidder announcement returns increase with relative deal size. We include *Diversify* since Morck, Shleifer, and Vishny (1990) show that bidders earn negative returns when making unrelated acquisitions. Schwert (2000) finds that acquirers realize lower abnormal returns in hostile takeovers, so we include *Hostility*, which equals one if the SDC classifies the acquisition as a hostile takeover and zero if the SDC classifies the acquisition as a friendly takeover. Since cash (stock) is more likely to be used as a method of payment when there is low (high) valuation uncertainty in the acquisition (Travlos (1987), Loughran and Vijh (1997)), we also control for *Pure Cash* in the regression. Coefficients are estimated from ordinary least squares (OLS) regressions. The *t*-statistics are calculated using Huber/White/ Sandwich heteroskedasticity-consistent errors.

[INSERT TABLE V ABOUT HERE]

⁹³ *CAR* is measured from one day before to one day after the announcement date. Using either the abnormal return on the announcement day or the cumulative abnormal return from two days before to two days after the announcement date as the dependent variable does not change our main results.

Column (1) of Table V reveals that target's *CAR* is significantly and negatively related to acquirer's decision to hire target's ex-advisor. This is consistent with the "information advantage" argument outlined in Section I. In terms of economic significance, the decision for the acquirer to hire target's ex-advisor lowers target's *CAR* by 6%, which amounts to 1/3 of the average *CAR* (18%) for all target firms across all transactions in our sample. This result also suggests that investors may be sophisticated enough to recognize that target's ex-advisors can cause damage to target firms when they are hired by acquirers in M&A transactions.

Column (2) shows that acquirers' *CAR* is not significantly related to its decision to hire the target's ex-advisor. The estimated coefficient of *HireTargetEx* is 0.01 with *t*-statistic being 0.6. Although we postulated that hiring the target's former advisor may provide the acquirer with competitive edge in the bidding process, the results suggest that this decision does not create value for the acquirer's shareholders. We interpret it as the evidence supporting the competitive market hypothesis proposed by Boone and Mulherin (2008) who document no significant relation between bidders' stock returns and the level of merger competition.⁹⁴ The takeover competition hypothesis argues that the presence of actual or potential competition leads to efficient pricing of the target and results in zero profits to the winning bidder. In other words, in a competitive takeover market, winning acquirers rationally respond to the level of takeover competition and the uncertainty associated with the targets' value. Although rational acquirers can reduce the level of takeover competition through hiring target's ex-advisors, they earn breakeven returns because the entire takeover market is competitive and efficient. The negative coefficient of *TargetHasEx* indicates that when target's ex-advisors are available, and if the acquirer does not hire target's ex-advisors, acquirer's *CAR* is lower than otherwise.

⁹⁴ Specifically, Boone and Mulherin (2008) argue that the winning acquirer does not make systematic errors in adapting its strategy to the level of competition and uncertainty regarding target value, and hence no relation should exist between acquirer returns and either the number of bidders or the uncertainty in target values.

The coefficients on other explanatory variables are generally consistent with the findings in prior studies. Consistent with Moeller, Schlingemann, and Stulz (2004), we find that glamour acquirers experience more negative *CAR*. The acquirers' *CAR* is higher for tender offer, consistent with Bates and Lemmon (2003) and Officer (2003). We also find acquirer's *CAR* is higher for pure-cash deals (Travlos (1987)). Besides, target *CAR* is higher in hostile deals and pure-cash deals, consistent with Andrade, Mitchell, and Stafford (2001). Target firms with low *M/B* and high free cash flows experience more positive *CAR*, consistent with Manne (1965) and Alchian and Demsetz (1972) who show that corporate takeovers can be used to create shareholder value by eliminating poorly performing managers.

Column (1) of Table VI reports the regression results for premiums paid by acquirers. Following Bates and Becher (2011), we include in the regression firm characteristics (*Ln(Assets)*, *M/B*, *Leverage*, *CashFlow*) as control variables. To account for deal characteristics, we include four indicator variables for tender offer, diversifying mergers, hostile transactions, and pure-cash transactions, respectively. We also control for *relative size* and adjust standard errors for heteroskedasticity and correlation across observations for a given deal. The constant term, year fixed effects and industry fixed effects are also included but not reported in the table.

[INSERT TABLE VI ABOUT HERE]

We document that takeover premium is negatively related to acquirer's decision to hire target's former advisors. The coefficient of -0.06 indicates that hiring target's ex-advisor lowers the premium paid to targets by 6%, which is about 20% of the average premium (31%) across all transactions in our sample. This result is consistent with the view that the competitive advantage gained from hiring target's ex-advisors reduces acquirers' incentive to offer a higher premium in order to deter a competing bidder. Furthermore, hiring target's ex-advisor enables acquirers to better estimate the value of target firms and thus reduce the risk of overpayment.

In column (2) of Table VI, we use the total dollar value of synergy, scaled by the pre-bid market capitalization of the acquiring firm, as the dependent variable. The results reveal that hiring of target's ex-advisor does not affect the total synergy. This result is inconsistent with the "deal improvement" hypothesis which predicts that the target's ex-advisors act as information conduits and use their information advantage to improve deal outcomes, leading to a greater combined gain from the merger. In untabulated tests, we follow Rau and Vermaelen (1998) and measure long-term value creation using the post-acquisition stock performance of the acquiring firm over the three-period following the year of acquisition. The results (untabulated) indicate that *HireTargetEx* has no significant effect on the long-term stock performance.

In column (3), we use OLS regression analysis to examine how the use of target's ex-advisor affects the division of synergy gain between acquirer and target.⁹⁵ The dependent variable (*TSOS*) in column (3) is target's share of synergy, respectively. The control variables are the same as those in the premium and synergy regressions.

The results in column (3) suggest that target's share of synergy (*TSOS*) is negatively and significantly related to acquirer's choice to hire target's ex-advisor, consistent with the "information advantage" hypothesis which predicts that target firms are at a bargaining disadvantage when their ex-advisors are hired by acquiring firms. The coefficient of *HireTargetEx*, -0.5, suggests that hiring target's ex-advisor on average reduces target shareholders' share of synergy by 0.5. This negative effect is substantial given that the mean and median values of *TSOS* are 1.5 and 1.01, respectively. In untabulated tests, we follow Bates, Lemmon, and Linck (2006) and consider the *relative* target's share of synergy (*RTSOS*), which is calculated as the share of synergy to target shareholders relative to their proportional share of the

⁹⁵ Following Golubov, Petmezas, and Travlos (2012), we use OLS regression analysis. Our results are qualitatively unchanged if Tobit model is used.

firm owned prior to the bid. That is, $RTSOS = TSOS/(1-\alpha)$. *RTSOS* measures the proportional gains for target shareholders relative to their pre-bid ownership of the target. The results (untabulated) indicate that *HireTargetEx* has a negative and significant effect on *RTSOS* as well (the coefficient of *HireTargetEx* is -0.51; the *t*-statistic = -2.4), indicating that it is target's pre-bid shareholders who bear the brunt of diminished share of value created by the transaction. Taken together, our analysis reveals that although hiring target's ex-advisor does not create more synergies, it does help the acquiring firms to achieve significant bargaining advantage in merger transactions and capture a higher share of merger synergies.

V. Tests for Endogeneity and Additional Analysis

In this section, we perform additional analysis to address the endogeneity issues and examine the robustness of our results. We tabulate the results in Table VII. While all control variables in Tables IV-VI are still included in the new tests, for the sake of brevity, we only tabulate the coefficients of *HireTargetEx*, *TargetHasEx*, and the newly added variables.

A. Tests for Endogeneity

So far, we have performed plain vanilla OLS regressions which assume that acquirer's advisor choice is exogenously determined. Thus, our results are potentially subject to two types of endogeneity. The first type is omitted variable bias. While we have controlled for a standard set of variables that have been shown by previous studies to affect takeover competition and deal outcomes, the relation we observe may be spurious if our model omits any variables that affect both the advisor choice and merger outcomes. The other possible endogeneity issue is reverse causality. For instance, it is possible that acquiring firms are more likely to hire target firms' ex-advisors if target firms have weak negotiation power due to poor operating performance, leading

to a negative association between *HireTargetEx* and *CAR* or premium for target firms. In both cases, the coefficient estimates from the OLS regressions are biased and inconsistent.

[INSERT TABLE VII ABOUT HERE]

We employ a two-step treatment method to address the endogeneity issues regarding the results reported in Tables V and VI. The first-step uses the probit regression in Table III to estimate the probability for an acquirer to hire target's ex-advisor as its M&A advisor. We then obtain the inverse Mills ratio (IMR) from the first stage and use it as an additional explanatory variable in the second stage regression that examine the impact of hiring target's ex-advisor on deal outcomes. Convincingly implementing the treatment effect model requires at least one variable in the first stage equation can be excluded from the set of independent variables in the second stage regression (so called exclusion restrictions). In Table III, we use the number of advisors hired by target firms in the past five years to meet exclusion restrictions.⁹⁶ However, since probit and negative binomial regressions in Table IV are nonlinear models to which the treatment effect adjustments cannot be applied, we instead employ a two-step bootstrapping approach, which involves predicting the likelihood of hiring target's ex-advisor in the first stage using the specification in Table III, and using the predicted value in the second stage. We bootstrap the estimation 500 times to obtain consistent standard errors and report the coefficients' 95% confidence interval estimates in the Table VII (Panel A).

⁹⁶ We select the exclusion restrictions in a manner similar to Fang (2005) and Golubov, Petmezas, and Travlos (2012). For example Golubov, Petmezas, and Travlos (2012) argue that endogeneity is a concern when analyzing whether firms hire reputable M&A advisors. The authors use the variable "scope" as the exclusion restriction (which indicates the extent to which the reputable bank of the M&A deal has served the firm for equity, bond, and acquisition issues during the past five years) and then assume that a firm is more likely to hire reputable bank as its M&A advisor if it has experience with hiring reputable banks in the past.

The results of the second stage of the two-step analysis are reported in Panel A of Table VII. The coefficients of *HireTargetEx*, however, are generally consistent with those obtained using OLS regressions, mitigating the concern that endogeneity drives our results.⁹⁷

B. Simulation Analysis

To further mitigate the concern that acquirers hire target firms' ex-advisors simply because these advisors are active in the takeover market, we conduct a simulation analysis in which acquiring firms are assumed to randomly choose M&A advisors based on advisor's market share. In other words, an advisor's probability of being chosen by an acquiring firm is set equal to the market share of the advisor in the previous year. Based on the simulated pairing of advisors and acquiring firms, we construct the hypothetical bank-firm advisory relationship for each M&A transaction, and define simulated *HireTargetEx* and *TargetHasEx* accordingly. We bootstrap the simulation 500 times to obtain consistent standard errors and report the average coefficients and coefficients' 95% confidence interval in Panel B of Table VII.⁹⁸ The results show that the simulated *HireTargetEx* is statistically insignificant in regressions because the bootstrapped 95% confidence interval for *HireTargetEx* spans zero, suggesting that our results are unlikely to be driven by acquiring firms' random choice of advisors based on advisor's market shares.

C. Target Hires Acquirer's Ex-advisor

⁹⁷ The bootstrapped 95% confidence interval for *HireTargetEx* does not span zero in the regression with the dependent variable *MultiBidder*, indicating that the coefficient estimate on *HireTargetEx* is significantly different from zero at the 5% level. The bootstrapped 95% confidence interval for *HireTargetEx* spans zero in the regression with the dependent variable *NBidder*, however, the 90% confidence interval (untabulated) suggests that the coefficient is significant at the 10% level.

⁹⁸ Across 500 simulations, on average, among the 3,251 deals, 29 transactions have simulated advisors being target's ex-advisors.

While we have shown that acquirers can gain information and bargaining advantage by hiring target's ex-advisors, can target firms counteract their disadvantages by hiring acquirer's ex-advisors? Our sample includes 1,544 deals in which acquirers have ex-advisors from past M&A transactions. Target firms hire acquirer's ex-advisors in 199 deals. To examine whether target firms can benefit from hiring acquirer's ex-advisors, we augment our regression models by including two new variables, *HireAcquirerEx* and *AcquirerHasEx*. *HireAcquirerEx*, is equal to one if the target firm hires an advisor who advised the acquiring firm in past M&A transactions, and zero otherwise. *AcquirerHasEx*, is set equal to one if the acquiring firm has ex-advisors, and zero otherwise. We include *AcquirerHasEx* as a control variable to account for the possibility that some acquirers may not have ex-advisors for target firms to select from.

The results reported in Panel C of Table VII suggest that hiring acquirer's ex-advisor has no significant effect on *CAR* of target firms, synergy, premium received by target firms, and target's share of synergies. In addition, hiring acquirer's ex-advisor tends to reduce rather than increase competition among potential bidders. Taken together, our results indicate that target firms gain no discernible advantage through hiring acquirer's ex-advisor. We argue that hiring merger counterparty's ex-advisors has completely different implications for acquirers and targets. Although target firms may also have incentives to gain information or bargaining advantage by hiring acquirers' ex-advisors, the incentives come with one big caveat – as target firms normally cease to exist as standalone companies after successful mergers, they cannot use the promise of future businesses to lure acquirers' ex-advisors to accept the advisory mandate. Additionally, acquirers' ex-advisors may be concerned about receiving future mandates from the acquirer if their services (to the target) are perceived to diminish the acquirer's gains. In contrast, acquirers can use the promise of future business to motivate target's ex-advisors to work hard on their

behalf, as evident by our sample statistics that 58% of these banks are hired as advisors by acquirers in future merger transactions.

D. Hire Target's Ex-underwriter as Advisor

To examine whether hiring target's ex-underwriters has similar value effects as hiring target's ex-advisor, we include in regressions a dummy variable that is equal to one if an acquirer hires target's ex-underwriter as a M&A advisor, and zero otherwise. Also included is *TargetHasExUnderwriter*, which equals one if the target firm has ex-underwriter from past issuance activities, and zero otherwise. The results in Panel D of Table VII reveal that, unlike targets' ex-advisors, hiring targets' ex-underwriter has no effect on the likelihood of having competing bids, the number of rival bidders, premium, synergy, and CARs. Firstly, these findings imply that compared to target firms' ex-underwriters, ex-advisors inherently offer acquirers more value relevant services because of their experience of valuing target firms and expertise of identifying synergy in past M&A transactions. In contrast, underwriters specialize in collecting information from institutional investors during book-building and offer after-market support to the issuing firms, and may not be familiar with valuing a target firm in M&A. In other words, underwriters and advisors have different expertise. Secondly, underwriting normally is done by underwriting teams in investment banks, while the M&A advisory is performed by M&A teams. Our results (or lack thereof) suggest that any potential information transmission between two teams in the same bank may not be particularly effective.

E. Robustness Checks

To check the robustness of our main results, we conduct several additional tests. First, our sample includes 3,251 merger deals undertaken by publicly listed and US domiciled firms

between 1985 and 2008. However, due to missing values of dependent and explanatory variables, the sample size varies a lot across different tables. As a robustness check, we exclude observations with missing value of any dependent and explanatory variables in Tables IV-VI, re-estimate all regressions, and report the results in Panel E of Table VII. Although we end up with a much smaller sample that consists of 1,500 deals, our results are qualitatively unchanged and reported in Panel E of Table VII.⁹⁹

Throughout our analysis, we have controlled for *TargetHasEx* in regressions to address the selection issue that acquiring companies may not have a chance to hire target's ex-advisors if target firms have not engaged any advisors in the past. To check whether our results are sensitive to inclusion of this variable, we remove *TargetHasEx* from the models, re-estimate all regressions, and report the coefficients of *HireTargetEx* in Panel F of Table VII. Our main results are essentially unaffected.

Finally, it is possible that acquiring firms hire target's ex-advisors because target's ex-advisors are too large to avoid. Target's ex-advisors may be reputable investment banks or have large market shares in the target firm's industry. As a result, *HireTargetEx* may simply capture the effect of advisor's merger expertise in a certain industry or the effect of advisor's market share. To address this concern, in Panel G of Table VII, we control for two additional advisor characteristics. *Advisor's Industry Merger Expertise* is computed as the number of mergers advised by a bank for a firm's four-digit SIC industry divided by the total number of mergers in the industry during the past five years.¹⁰⁰ *Top-tier Advisor* is a dummy variable and it equals one if the firm hires a top-tier advisor, and zero otherwise. Following Golubov, Petmezas, and

⁹⁹ In this small sample of 1,500 deals, acquirers hire targets' ex-advisors in 39 deals, which accounts for 10.0% of 391 deals in which target firms have ex-advisors and 2.6% of all deals (1,500).

¹⁰⁰ By construction, it takes a value between zero and one. If there were no mergers in the industry over the past five years, all banks are assigned a value zero for industry expertise.

Travlos (2012), we refer to the top eight investment banks with largest market shares as top-tier, and all other advisors as non-top-tier. Our main results still hold, suggesting that our findings are not driven by advisors' merger expertise or advisor's market shares.¹⁰¹

F. Additional Analysis

We also examine whether acquirers pay a fee premium in exchange for services provided by target's ex-advisors. We define the total advisory fee as a percentage of deal value and then regress it on the independent variables used in Table VI. The results (untabulated) suggest that there is no significant fee premium when target's ex-advisors are hired by acquirers. However, this does not necessarily mean that target's ex-advisor obtains no benefit - in our sample about 58% of these banks are hired as advisors by acquirers in future merger transactions.

Furthermore, we examine whether hiring merger-counterparty's ex-advisor impacts the probability of deal completion and time to resolution. To capture deal completion, we use a dummy variable which is equal to one for completed transactions, and zero for withdrawn bids. Time to resolution is defined as the number of calendar days between the announcement and resolution (completion or withdrawal) dates. Under the deal improvement hypothesis, having information about targets and acquirers and the ability to influence both sides of deals allows target's ex-advisors to complete deals more quickly. However, we find no evidence suggests that target's ex-advisors impact either the likelihood of deal completion or the time to resolution.

VI. Conclusion

¹⁰¹ Our results are qualitatively unchanged if we control for advisor's market share, which is defined as the fraction of total transactions that have been advised by the bank in the previous year.

This paper examines acquiring firms' choice to hire target firms' ex-advisors. Our analysis suggests that hiring target's ex-advisors indeed provides benefits to the merging firms, but these benefits are distributed asymmetrically between them. Our results suggest that hiring target's ex-advisor provides the acquirer with a better understanding of target's true value and helps it to identify the sources of synergy. These acquirers also face reduced competition from outside (less informed) bidders who may be concerned with being susceptible to the winner's curse. Both the likelihood of competing bids, as well as the number of competing bidders is reduced when the target's ex-advisor is hired by acquirer. Acquirers who hire target's ex-advisors pay lower premiums, although their own abnormal returns are unaffected. Concurrently, target abnormal returns are lower, as is their share of synergies. The above results are robust for alternative model specifications, estimation methods, and tests for endogeneity.

We do not, however, obtain comparable results when a target hires acquirer's ex-advisor. The asymmetry in results may reflect that fact that the target cannot use the promise of future businesses to lure acquirers' ex-advisors to accept the advisory mandate. Overall, we conclude that firms' decisions to hire merger counterparty's ex-advisors to advise on current mergers has significant, albeit one-sided, benefits for some participants in such transactions.

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Table I: Most Active Advisors for Acquiring Firms

This table presents the twenty five most active financial advisors for acquiring firms in our sample in terms of transaction value in US\$ billion. The sample consists of 3,251 M&A transactions in SDC/Platinum between US public firms during the period of 1985-2008. Acquirers are required to acquire the majority shares of target firms and employ at least one advisor from the list in Appendix A. Column (1) reports the total value of all mergers advised by the bank and its predecessors. Column (2) reports the total number of all mergers advised by the bank and its predecessors. If there is more than one bank advising the acquirer in a transaction, each participating bank will get 1/n share of deal value or 1/n of the count, where n is the number of advisers. Column (3) reports the number of deals in which the target firm hired advisors in M&A transactions during the past five years, i.e., the variable, *TargetHasEx*, is equal to 1. Column (4) presents the number of deals in which the bank advised target firms in past five years M&A transactions, i.e., the variable, *HireTargetEx*, is equal to 1.

Rank	Advisor Names	(1) Transaction value (\$billion)	(2) No. of deals	(3) No. of deals with <i>TargetHasEx</i> = 1	(4) No. of deals with <i>HireTargetEx</i> = 1
1	Bank of America Merrill Lynch	1,002	420	105	10
2	JP Morgan	821	275	85	2
3	Citigroup	793	299	80	9
4	Goldman Sachs	786	282	81	14
5	Credit Suisse	617	356	95	12
6	Morgan Stanley	577	263	65	4
7	Lehman Brothers (Barclays Capital)	388	185	50	4
8	UBS	188	161	36	3
9	Lazard	173	63	16	2
10	Deutsche Bank	91	99	15	2
11	Dresdner Bank (Commerzbank)	65	26	8	0
12	Wachovia (Wells Fargo)	54	72	9	0
13	Keefe, Bruyette and Woods	40	108	19	3
14	Blackstone	33	8	1	0
15	Stephens Inc.	32	16	4	0
16	Oppenheimer Holdings	29	30	6	0
17	Drexel Burnham Lambert	27	45	10	2
18	Thomas Weisel Partners	22	15	1	0
19	Sandler O'Neill Partners	21	74	8	1
20	Houlihan Lokey	20	17	4	1
21	Greenhill	18	8	2	0
22	Allen & Company	16	6	3	0
23	Evercore Partners	16	4	2	0
24	Peter J Solomon	14	6	1	0
25	William Blair	12	11	2	0
	Below top 25	268	403	54	4
	Total	6,122	3,251	760	73

Table II: Summary Statistics

The sample consists of M&A transactions in SDC/Platinum between US public firms during the period of 1985-2008. Acquirers are required to acquire the majority shares of target firms and employ at least one advisor from the list in Appendix A. *CAR* is three-day cumulative abnormal return calculated using the market model. *Premium* is measured as the initial offer price (or final price if initial price unavailable) as reported by SDC, deflated by the share price of the target at five trading days preceding the announcement date, less one. *NBidders* is the number of competing bidders. *Synergy* is the total dollar-denominated synergy scaled by the pre-bid market capitalization of the acquiring firm. *ASOS* and *TSOS* are the acquirer's and target's share of synergies, respectively. Tender Offer equals one for tender offers, and zero otherwise. *Relative Size* is the deal value divided by the acquirer's market value of equity at the end of the fiscal year prior to the acquisition announcement. *Diversify* equals one if the acquirer and target have different 4-digit SIC codes reported by SDC and zero otherwise. *Hostility* equals one if the SDC classifies the acquisition as a hostile takeover, and zero if the SDC classifies the acquisition as a friendly takeover. *Pure Cash* equals one if the acquisition is financed by all cash, and zero otherwise. *Ln(Assets)* is the natural logarithm of book value of total assets. *Leverage* is (Short-term debt + long-term debt)/total assets. M/B is the market-to-book asset ratio. Free cash flow (*CashFlow*) is operating income before depreciation - interest expense - income taxes - capital expenditures, scaled by book value of total assets. Columns 1-3 summarize the deal and firm characteristics for the whole sample. In columns 4-7, the transactions are grouped into two subsamples according to whether the acquirer's advisor advised the target firm in M&A transactions (*HireTargetEx* = 1) or not (*HireTargetEx* = 0) during the past five years. The symbols, *, **, and ***, indicate that subsample means are significantly different from each other at the 10%, 5%, and 1% levels, respectively.

	All Deals (N = 3,251)			<i>HireTargetEx</i> = 0 (N = 3,178)		<i>HireTargetEx</i> = 1 (N = 73)	
	Mean	Median	Standard deviation	Mean	Median	Mean	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Deal Characteristics							
<i>CAR</i> ^{Acquirer}	-0.02	-0.01	0.08	-0.02	-0.01	-0.03	-0.02
<i>CAR</i> ^{Target}	0.18	0.15	0.19	0.18	0.15	0.13***	0.11**
<i>Premium</i>	0.31	0.28	0.23	0.32	0.28	0.25***	0.21***
<i>NBidders</i>	0.11	0	0.39	0.11	0.00	0.15	0.00
<i>Synergy</i>	0.01	0.03	0.36	0.02	0.01	-0.01*	-0.01
<i>TSOS</i>	1.50	1.01	1.71	1.50	1.02	1.34	0.94
<i>ASOS</i>	-0.50	-0.01	1.71	-0.50	-0.02	-0.34	0.06
<i>Tender Offer</i>	0.19	0	0.39	0.19	0.00	0.14	0.00
<i>Relative Size</i>	0.69	0.36	1.05	0.69	0.36	0.85	0.57*
<i>Diversify</i>	0.48	0	0.50	0.48	0.00	0.53	1.00
<i>Hostility</i>	0.06	0	0.24	0.06	0.00	0.08	0.00
<i>Pure Cash</i>	0.25	0	0.43	0.25	0.00	0.14***	0.00**
Panel B: Firm Characteristics							
<i>Ln (Assets)</i> ^{Acquirer}	7.46	7.45	1.98	7.44	7.43	8.50***	8.66***
<i>Leverage</i> ^{Acquirer}	0.23	0.20	0.18	0.23	0.20	0.28**	0.27**
<i>M/B</i> ^{Acquirer}	2.15	1.40	2.73	2.15	1.40	1.94	1.48
<i>Cash Flow</i> ^{Acquirer}	-0.06	0.04	0.67	-0.05	0.04	-0.18	0.03
<i>Ln (Assets)</i> ^{Target}	6.10	6.00	1.85	6.06	5.97	7.59***	7.17***
<i>Leverage</i> ^{Target}	0.22	0.19	0.20	0.22	0.19	0.29**	0.24
<i>M/B</i> ^{Target}	1.90	1.32	1.96	1.91	1.32	1.65**	1.32
<i>CashFlow</i> ^{Target}	-0.07	0.02	0.62	-0.07	0.02	-0.05	0.03

Table III: Determinants of Hiring Target's Ex-advisors

We estimate a probit model to estimate the probability that an acquirer hires target's ex-advisors of M&A transactions in SDC/Platinum between US public firms during the period of 1985-2008. Acquirers are required to acquire the majority shares of target firms and employ at least one advisor from the list in Appendix A. Acquirer's expertise in target's industry is defined as the number of mergers done by acquirer in target's four-digit SIC industry divided by the total number of mergers in the industry involved during the past five years. Relative bargaining power is defined as the ratio of the natural logarithm of total assets of the acquirer to that of the target. Other deal and firm characteristics are defined in the legend of Table II. The z-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given firm. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	<i>HireTargetEx</i>
Number of advisors hired by target in the past	0.71*** (11.6)
Number of advisors hired by firm in the current deal	0.12 (1.3)
Acquirer's expertise in target's industry	-2.26*** (-2.8)
Relative bargaining power	0.02*** (3.0)
Tender offer	0.06 (0.3)
Relative Size	0.02 (0.3)
Diversify	0.34*** (2.7)
Hostility	-0.15 (-0.6)
Pure-Cash Deals	-0.25 (-1.4)
Observations	3,172
R-squared	0.32

Table IV: The Effects of Hiring Target's Ex-advisors on Takeover Competition

The sample consists of M&A transactions in SDC/Platinum between US public firms during the period of 1985-2008. Acquirers are required to acquire the majority shares of target firms and employ at least one advisor from the list in Appendix A. In column (1), the dependent variable is a dummy variable, which is equal to 1 if multiple bidders exist, and zero otherwise. The probit model is estimated and marginal effects of coefficients are reported. In column (2), the dependent variable is the number of the rival bidders (NBidders) and the econometric method used is the negative binomial regression. Toehold dummy is equal to 1 if acquirer's ownership in the target at the announcement date is larger than 5%. Premium is measured as the initial offer price (or final price if initial price unavailable) as reported by SDC, deflated by the share price of the target at five trading days preceding the announcement date, less one. Percentage of cash is the percentage of deal value that is paid with cash. Ln(Assets) is the natural logarithm of book value of total assets. Leverage is (Short-term debt + long-term debt)/total assets. M/B is the market-to-book asset ratio. Free cash flow is operating income before depreciation - interest expense - income taxes - capital expenditures, scaled by book value of total assets. All explanatory variables are measured at the end of the fiscal year immediately before the acquisition announcement date. All continuous variables are winsorized at the 0.5% level at both tails of their distributions. Constant terms, year fixed effects, and industry fixed effects are included in the regressions but not reported. The z-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given deal. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Models:	(1)	(2)
Dependent Variables:	Probit <i>MultiBidder</i>	Negative Binomial <i>NBidders</i>
<i>HireTargetEx</i>	-0.03** (-2.1)	-0.89** (-2.0)
<i>TargetHasEx</i>	0.01 (0.7)	0.25 (1.6)
Toehold dummy	-0.03** (-2.1)	-1.08** (-2.0)
Premium	-0.03* (-1.7)	-0.56 (-1.6)
Percentage of cash	0.00*** (4.8)	0.01*** (4.0)
Leverage ^{Target}	-0.06*** (-2.7)	-1.16*** (-2.7)
Ln(Assets) ^{Target}	0.02*** (5.5)	0.28*** (5.3)
M/B ^{Target}	-0.01* (-1.8)	-0.26** (-2.1)
CashFlow ^{Target}	0.01 (1.4)	0.35 (1.3)
Observations	1,736	1,736
Pseudo R-squared	0.20	0.17

Table V: The Effect of Hiring Target's Ex-advisors on Announcement Returns

The sample consists of M&A transactions in SDC/Platinum between US public firms during the period of 1985-2008. Acquirers are required to acquire the majority shares of target firms and employ at least one advisor from the list in Appendix A. *CAR* is three-day cumulative abnormal return calculated using the market model. The dependent variables in columns (1) and (2) are target's and acquirer's *CAR*, respectively. Firms characteristics (*Ln(Assets)*, *M/B*, *Leverage*, *CashFlow*) are measured for targets and acquirers, respectively in columns (1) and (2). The detailed definitions of other variables are in the legend of Table II. All explanatory variables are measured at the end of the fiscal year immediately before the acquisition announcement date. All continuous variables are winsorized at the 0.5% level at both tails of their distributions. Constant terms, year fixed effects, and industry fixed effects are included in the regressions but not reported. The z-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given deal. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1) <i>CAR^{Target}</i>	(2) <i>CAR^{Acquirer}</i>
<i>HireTargetEx</i>	-0.06** (-2.0)	0.01 (0.6)
<i>TargetHasEx</i>	0.00 (0.1)	-0.01*** (-3.0)
<i>Tender offer</i>	0.09*** (6.5)	0.01* (1.7)
<i>Relative Size</i>	-0.02*** (-4.3)	-0.00 (-0.7)
<i>Diversify</i>	-0.00 (-0.3)	-0.00 (-0.3)
<i>Hostility</i>	0.04** (2.5)	-0.00 (-0.5)
<i>Pure-Cash Deals</i>	0.04*** (3.3)	0.02*** (5.5)
<i>Leverage</i>	-0.02 (-0.9)	0.01 (1.1)
<i>Ln(Assets)</i>	-0.00 (-1.5)	-0.00 (-1.2)
<i>M/B</i>	-0.01** (-2.4)	-0.00** (-2.2)
<i>CashFlow</i>	0.03*** (2.9)	0.00 (0.3)
Observations	1,895	2,093
Adjusted R2	0.13	0.08

Table VI: The Effects of Hiring Target's Ex-advisors on Takeover Premium and Synergies

The sample consists of M&A transactions in SDC/Platinum between US public firms during the period of 1985-2008. Acquirers are required to acquire the majority shares of target firms and employ at least one advisor from the list in Appendix A. The dependent variable in column (1) is the premium paid by bidders to targets. The dependent variable in column (2) is the total dollar value of synergy scaled by the pre-bid market capitalization of the acquiring firm. In columns (3), *TSOS* is the target's share of synergy. The detailed definitions of other variables are in the legend of Table II. All explanatory variables are measured at the end of the fiscal year immediately before the acquisition announcement date. All continuous variables are winsorized at the 0.5% level at both tails of their distributions. Constant terms, year fixed effects, and industry fixed effects are included in the regressions but not reported. The z-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given deal. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	<i>Premium</i>	<i>Synergy</i>	<i>TSOS</i>
<i>HireTargetEx</i>	-0.06** (-2.0)	-0.02 (-1.0)	-0.50** (-2.4)
<i>TargetHasEx</i>	-0.00 (-0.2)	-0.01** (-2.1)	-0.11 (-1.1)
<i>Leverage</i> ^{Acquirer}	-0.01 (-0.3)	0.03 (1.5)	-0.17 (-0.6)
<i>Ln(Assets)</i> ^{Acquirer}	0.02*** (3.9)	-0.01*** (-3.0)	0.00 (0.1)
<i>M/B</i> ^{Acquirer}	0.01*** (2.6)	-0.00** (-2.2)	-0.01 (-0.5)
<i>CashFlow</i> ^{Acquirer}	-0.01 (-0.4)	-0.00 (-0.3)	-0.04 (-0.6)
<i>Tender offer</i>	0.02 (1.4)	0.02** (2.1)	0.01 (0.1)
<i>Relative Size</i>	0.02** (2.3)	0.01*** (3.6)	0.03 (0.5)
<i>Diversify</i>	-0.00 (-0.1)	-0.00 (-0.8)	-0.04 (-0.5)
<i>Hostility</i>	0.03 (1.5)	0.02 (1.4)	-0.03 (-0.2)
<i>Pure-Cash Deals</i>	-0.01 (-0.3)	0.01* (1.7)	-0.36*** (-3.1)
<i>Leverage</i> ^{Target}	0.04 (1.1)	-0.03* (-1.9)	-0.23 (-0.9)
<i>Ln(Assets)</i> ^{Target}	-0.03*** (-4.8)	0.01*** (3.0)	0.08* (1.8)
<i>M/B</i> ^{Target}	-0.02*** (-4.1)	-0.00** (-2.5)	-0.01 (-0.5)
<i>CashFlow</i> ^{Target}	-0.02** (-2.0)	0.01 (1.4)	0.18* (2.0)
Observations	1,559	1,600	1,600
Adjusted R2	0.09	0.13	0.02

Table VII: Tests for Endogeneity and Additional Analysis

The sample consists of M&A transactions in SDC/Platinum between US public firms during the period of 1985-2008. Acquirers are required to acquire the majority shares of target firms and employ at least one advisor from the list in Appendix A. Panel A reports the tests for endogeneity. The first two columns report the two-stage bootstrapping results and the others are regarding the second-stage regression results of the two-step treatment effect model. In the first two columns, 95% confidence intervals of the bootstrapped coefficients are reported. In Panel B, we conduct a simulation analysis in which acquiring firms are assumed to randomly choose M&A advisors based on advisor's market share. In panel C, we control for two additional dummy variables to account for target firms hiring acquirer's ex-advisors. In panel D, we add two new variables as to whether acquirers hire target's ex-underwriters as M&A advisors. In Panel E, we exclude deals with missing value for any dependent and explanatory variables in Tables IV- VI. In panel F, we exclude *TargetHasEx* from the regression models. In panel G, we add advisor's industry merger expertise and advisor's market share as additional control variables. All regressions include the same control variables as those used in Tables IV-VI, but the coefficients on control variables are not tabulated. Detailed other variable definitions are in the legend of Table II. The *t*-statistics in parentheses are calculated from the Huber/White/Sandwich heteroskedastic consistent errors, which are also corrected for correlation across observations for a given deal. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variables	<i>MultiBidder</i>	<i>NBidders</i>	CAR^{Target}	$CAR^{Acquirer}$	<i>Premium</i>	<i>Synergy</i>	<i>TSOS</i>
Panel A: Tests for endogeneity							
<i>HireTargetEx</i>	-0.07 [-0.12, -0.02]	-1.07 [-2.20, 0.06]	-0.20*** (-3.5)	-0.01 (-0.2)	-0.13** (-2.0)	-0.05 (-1.5)	-1.06** (-2.1)
<i>TargetHasEx</i>	0.02 [-0.06, 0.10]	0.26 [-0.33, 0.85]	0.01 (0.7)	-0.01*** (-2.7)	-0.00 (-0.0)	-0.01* (-1.8)	-0.09 (-0.8)
<i>IMR</i>			0.08*** (2.7)	0.01 (0.5)	0.04 (1.1)	0.02 (1.1)	0.31 (1.3)
Panel B: Randomly choosing M&A advisors based on advisor's market share							
<i>HireTargetEx</i> (Simulated)	-0.02 [-0.07 0.10]	-0.58 [-6.79 5.62]	-0.01 [-0.10 0.07]	-0.00 [-0.04 0.03]	-0.01 [-0.12 0.10]	-0.01 [-0.06 0.05]	-0.07 [-0.85 0.71]
<i>TargetHasEx</i> (Simulated)	0.001 [-0.012, 0.014]	0.162 [0.108, 0.216]	-0.004 [-0.007, -0.001]	-0.013 [-0.014, -0.012]	-0.009 [-0.013, -0.005]	-0.015 [-0.017, -0.013]	-0.157 [-0.186, -0.128]
Panel C: Target hiring acquirer's ex-advisor							
<i>HireTargetEx</i>	-0.03** (-2.2)	-0.90** (-2.1)	-0.06** (-2.0)	0.01 (0.5)	-0.06** (-2.1)	-0.02 (-1.0)	-0.50** (-2.4)
<i>TargetHasEx</i>	0.01 (0.7)	0.23 (1.5)	-0.00 (-0.0)	-0.01*** (-3.0)	-0.00 (-0.2)	-0.01** (-2.0)	-0.11 (-1.1)
<i>HireAcquirerEx</i>	-0.03** (-2.2)	-0.56 (-1.5)	-0.02 (-0.9)	0.00 (0.1)	-0.03 (-1.3)	-0.00 (-0.5)	0.01 (0.1)
<i>AcquirerHasEx</i>	0.01 (1.1)	0.14 (1.0)	0.01 (1.4)	-0.00 (-1.0)	0.00 (0.1)	-0.00 (-0.6)	-0.01 (-0.1)

Panel D: Hiring target's ex-underwriters							
<i>HireTargetEx</i>	-0.03*	-0.82*	-0.06**	0.01	-0.07**	-0.02	-0.51**
	(-1.9)	(-1.8)	(-2.3)	(0.5)	(-2.3)	(-1.1)	(-2.4)
<i>TargetHasEx</i>	0.01	0.24	0.00	-0.01***	-0.00	-0.01**	-0.11
	(0.7)	(1.5)	(0.1)	(-2.9)	(-0.2)	(-2.1)	(-1.1)
<i>HireTargetExUnderwriter</i>	-0.01	-0.17	0.02	0.00	0.02	0.01	0.05
	(-0.4)	(-0.8)	(1.3)	(0.3)	(1.1)	(1.1)	(0.3)
<i>TargetHasExUnderwriter</i>	0.01	0.23	-0.00	-0.01*	-0.02	-0.00	0.01
	(1.5)	(1.3)	(-0.4)	(-1.8)	(1.5)	(-0.0)	(0.1)
Panel E: Unified sample that includes deals with no missing values for all variables in Tables IV-VI							
<i>HireTargetEx</i>	-0.05**	-0.89**	-0.05	-0.00	-0.06*	-0.01	-0.48**
	(-2.1)	(-2.0)	(-1.5)	(-0.2)	(-2.0)	(-0.6)	(-2.2)
<i>TargetHasEx</i>	0.01	0.24	-0.00	-0.01*	-0.00	-0.01*	-0.10
	(0.7)	(1.5)	(-0.2)	(-1.8)	(-0.1)	(-1.7)	(-0.9)
Panel F: Excluding <i>TargetHasEx</i>							
<i>HireTargetEx</i>	-0.03*	-0.75*	-0.06**	-0.00	-0.06**	-0.03	-0.57***
	(-1.9)	(-1.7)	(-2.1)	(-0.1)	(-2.2)	(-1.5)	(-2.9)
Panel G: Controlling for additional advisor characteristics							
<i>TargetExAdvisor</i>	-0.03**	-0.89**	-0.06**	0.01	-0.06**	-0.02	-0.50**
	(-2.1)	(-2.0)	(-2.0)	(0.6)	(-2.0)	(-0.9)	(-2.4)
<i>TargetHasExAdvisor</i>	0.01	0.25	0.00	-0.01***	-0.00	-0.01**	-0.11
	(0.8)	(1.6)	(0.1)	(-3.1)	(-0.2)	(-2.1)	(-1.0)
<i>Advisor's Industry Merger Expertise</i>	0.04	0.76	0.00	-0.00	-0.01	-0.03	0.28
	(1.2)	(1.5)	(0.1)	(-0.2)	(-0.2)	(-1.5)	(0.8)
<i>Top-tier Advisor</i>	-0.01	-0.17	0.01	0.00	-0.01	0.01	-0.09
	(-0.9)	(-0.8)	(0.7)	(0.7)	(-0.4)	(0.7)	(-0.8)

Appendix A: Major Bank Mergers in the Banking Industry

The table summarizes the major merger and acquisition events in the banking industry. The sample banks are selected by forming a union of two groups of banks: (1) the sample of Ljungqvist, Marston and Wilhelm (2006); and (2) the sample of 50 most active banks in M&A activities by transaction value over the period 1985 to 2008. The effective dates of bank mergers are obtained from Corwin and Schultz (2005) and Ljungqvist, Marston, and Wilhelm (2006), supplemented by other financial news sources. The numbers in the brackets following bank names define the predecessor-successor relationships among banks. The number at the beginning represents the surviving bank. The first subsequent character (a or b) represent one of the two predecessors of the surviving bank. The second, third and fourth characters further define the earlier predecessors. For example, Credit Suisse First Boston (2a) and Donaldson Lufkin & Jenrette (2b) are predecessors of Credit Suisse (2), the surviving bank. Credit Suisse (2aa) and First Boston Corp. (2ab) are predecessors of Credit Suisse First Boston (2a).

Surviving Bank	Effective date	Bank 1	Bank 2
<i>Sample bank from Ljungqvist, Martson and Wilhelm (2006)</i>			
Citigroup/Salomon Smith Barney (1)	19860731	Schroders (1aba)	Wertheim Holdings (1abb)
	19971128	Salomon Brothers (1aaba)	Smith Barney Inc. (1aabb)
	19981008	CitiCorp (1aaa)	Travelers (1aab)
	20000501	Salomon Smith Barney Holdings (1aa)	Schroders-Worldwide Investment (1ab)
	20010202	Salomon Smith Barney Holdings (1a)	Geneva Companies (1b)
Credit Suisse (2)	19881222	Credit Suisse (2aa)	First Boston Corp. (2ab)
	20001103	Credit Suisse First Boston (2a)	Donaldson Lufkin & Jenrette (2b)
Lehman Brothers (3)	19840510	Shearson/American Express (3aa)	Lehman Brothers (3ab)
(now Barclays Capital)	19880429	Shearson Lehman Brothers (3a)	EF Hutton (3b)
JP Morgan (4)	19920326	Chemical Bank (4aaaaaaa)	Manufacturers Hanover Bank (4aaaaaab)
	19960331	Chemical Bank (4aaaaaa)	Chase Manhattan (4aaaaab)
	19990325	Robert Fleming Hldgs Ltd (4aaaba)	Jardine Fleming Group Ltd (4aaabb)
	19991210	Chase Manhattan Corp. (4aaaaa)	Hambrecht & Quist Group (4aaaab)
	20000411	Chase Manhattan Corp. (4aaaa)	Robert Fleming Hldgs Ltd (4aaab)
	20001231	Chase Manhattan Corp. (4aaa)	JP Morgan & Co. (4aab)
	20040701	JP Morgan Chase & Co. (4aa)	Bank One Corp. (4ab)
	20080530	JP Morgan Chase & Co. (4a)	Bear Stearns Companies, Inc. (4b)
	19950131	PaineWebber (5baa)	Kidder Peabody & Co., Inc. (5bab)
	19950703	Swiss Bank Corp. (5abaa)	SG Warburg Securities (5abab)
UBS (5)	19970902	SBC Warburg (Swiss Bank Corp.) (5aba)	Dillon Read & Co. (5abb)
	19980629	Union Bank of Switzerland (5aa)	Swiss Bank Corp. (5ab)
	20000612	PaineWebber Group, Inc. (5ba)	JC Bradford & Co. (5bb)
	20001103	UBS AG (5a)	Paine Webber Group, Inc. (5b)
	19900330	Deutsche Bank AG (6ba)	Morgan Grenfell (6bb)
Deutsche Bank (6)			

Wachovia Corp. (7) (now Wells Fargo)	19960801	James D Wolfensohn Inc. (6aba)	Bankers Trust New York Corp. (6abb)
	19970902	Alex Brown, Inc. (6aa)	Bankers Trust New York Corp. (6ab)
	19990604	BT Alex Brown (6a)	Deutsche Bank AG (6b)
	19980202	First Union Corp. (7aaaa)	Wheat First Butcher Singer (7aaab)
	19990401	Wachovia Corp. (7aaba)	Interstate/Johnson Lane (7aabb)
	19990731	Prudential Securities (7abaa)	Vector Securities Intl., Inc. (7abab)
	19991231	Prudential Securities (7aba)	Volpe Brown Whelan & Co. (7abb)
	20010904	First Union Corp. (7aaa)	Wachovia Corp. (7aab)
	20030701	Wachovia Corp. (7aa)	Prudential Securities (7ab)
	20071001	Wachovia Corp. (7a)	AG Edwards Inc. (7b)
Oppenheimer Holdings (8)	19890815	Canadian Imperial Bank of Commerce (8abaa)	Wood Gundy Inc. (8abab)
	19971103	CIBC Wood Gundy Securities (8aba)	Oppenheimer & Co., Inc.(8abb)
	20030103	Fahnestock Viner Holdings Inc. (8aa)	CIBC Oppenheimer's retail brokerage business (the Private Client and U.S. Asset Management Divisions) was sold (8ab)
Bank of America Merrill Lynch (9)	20080114	Oppenheimer Holdings Inc. (8a)	CIBC World Markets-US Businesses (8b)
	19920422	BankAmerica Corp. (9aaaaaa)	Securities Pacific (9aaaaab)
	19940901	BankAmerica Corp. (9aaaaa)	Continental Bank (9aaaab)
	19971001	BankAmerica Corp. (9aaaa)	Robertson Stephens & Co. (9abbb)
	19971001	NationsBank Corp. (9aaba)	Montgomery Securities (13a)
	19980202	Fleet Financial Group Inc. (9abaa)	Quick & Reilly Group(9abab)
	19980901	BankBoston Corp. (9abba)	Robertson Stephens & Co. (9abbb)
	19980930	BankAmerica Corp. (9aaa)	NationsBank Corp. (9aab)
	19991001	Fleet Financial Group Inc. (9aba)	BankBoston Corp. (9abb)
	20040401	BankAmerica Corp. (9aa)	FleetBoston Financial (9ab)
Morgan Stanley (10) Cowen Group (11)	20061218	Merrill Lynch & Co., Inc.(9ba)	Petrie Parkman & Co., Inc.(9bb)
	20090101	Bank of America Corp. (9a)	Merrill Lynch & Co., Inc.(9b)
	19970531	Dean Witter Discover & Co. (10a)	Morgan Stanley Group, Inc. (10b)
	19980630	Cowen & Co. (11a)	Societe Generale Securities (11b)
Goldman Sachs (12) Thomas Weisel Partners (13)	2006	Cowen carved out	
	19980921	Spun off from Montgomery Securities (13a)	

Other banks which are classified as the top-50 in SDC by transaction value

Drexel Burnham Lambert (14)			
Lazard (15)			
Piper Jaffray (16)	19980501	US BanCorp. (16aa)	Piper Jaffray Companies (16ab)
	19990104	US BanCorp. (16a)	Libra Investment, Inc. (16b)
	20031231	US BanCorp. (16x) spun off Piper Jaffray (16)	
SunTrust Robinson-Humphrey (17)	19980102	SunTrust Banks Inc. (17aa)	Equitable Securities Corp. (17ab)
	20010727	SunTrust Banks Inc. (17a)	Robinson-Humphrey (17b)
Houlihan Lokey (18)			
ABN-AMRO (19)	19950309	ING (19baa)	Barings Securities (19bab)
	19950927	ABN-AMRO Holding N.V. (19aa)	Chicago Corporation (19ab)
	19971008	ING Barings (19ba)	Furman Selz LLC (19bb)
	20010430	ABN-AMRO Holding N.V. (19a)	ING Baring-US Operations (19b)
Dresdner (20)	19950823	Dresdner Bank AG (20aa)	Kleinwort Benson (20ab)
(now Commerzbank)	20010105	Dresdner Bank AG (20a)	Wasserstein Perella Group, Inc. (20b)
Stephens Inc. (21)			
Greenhill (22)			
Jefferies (23)	20010321	Jefferies & Co. (23aaa)	Quarterdeck Investment (23aab)
	20031223	Jefferies Group Inc. (23aa)	Broadview Holdings (23ab)
	20070621	Jefferies & Co. (23a)	Putnam Lovell Group Inc. (23b)
Blackstone (24)			
EverCore Partners (25)			
Allen & Co. (26)			
RBC Capital Market (27)	19980102	Dain Bosworth (27aabaa)	Rauscher Pierce Refsnes (27aabab)
	19980406	Dain Rauscher Corp. (27aaba)	Wessels Arnold & Henderson LLC (27aabb)
	20010110	Royal Bank of Canada (27aaa)	Dain Rauscher Corp. (27aab)
	20011101	Royal Bank of Canada (27aa)	Tucker Anthony Sutro (27ab)
	20070111	RBC Capital Market (27a)	Daniels & Associates Inc. (27b)
Stifel Financial Corp. (28)	20020429	Ryan Beck & Co. (28ba)	Gruntal & Co. (28bb)
	20070228	Stifel Financial Corp. (28a)	Ryan Beck & Co. (28b)
KPMG (29)			
Peter J Solomon (30)			
Raymond James (31)	19980511	First Chicago NBD Corp. (31aaa)	Roney & Co. (31aab)
	19981002	First Chicago NBD Corp. (31aa)	BANC ONE Corp. (31ab)
	19990614	Roney Capital Markets (BANC ONE)	Raymond James Financial, Inc. (31b)

William Blair (32)		(31a)	
PricewaterhouseCoopers (33)	19980701	Price Waterhouse (33a)	Coopers & Lybrand LLC (33b)
Ernst & Young (34)			
Needham & Co. (35)			
Simmons & Co. (36)			
KeyCorp(37)	19980908	McDonald & Co. Investments, Inc. (37aaa)	Essex Capital Markets, Inc. (37aab)
	19981026	McDonald & Co. Investments, Inc. (37aa)	KeyCorp(37ab)
	19990603	McDonald & Co. Investments, Inc. (37a)	Trident Financial Corp. (37b)
Keefe, Bruyette and Woods (38)	19960508	Keefe, Bruyette and Woods (38a)	Charles Webb & Co. (38b)
Sandler O'Neill Partners (39)			
Alliant Partners (40)			
Austin Associates Inc. (41)			
Robert W Baird & Co. (42)			
Baxter Fentriss & Co. (43)			
BB&T Corp. (44)	19971002	BB&T Corp. (44aaa)	Craigie Inc. (44aab)
	19990326	BB&T Corp. (44aa)	Scott & Stringfellow Financial (44ab)
	20050105	BB&T Corp. (44a)	Windsor Group LLC (44b)
Berkery, Noyes & Co. (45)			
BMO Capital Markets (46)	19871031	Bank of Montreal (46a)	Nesbitt Thomson Inc. (46b)
Brown, Gibbons, Lang & Co. (47)			
Duff & Phelps (48)			
Friedman Billings Ramsey (49)			
Goldsmith Agio Helms & Co. (50)			
Grant Thornton LLP (51)			
Harris Williams & Co. (52)			
Hovde Financial (53)			
Lincoln International (54)			
Morgan Joseph & Co., Inc.(55)			
Morgan Keegan Inc. (56)			
Rothschild (57)			
RSM EquiCo Capital Markets (58)			
Sperry Mitchell (59)			
Updata Capital Inc. (60)			