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**Contents**

**Summary**

In essay one, we distinguish between two types of equity capital namely, proceeds collected from the exercise of employee stock options and those raised from all other equity issues. We examine the spending patterns of these proceeds and find that firms do not have a greater tendency to spend option proceeds than they do with other equity proceeds. In fact, option proceeds are so highly saved that cash savings constitute its major use, followed by investment and equity repurchase. That said, more financially constrained firms allocate more option proceeds to investment and less to equity repurchase. We also show that option proceeds are important in explaining the time trend of the cash holdings of U.S. firms.

In essay two, we employ comprehensive measures of investment and cash flow, and evaluate the findings of Chen and Chen (2012) that the investment-cash flow sensitivity of U.S. firms has disappeared over time. We show that the said sensitivities were distinctive from zero for all sample years, and that the apparent disappearance of investment-cash flow sensitivity resulted from Chen and Chen (2012) using a restrictive measure of investment i.e., capital expenditure. We then show that the cash flow sensitivities of non-capital expenditure investments offset, to some extent, the decreasing capital expenditure-cash flow sensitivity such that the overall investment-cash flow sensitivity has not disappeared over time.

In essay three, we use a large sample of nonfinancial U.S. firms over the period 1971 to 2015 to examine how financial resources are allocated to different corporate uses. We find that the allocations of funds have changed over time; Firms have been shifting their funds allocations away from investment and working capital, and towards cash savings and debt retirement. Moreover, the time trends associated with these allocations are driven not only by changes in sample composition, but also by changes in allocation dynamics. We also find that these time-series changes in funds allocations are related to several macroeconomic factors.

## Essay One: The Allocation of Equity Issuance Proceeds

### Abstract

Employee stock option exercises have become an important means through which U.S. firms issue equity. We separate equity issuance proceeds into two parts: proceeds generated by the exercise of employee stock options, and proceeds engendered by all other forms of public and private equity issues. We document that, for a sample of nonfinancial U.S. firms over the period 1996-2015, the aggregate amount of option proceeds is greater than that of other equity proceeds. We then examine how firms allocate option proceeds across various uses and find that cash savings constitute the most important use of option proceeds, followed by investment and equity repurchase. Further analysis reveals that more financially constrained firms allocate relatively more option proceeds to cash holdings and investment, and less to equity repurchase. Finally, we show that option proceeds are important in explaining the increasing time trend of cash holdings by U.S. firms; A one standard deviation increase in option proceeds produces an increase of 0.029 in the average cash-to-assets ratio.

**JEL classification**: G30; G32; J33
**Keywords**: Employee stock option; Equity issuance; Cash flow allocation; Cash holdings

## I. Introduction

Equity issuance is an important way in which firms raise capital. Historically, initial public offerings (IPOs), seasoned equity offerings (SEOs), and private placements have been the most traditional approaches of equity issuance.[1] In recent years however, the trend of offering stock options to employees has become so widespread among U.S. firms that employee stock options (ESOs, hereafter) has emerged as an important channel through which firms issue equity. To wit, when employees exercise their stock options, they purchase the underlying stock at the option strike price, resulting in cash inflows to their employer firms. In fact, we collect data on ESOs for a sample of nonfinancial firms that ever exists in the S&P1500 index and/or NASDAQ 100 index, and find that the amount of equity raised from the exercise of ESOs (i.e., option proceeds) sums to a daunting US$760.9 billion for the period 1996-2015.[2] This amount is more than the combined amount (US$624.5 billion) of all other forms of equity issuance, including IPOs, SEOs, and private placements. For many firms, option proceeds have become one of the largest items reported on their cash flow statements.[3]

That said, ESOs are not typically regarded as a form of financing. Rather, the primary motivation for corporations to issue ESOs is to provide their employees with some form of non-cash awards, which not only compensate employees for their service to the firms, but also align incentives for performance.[4] In fact, given that the grants of employee stock options do

[1] Equity issuance includes IPOs, SEOs, private placements, rights offering, as well as stock sales through direct purchase plans, preferred stock issues, conversion of debt and preferred stock, employee option exercises and employee benefit plans.

[2] Using data of S&P 100 firms over the period 1999-2001, Fama and French (2005) also find that the value of equity issued to employees through compensation plans exceeds that issued through SEOs, and private placements.

[3] For example, Cisco Systems, Inc. received $4.944 billion worth of option proceeds from its employees in 2007. IBM (International Business Machines Corporation) obtained $3.302 billion, $3.052 billion, and $3.774 billion of option proceeds from its employees in 2008, 2009, and 2010, respectively.

[4] Hall and Liebman (1998) find a strong positive relation between firm performance and CEO compensation, driven almost entirely by changes in the value of stock and stock options held by the CEO. They posit that stock options help to mitigate agency costs by aligning the incentives of executives with those of their firms' owners. Oyer and Schaefer (2005) suggest that stock option grants provide incentives to middle managers and efficiently compensate and/or retain employees who are sufficiently optimistic about their firms' prospects. Chang et al. (2015) find that stock options granted to non-executive employees increase risk-taking incentive, enhance failure-

not require contemporaneous cash payouts, firms experiencing low profitability, cash flow constraints and/or high costs of external capital typically substitute equity awards for cash compensation.[5] As these firms subsequently achieve prosperity, the value of their equities would increase, and employees would find it profitable to exercise their in-the-money stock options. Firms therefore experience an inflow of option proceeds when they are doing operationally well. To be specific, the funds received from the exercise of employee stock options represent the consequential outcome of compensating employees and aligning their interests with those of their firms' owners, and not the conscientious effort of the firms' managers to raise funds for specific purposes.

We study how firms spend proceeds collected from the exercise of ESOs. That is, firms could use option proceeds to make investment, stockpile cash, repurchase equity, retire debt, or pay dividends. In view of the substantial amounts of option proceeds that firms received, the allocation of these funds across various uses should therefore have important implications for corporate policies (e.g., investment, cash management, financing, and payout). Furthermore, we investigate whether there is a difference in the way firms spend option proceeds and proceeds generated by other forms of equity issuance.

Specifically, employees decide on whether and when to exercise their ESOs, as well as the amount of ESOs to exercise. The issuance of equity associated with the exercise of ESOs is therefore primarily initiated by employees; Option proceeds arrive regardless of whether firm have immediate cash needs. The amount and timing of option proceeds are difficult to predict because the exercise of ESOs depends on not only the stock market conditions, but also the rationality of employees to exercise their in-the-money ESOs. In contrast, proceeds from other equity issues, which we termed as other equity proceeds, result from the conscientious

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bearing capacity, encourage long-term commitment, and promote teamwork of employees, leading to greater innovation success.

[5] See Yermack (1995), Dechow et al. (1996), and Core and Guay (2001).

effort made by firms' managers to raise capital for specific uses. Hence, other equity proceeds are more anticipated and less discretionary than option proceeds.[6] In view of these differences, separating option proceeds from other equity proceeds can better reveal managerial motives behind different forms of equity issuance (e.g., McLean, 2011; Kim and Weisbach, 2008).[7]

Next, we examine the extent to which financial constraint as well as agency problems affects the allocation of option proceeds. There is very little theoretical guidance on how firms facing more severe financial constraint or agency problems should simultaneously invest, stockpile cash, repurchase equity and retire debt when they receive option proceeds. Therefore, there is a need for empirical evidence to inform theory. Several studies have examined the various uses of option proceeds. For example, Babenko, Lemmon, and Tserlukevich (2011) find that an average firm invests as much as 34 cents per dollar of option proceeds. Bens, Nagar, and Wong (2002) and Bens et al. (2003) document that firms repurchase equity after the exercise of ESOs to alleviate the associated earnings dilution.

Unlike prior studies that examine in isolation, a specific use of option proceeds, we offer a complete view of the allocation of option proceeds by simultaneously tracking all the uses, interrelated among one another based on the cash flow identity, which states that the sum of all uses of funds must equal to the sum of all sources of funds. Specifically, we employ an integrated regression framework in which various uses of funds (i.e., investment, cash savings, equity repurchases, debt retirement, and dividends) are regressed on option proceeds, other equity proceeds, other sources of funds, and firm controls. Other sources of funds include internal cash flow and debt issuance proceeds.

[6] Other equity proceeds are more anticipated than option proceeds because the timing (e.g. SEO issuance dates) and amount (e.g. SEO issue prices) of other equity proceeds are usually pre-determined. How these proceeds are to be spent is also typically specified in the prospectus such that when they are subsequently collected from investors, they are not readily available for alternative uses.

[7] In a recent paper, McKeon (2015) uses the size of equity issues to separate employee-initiated issues from firm-initiated ones and find that they have different implications for corporate policies.

To date, there is no consensus with regards to what firms would do when they receive an incremental dollar of cash flow. In our integrated regression framework, each use of funds is regressed on all sources of funds, including option proceeds. As such, the coefficient of each use of funds on option proceeds indicates the allocation of these proceeds to that specific use. Moreover, since the uses of funds must completely absorb the option proceeds, a dollar increase in the amount of option proceeds would lead to an incremental allocation to the use(s), which must sum to that additional dollar of option proceeds. Thus, our methodology can effectively pin down to which use(s) of funds an additional dollar of option proceeds is allocated to.

We collect from several sources, data on broad-based ESO programs for a panel of nonfinancial U.S. firms during the period 1996-2015. Following Frank and Goyal (2003) and Chang et al. (2014), we use the flow-of-funds (cash flow) statement of Compustat to define the uses and sources of funds so that the cash flow identity holds well in our data. In other words, all uses of funds sum to the sources of funds. We then use ordinary least squares (OLS) regressions to separately estimate five equations with respect to the firms' uses of funds namely, investment, the change in cash holdings, equity repurchases, debt reductions, and dividends.[8]

Our baseline regression results show that on average, for every dollar of option proceeds received, firms direct 23.2 cents to investment, save 70.1 cents as cash, repurchase 20.8 cents worth of equity, reduce debt retirement by 14.9 cents, and pay 0.8 cents as dividends. Notably, the coefficients of all uses on option proceeds sum to unity by virtue of the cash flow identity. On the other hand, firms direct 37.8 cents per dollar of other equity proceeds to investment, 45.1 cents to cash holdings, 0.2 cents to equity repurchase, 16.6 cents to debt

[8] We do not consider the change in working capital as a use of cash flow. Instead, we include it in the calculation of cash flow, as suggested by Bushman, Smith, and Zhang (2011). The rationale is detailed in Section III (B). Alternatively, the five equations can be estimated simultaneously using seemingly unrelated regressions (SUR). Chang et al. (2014) show that since each equation in the system has its dependent variable and the explanatory variables in all equations are either exogenous or predetermined, SUR estimates are equivalent to equation-by-equation OLS estimates if the same set of explanatory variables is included in each equation.

retirement, and 0.2 cents to dividends. The rate of cash savings is therefore higher for option proceeds than for other equity proceeds. Moreover, given that the earnings dilution effect and leverage impact of IPOs, SEOs, and private placements are more readily anticipated, and possibly catered for, than those triggered by the exercise of ESOs, we find firms repurchasing equity more extensively after receiving option proceeds than they do with other equity proceeds. They also cut back on debt repurchase only after ESOs are exercised. In sum, firms do not have a relatively higher tendency to spend option proceeds. Rather, option proceeds are so greatly saved that cash savings emerge as the most important use of option proceeds, followed by investment and equity repurchase.

Among the different sources of funds, option proceeds are the most highly saved in the year of receipt. These savings are then significantly drawn down in the following year, and redirected to equity repurchase, in line with the conjecture of Arkes et al. (1994) that firms take time to plan for the spending of ad-hoc cash inflows. However, contrary to their hypothesis, firms in our sample do not spend the money away before they are committed for specific uses. Rather, they save a large portion of it for future use. That said, we find that the short-term effect of option proceeds on cash savings does not completely reverse as firms do not spend all the savings in subsequent years. On the other hand, consistent with the findings of McLean (2011) that equity issuance proceeds are increasingly saved due to increasing precautionary motives, we find the savings from other equity proceeds to be relatively more permanent as they are not heavily depleted in subsequent years.

We next evaluate the spending pattern of option proceeds for firms facing different degree of financial constraint. We find that firms that are less financially constrained do not rely on option proceeds for investment as much as more financially constrained firms do. Under every measure of financial constraint, the rate of investment of option proceeds is statistically significant for more financially constrained firms, ranging from 33.5 cents to 40 cents, but not statistically significant for less financially constrained firms. Rather, less financially constrained firms considerably repurchase equity with their option proceeds.

We further examine whether firms with varying degree of corporate governance spend their option proceeds differently. On average, we find that firms with high corporate governance do not allocate their option proceeds to investment and cash savings any differently from firms with low corporate governance. Although firms with high corporate governance repurchase relatively more equity, this incremental allocation to equity repurchase is either not statistically significant or marginally significant for most of the corporate governance measures.

Lastly, we examine how equity issuance proceeds (particularly option proceeds), contribute to explaining the average cash-to-assets ratio of our sample firms during the period 1996-2015. That is, we regress the cash-to-assets ratios of these firms on a set of variables known by Bates et al. (2009) as determinants of cash holdings. In addition, we include proceeds from equity and debt issuances as explanatory variables and find them to be statistically significant in explaining the observed cash-to-assets ratios. Specifically, both option proceeds and other equity proceeds represent sources of cash and have a positive effect on the cash-to-assets ratio of an average firm. Economically, our results suggest that a one standard deviation increase in option proceeds leads to an average increase in cash-to-assets ratio of 0.029, whereas a similar increase in other equity proceeds produces an increase in the ratio of only 0.006. For additional perspective, we compute the hypothetical cash-to-assets ratios that would prevail if firms did not save their option proceeds at the yearly saving rates. We find that the said ratios are consistently lower than the actual ratios and conclude that the accumulation of option proceeds as cash helps to explain the observed cash-to-assets ratios of our sample firms.

Our paper contributes to the literature in three ways. First, we show that ESOs constitute more than a form of employee compensation or incentive scheme in that the proceeds collected from the exercise of ESOs have become a very important source of corporate financing.

Specifically, we provide important insights into how firms deploy option proceeds for various uses and how financial constraint and agency problems affect the deployment. Second, our integrated regression framework offers a complete view of how firms allocate all sources of funds to various uses, which are interrelated among one another by the cash flow identity. To be specific, we separate option proceeds from other equity proceeds and examine the allocation of these funds to different uses. Third, we build on the empirical literature on cash holdings by highlighting the important role of equity issuance proceeds (particularly option proceeds) in explaining the cash holding behavior of nonfinancial U.S. firms and quantifying how much these funds contribute to the recent cash build up, as documented by Bates et al. (2009). In fact, the cash-to-assets ratios of our sample firms would be significantly lower than the observed ratios if firms did not save their option proceeds at the yearly estimated saving rates.

The remainder of the paper is organized as follows: Section II reviews the literature related to our scope of research, Section III describes the data and variables used in our analysis, Section IV highlights the empirical methodology, Section V presents the summary statistics of our sample, Section VI describes the empirical results, and Section VII concludes.

## II. Related Literature

In general, the primary motivation for corporations to grant ESOs is to provide their employees with some form of non-cash awards, which not only compensate employees for their service to the firms, but also align incentives for performance. In other words, ESOs are not typically regarded as a form of financing; Funds received from the exercise of employee stock options represent the consequential outcome of compensating employees and aligning their interests with those of their firms' owners, and not the conscientious effort of the firms' managers to raise funds for specific purposes. However, in the recent decades, stock option grants to employees have become an important component of employee compensation policy (e.g., Hochberg and Lindsey, 2010) [9] so much so that option proceeds have become one of the largest items reported on their cash flow statements.

Given that employees are involved in the day-to-day operations of their employer firms, they naturally have access to more corporate information relative to outside investors. Therefore, stock option proceeds collected from employees represent a source of funds that is not as severely affected by asymmetric information or moral hazard as that of external equity financing. In fact, Huddart and Lang (2003) document strong evidence that the exercises of employee stock options predict stock price movements. Specifically, the unexpected component of option exercise increases before stock price downturns and decreases prior to stock price increases. That said, the cost of financing from employees is not necessarily lower than the cost of financing provided by outside investors because by construction, the exercise of in-the-money stock options entails the issuance of equity to employees at a discount from the market share price.

When employees exercise their ESOs, they pay the associated strike price to their employer firms, which consequently experience an inflow of funds for the equity issued to these employees. However, the amount and the timing of these proceeds that firms can expect to receive as a result of granting ESOs to their employees are, to some extent, uncertain because the exercise of ESOs depends on not only the stock market conditions, but also the rationality of employees to exercise in-the-money ESOs. In fact, Huddart and Lang (1996) find that employees typically exercise their ESOs prematurely thereby forgoing as much as half of their Black-Scholes values, and that the exercise activity is affected by recent stock price movements, the market to strike ratio, time to maturity, volatility and the proximity to vesting dates. Heath,

[9] Hall and Murphy (2003) document that the aggregate value of employee stock options granted by U.S. companies increased drastically from $11 billion in 1992 to $119 billion in 2000.

Huddart and Lang (1999) show that psychological factors influence the exercise of ESOs; Employees have stock price reference points and exercise their ESOs in response to stock price trends. Huddart and Lang (2003) find that junior and senior employees are both likely to exercise their ESOs when they expect the associated stock return to be low in the next six months. Bettis, Bizjak, and Lemmon (2005) find that ESOs are exercised prematurely following unexpected stock price run-ups, and that firms with high stock price volatility experience the earliest exercise of ESOs.

Hence, option proceeds represent a more ad-hoc inflow of funds to the firms than do other equity proceeds. To be specific, option proceeds are more unanticipated and discretionary than other equity proceeds. We therefore build upon the literature on ESOs by studying how option proceeds and other equity proceeds are spent. In particular, we examine whether firms have a higher tendency to spend option proceeds than other equity proceeds. Moreover, we evaluate the spending pattern of option proceeds in light of the asymmetric information model, as well as the agency model of managerial behavior. In doing so, we adopt the cash flow identity framework of Chang et al. (2014) and identify the main uses of option proceeds as including investment, cash savings, equity repurchase, debt retirement, and dividends.

To date, there has been several studies examining the impact of option proceeds on the corporate policy of investment and/or equity repurchase, but not on the collective policy of investment, cash holdings, security repurchases, and dividends. Specifically, Kahle (2002) finds that firms have a high tendency to repurchase equity when the total amount of exercisable ESOs (i.e., both executive and non-executive) as a percentage of outstanding shares, is high. Bens, Nagar, and Wong (2002), and Bens et al. (2003) find that firms, concerned about the dilution effect of ESOs, cut back on investment to repurchase equity when they are experiencing significant ESO exercises. Babenko, Lemmon, and Tserlukevich (2011) show that firms invest an average $0.34 per dollar of option proceeds. Moreover, only firms that are not financially constrained use option proceeds to repurchase stocks; Financially constrained firms use these cash flows for investment.

By analyzing how option proceeds are allocated to all the uses of funds, our paper elaborates on the strand of literature that centers on the allocation of option proceeds to any one use. In fact, if investment, cash savings, security repurchases, and dividends are competing uses of firms' funds, our integrated regression framework enables us to empirically gauge the relative importance of these uses. Particularly, we add that cash savings is the most important use of option proceeds. Although McLean (2011) finds that firms increasingly save their equity capital when they have high precautionary motives, he did not distinguish between option proceeds and other equity proceeds. While he finds that the saving rate has increased from 23.0 cents per dollar of equity capital in 1970 to 60.0 cents in recent years, we further show that, on average, option proceeds are saved at a higher rate than are other equity proceeds. That said, cash savings constitute the most fundamental use of both option proceeds and other equity proceeds. In fact, Keynes (1936) long argues that firms hold cash to protect against adverse cash flow shocks that may force them to default on payments or forgo valuable investment opportunities. Opler et al. (1999), and Bates et al. (2009) find support for this precautionary motive of cash holdings.

Specifically, Bates et al. (2009) report that the average cash-to-assets ratio of U.S. industrial firms has significantly increased from 10.5% in 1980 to 23.2% in 2006, and that the precautionary motive of cash holdings plays an important role in explaining the increase. He and Wintoki (2016) show additionally that research and development investment accounts for a significant portion of this increase. We add to this strand of literature by not only showing that proceeds from both equity and debt issuances contribute to the increase, but also illustrating that the impact on cash-to-assets ratio vary depending on the source of the equity funds (i.e., option proceeds versus other equity proceeds). Furthermore, we show that the average yearly cash-to-assets ratios would be consistently lower than those currently observed if firms did not save their option proceeds at the estimated annual saving rates. For example, we find that in 2015, the average cash-to-assets ratio would be 39.3% lower than actual if sample firms did not save their option proceeds.

To date, the bulk of academic research on equity issuance has been focused on examining either the total amount of equity issues or its component amounts (i.e., option proceeds or other equity proceeds, but not both). For example, McLean (2011) studies the cash savings of overall equity issuance proceeds. Fama and French (2005) as well as Babenko, Lemmon, and Tserlukevich (2011) examine the implications of option proceeds received by a small sample of U.S. firms. In a separate strand of research, Ritter (1997) and Pontiff and Woodgate (2008) analyze the post-SEO operating performance and long-run stock returns, respectively. By considering the impact of not only equity issuance proceeds, but also its components (option proceeds and other equity proceeds), on the collective policy of investment, cash holdings, and equity repurchase, our research on equity issuance is thus more holistic than these studies.

In particular, we suggest that distinguishing between capital raised from the exercise of ESOs, and that raised from other equity issues is important because they are driven by different motives. Notably, McKeon (2015) puts forth that equity issuance triggered by the exercise of ESOs is unlikely to reveal managers' motives to issue equity because the grant of ESOs, which is typically made years prior to the issuance of equity, represents the consequential outcome of compensating employees for their service to the firms, and involve no fundraising action on part of their managers. Differentiating firm-initiated equity issues (such as IPOs, SEOs and private placements) from employee-initiated issues (mainly driven by the exercise of ESOs) based on the relative issue size, McKeon (2015) argues that the high saving rate of equity capital documented by McLean (2011) is largely driven by employee-initiated equity issues.[10]

By examining the saving rate of overall equity issuance proceeds, as well as those of option proceeds and other equity proceeds, we reconcile the works of McLean (2011) and McKeon (2015). We find that firms save an average of 46.5 cents per dollar of total equity issuance proceeds during the period 1996-2015. Moreover, we show that while option proceeds are highly saved, other equity proceeds are similarly saved at a high rate, thereby producing an overall high saving rate of equity issuance proceeds. However, unlike McKeon (2015) who uses an arbitrary rule to impute the amount of employee-initiated equity issues, we explicitly collect data on such issues from various sources. Consequently, we offer a more accurate contrast of the magnitude of employee- versus firm-initiated equity issues. It is also noteworthy that while he examines the relation between market conditions and equity issuance, we focus on the allocation of equity issuance proceeds to different uses.

## III. Data and Variables

### A. Data

Our sample consists of firms that ever exist in the S&P1500 index and/or Nasdaq100 index during the period 1996-2015. Like Babenko, Lemmon, and Tserlukevich (2011), we include in our sample, both firms that grant ESOs and those that do not. Following Frank and Goyal (2003) and Chang et al. (2014), we use the flow-of-funds (*SCF*) data to define variables that made up the cash flow identity. For firms with missing *SCF* data, we manually collect whenever possible, the data from 10-K statements that firms file with the Securities and Exchange Commission (SEC). Dollar values are converted into 2009 constant dollars using the

[10] Specifically, using quarterly Compustat data and defining the equity issue size as the quarterly proceeds divided by market value of equity, McKeon (2015) defines employee-initiated (firm-initiated) equity issuances as those with issue size lesser (greater) than 2% (3%).

GDP deflator. Data on stock prices are retrieved from the Center for Research on Security Prices (CRSP) files.

Data on broad-based ESO programs are obtained from a combination of four sources. For the years 1996 to 2003, we rely mainly on the firms'10-K statements to obtain data on the quantity and weighted average strike price of ESOs exercised. In 2004, Compustat started reporting the values of these two variables on an annual basis. Therefore, for the period 2004 to 2015, we obtain the data from Compustat when we did not manage to collect them from the 10-K statements. Moreover, we tap on the Investor Responsibility Research Centre (IRRC) Dilution Database when the ESO data are neither collected from the firms' 10-K statements, nor available in Compustat. That said, only 5% of our data originates from the IRRC Dilution Database because it only covers S&P 1500 firms since 1998 and in 2005, IRRC was acquired by Institutional Shareholder Services (ISS), resulting in the unavailability of ESO data.

Lastly, we supplement our ESO data with information from Capital IQ, which offers the number of ESOs exercised for the period 1996-2011. However, given that Capital IQ does not provide the corresponding strike price of these exercised ESOs, we mainly use this database to identify firms for which no ESOs were exercised during the sample period. That is, firms which are reported in Capital IQ as having zero number of exercised ESOs are regarded as not having received option proceeds for that given year. In sum, we rely on the firms' 10-K statements and Compustat as the primary sources of ESO data and IRRC Dilution Database and Capital IQ as the supplementary data sources. Firms with missing data for option proceeds are excluded from our sample.

Following common practice, we exclude financial institutions (SIC codes 6000–6999), utilities (SIC codes 4900–4999), as well as 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, changes in working capital, and external financing. To minimize the sampling of financially distressed firms, we follow Almeida, Campello, and Weisbach (2004) and Almeida and Campello (2010) and exclude firm-years for which: (1) the market value of assets (GDP deflator adjusted) is less than $1 million, (2) the asset growth rate exceeds 100%, and (3) the annual amount of sales (GDP deflator adjusted) is less than $1 million. Furthermore, to ensure that the cash flow identity holds well in our data, we exclude observations for which the absolute value of the difference between the uses of funds and the sources of funds is greater than 1% of the beginning-of-period total assets. These sample filtering rules leave us with an unbalanced panel, consisting of 2,356 firms and 24,570 firm-year observations.

## B. The Cash Flow Identity and Variables

Our empirical analysis hinges upon the following cash flow identity, as defined using Compustat flow-of-funds (*SCF*) data:

$$Inv + \Delta C + ER + DR + Div + Oth = CF + EI + DI \tag{1}$$

where the right-hand side of equation (1) depicts the sources of funds, namely internal cash flow net of the change in working capital (*CF*)[11], and proceeds from equity and debt issuances (*EI* and *DI*, respectively). The left-hand side of equation (1) comprises the uses of funds, namely investment (*Inv*), cash savings as measured by the change in cash holdings ($\Delta C$), equity

[11] This definition follows previous studies on cash flow sensitivities. See Bushman, Smith, and Zhang (2011), Dasgupta, Noe, and Wang (2011) and Gatchev, Pulvino, and Tarhan (2010). Specifically, Bushman, Smith, and Zhang (2011) suggest that the cash flow measure used almost universally in the investment-cash flow literature is essentially earnings before depreciation, which contains a true cash component (operating cash flows) and a non-cash component in the form of working capital accruals. They find that the investment-cash flow sensitivity documented in previous studies is mainly due to the natural positive correlation between investment and working capital accruals. By removing the effect of the change in working capital and focusing on cash flow from operations, we mitigate the concern that our results are driven by the correlations between the uses of funds (particularly investment) and working capital accruals.

repurchase (*ER*), debt retirement (*DR*) and cash dividends (*Div*). *Oth* is a residual term for rounding errors and misreported data that might cause the cash flow identity to be unbalanced.

As an aggregate figure reported in the *SCF*, *EI* consists of all forms of equity issuance that give rise to cash inflows to a firm.[12] It includes public equity offerings, private placements to outside investors, proceeds from employee stock purchase plans, and proceeds from stock option exercises (*OP*). Specifically, we define *OP*, one of the key variables of our interest, as the number of ESOs exercised times the weighted average strike price of the ESOs exercised in a given fiscal year.[13] Hence, other equity proceeds refer to all other equity issuance proceeds besides those arising from ESO exercises. Therefore, defining total equity issuance proceeds as the sum of option proceeds and other equity proceeds i.e., *EI* = *OP* + (*EI*-*OP*), and substituting the definition into equation (1), we have the following augmented cash flow identity.

$$Inv + \Delta C + ER + DR + Div + Oth = CF + OP + (EI - OP) + DI \qquad (2)$$

According to the Compustat data manual, definitions of the variables in equation (1) vary depending on the format code a firm follows in reporting the *SCF* data. Appendix A details the construction of these variables based on the different format codes. All variables in the cash flow identity are scaled by one-year lagged book value of assets. To control for firm-specific characteristics, we include in our regression analysis, various firm characteristics as control

[12] Specifically, *EI* corresponds to Compustat Data Item Number 108 namely, Sale of Common and Preferred Stock (Statement of Cash Flows). It represents funds received from the issuance of common and preferred stock and includes the following items: (1) conversion of Class A, Class B, or special stock into common stock, (2) conversion of preferred stock and/or debt into common stock, (3) equity offerings, (4) exercise of stock options and/or warrants, (5) increase in capital surplus due to stock issuance, (6) issuance of warrants when combined with common stock, (7) related tax benefits due to issuance of common and/or preferred stock, (8) sale of common stock, (9) sale of preferred stock, (10) sale of redeemable preferred stock and (11) sale of stock. However, this data item excludes the issuance of warrants, share issuance costs when reported separately, and stock of subsidiary company.

[13] Babenko, Lemmon, and Tserlukevich (2011) point out that to the extent that employees are allowed to settle the exercise price using their common shares of the company, rather than cash, *OP* may overestimate the actual amount of cash that firms can receive from option exercises. However, by comparing the IRRC data with their hand-collected data on option proceeds from the Statement of Cash Flows, they find that alternative settlement methods of option exercises are uncommon in practice, and *OP* defined using the IRRC data is quite precise.

variables. The market-to-book ratio (*MB*) is a proxy for both firm value and growth opportunities and is defined as (total assets + market value of equity - book value of equity) / total assets. *Sales growth* is the growth rate of net sales and serves as an alternative proxy for growth opportunities. The log of book value of assets, *Ln*(*Assets*), is included as a proxy for firm size. *Leverage* is the ratio of total debt to total assets. *Tangibility* is a measure of the tangibility of a firm's assets and is defined as the net property, plant and equipment-to-asset ratio. These control variables, as well as the variables in equation (2), are winsorized at the top and bottom 1% of their distributions to mitigate the effect of outliers.

## IV. Empirical Methodology

To examine how firms allocate equity issuance proceeds to different uses, we measure the allocation using the coefficients on such proceeds within an integrated regression framework. That is, we estimate five empirical models in which we regress each use of funds (i.e., *Inv*, *ΔC*, *ER*, *DR*, and *Div*) on all sources of funds, firm-specific control variables, and year fixed-effects. Also included as one of the independent variables is the residual term, *Oth*, which captures any rounding errors and misreported data that might cause the cash flow identity to be unbalanced. Variables are demeaned by firm to remove the firm fixed effects. The regression equations are written as follow:

$$Inv_{it} = \beta_0^{Inv} + \beta_1^{Inv} \times CF_{it} + \beta_2^{Inv} \times OP_{it} + \beta_3^{Inv} \times (EI_{it} - OP_{it}) + \beta_4^{Inv} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \qquad (3)$$

$$\Delta C_{it} = \beta_0^{\Delta C} + \beta_1^{\Delta C} \times CF_{it} + \beta_2^{\Delta C} \times OP_{it} + \beta_3^{\Delta C} \times (EI_{it} - OP_{it}) + \beta_4^{\Delta C} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \qquad (4)$$

$$ER_{it} = \beta_0^{ER} + \beta_1^{ER} \times CF_{it} + \beta_2^{ER} \times OP_{it} + \beta_3^{ER} \times (EI_{it} - OP_{it}) + \beta_4^{ER} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \qquad (5)$$

$$DR_{it} = \beta_0^{DR} + \beta_1^{DR} \times CF_{it} + \beta_2^{DR} \times OP_{it} + \beta_3^{DR} \times (EI_{it} - OP_{it}) + \beta_4^{DR} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \qquad (6)$$

$$Div_{it} = \beta_0^{Div} + \beta_1^{Div} \times CF_{it} + \beta_2^{Div} \times OP_{it} + \beta_3^{Div} \times (EI_{it} - OP_{it}) + \beta_4^{Div} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \qquad (7)$$

$$Oth_{it} = \beta_0^{Oth} + \beta_1^{Oth} \times CF_{it} + \beta_2^{Oth} \times OP_{it} + \beta_3^{Oth} \times (EI_{it} - OP_{it}) + \beta_4^{Oth} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (8)$$

where *Y* represents the vector of firm-specific control variables, which include *MB*, *Sales growth*, *Ln*(*Assets*), *Leverage*, and *Tangibility*. The sensitivity of equity issuance proceeds to a particular use of funds thus reveals how much of an additional dollar of equity issuance proceeds is directed to that use. The allocations of option proceeds and other equity proceeds across the various uses of funds are therefore captured by $\beta_2^i$, and $\beta_3^i$, respectively.

This integrated framework of regressions has the methodological advantage of offering a complete view of how firms deploy funds for different uses as it simultaneously tracks all uses of funds, which are interrelated among one another by virtue of the cash flow identity. Specifically, it offers the intuitive interpretation that a change in the allocation of funds to a particular use must be met by an offsetting change in the allocation to some other use(s) since all uses of funds must sum to the sources of funds. Following Frank and Goyal (2003) and Chang et al. (2014), we use the *SCF* data to define all variables in the cash flow identity. Using a common data source has the advantage of achieving an almost balanced cash flow identity for our sample firms. In fact, Gatchev, Pulvino, and Tarhan (2010) rely on a similar cash flow identity but define its components using data from not only the *SCF*, but also the balance sheet, and income statement. As a result, their cashflow identity generally do not hold in their sample.

Chang et al. (2014) show that if the cash flow identity in equation (1) and (2) holds in the data, the coefficients on each source of funds should add up to unity across equations (3) to (8), and the coefficients on each control variable in *Y* should sum to zero. That is,

$$\beta_1^{Inv} + \beta_1^{\Delta C} + \beta_1^{ER} + \beta_1^{DR} + \beta_1^{Div} + \beta_1^{Oth} = 1$$

$$\beta_2^{Inv} + \beta_2^{\Delta C} + \beta_2^{ER} + \beta_2^{DR} + \beta_2^{Div} + \beta_2^{Oth} = 1$$

$$\beta_3^{Inv} + \beta_3^{\Delta C} + \beta_3^{ER} + \beta_3^{DR} + \beta_3^{Div} + \beta_3^{Oth} = 1$$

$$\beta_4^{Inv} + \beta_4^{\Delta C} + \beta_4^{ER} + \beta_4^{DR} + \beta_4^{Div} + \beta_4^{Oth} = 1$$

$$\sum_{i=1}^{5} \delta^i = 0.$$

If any source of funds increases by one dollar while holding other sources unchanged, then the change in all uses of that said source must sum to one dollar. However, if the shock stems from an exogenous or predetermined variable that represents neither a source nor a use of funds in the current period, then the total response across different uses of that particular source of funds must sum to zero.[14] In addition, Chang et al. (2014) demonstrate that estimating equations (3) to (8) in isolation is equivalent to estimating them as simultaneous equations, so long as these model specifications incorporate the same set of right-hand-side variables.[15]

## V. Summary Statistics

Figure 1 illustrates the evolution of equity issuance proceeds (GDP deflator adjusted) for our sample firms. In Panel A, we show that the overall equity issuance proceeds increase from an aggregate amount of US$36.9 billion in 1996 to US$69.3 billion in 2015. In particular, option proceeds increase substantially from US$16.7 billion in 1996 to US$26.9 billion in 2015. Notably, option proceeds and therefore total equity issuance proceeds, peak in 2007, the year before the financial crisis. In fact, option proceeds account for a large fraction of equity issuance proceeds throughout the sample period; The fraction has almost doubled over time, from being only 45.3% in 1996 to 73.3% in 2005, before dropping to 38.8% in 2015.

It is noteworthy that total equity issuance proceeds (*EI*) originates from the Compustat variable, *SSTK*. By definition, it includes the sale of common and preferred stock, as well as

[14] For instance, suppose the coefficient on *MB* is 0.1 in equation (3). This suggests 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 in *MB* on other use(s) must sum to -10% of total assets, holding all sources of funds variables constant.

[15] This result is not surprising on account that the simultaneous equations (3) - (8) qualify as seemingly unrelated regressions (SURs). In fact, Kruskal's (1960) theorem implies 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. This is exactly the case in our equations (3) - (8). See Greene (2008) (page 257-258) for a detailed proof.

the tax benefits associated with the exercise of ESOs.[16] That is, *EI* is the sum of proceeds from ESO exercises (*OP*), the tax benefits associated with these exercises (*TB*), and the proceeds from other equity issues (*EI – OP –TB*).[17] Therefore, to a certain extent, other equity proceeds (*EI – OP*) include some tax elements of option proceeds. That said, we noticed that after the year 2004, these tax benefits are being separately reported as the variable, *TXBCOF* in Compustat. As such, we reclassify these tax benefits as being part of option proceeds and plot the associated amounts in Panel B of Figure 1. To cater to the possibility that firms may not have completely adjusted to the change in reporting, we omit the initial year in which values of *TXBCOF* becomes available and report the combined amounts of option proceeds and their associated tax benefits from 2006 onwards. Despite the reclassification between option proceeds and other equity proceeds, our inferences remain generally unchanged. The amount of option-plus-tax benefits proceeds peaks in 2007 at US$80.2 billion (GDP deflator adjusted), and throughout the period 2006 to 2015, these proceeds represent a significant portion of overall equity issuance proceeds. In 2015, they sum to US$ 35.6 billion whereas other equity proceeds (total equity issuance proceeds less option-plus-tax benefits proceeds) amount to US$33.7 billion.

[Insert Table 1 Here]

Table 1 reports the descriptive statistics of our sample. The mean values of *OP* and *EI-OP* are 0.009 and 0.014, respectively, suggesting that the average size of other equity proceeds is greater than that of option proceeds. However, the median values of *OP* and *EI-OP* (0.003 and 0.0008, respectively) indicate that firms receive cash from ESO exercises more often than

[16] Specifically, when a firm grants nonqualified stock options to its employees, it effectively receives a tax deduction in the year when such options are exercised. In particular, the amount of tax deduction, which we so-called the tax benefits associated with the exercise of ESOs, is calculated as the intrinsic value of the ESOs on the exercise date.
[17] The cash flow identity can therefore be re-written as $Inv + \Delta C + ER + DR + Div + Oth = CF + OP + TB + (EI - OP - TB) + DI$.

they do from other equity issues. In fact, more than 75% (versus 55%) of the sample firms receive option proceeds (other equity proceeds) in any given year. In view that the median value of *EI-OP* is only 0.0008 while the $75^{th}$ percentile is 0.005, we infer that the high mean value of *EI-OP* is driven by other equity issues, which are infrequent and lumpy. The mean, 25th percentile, median, and 75th percentile values of the residual term, *Oth*, are all zero, suggesting that the cash flow identity holds well in our data. Firms in our sample are generally profitable; On average, only 6% of the sample firms report negative income during the sample period 1996-2015. In addition, the average values of Tobin's Q, and market-to-book ratio (1.947 and 1.974, respectively) imply that our sample firms do have investment opportunities to pursue throughout the said period.

[Insert Table 2 Here]

Table 2 lists the annual amounts of equity issuance proceeds (GDP deflator adjusted) for our sample firms. For each sample year, it depicts the total number of firms, as well as the number and percentage of non-issuers and equity issuers. Non-issuers refer to firms that did not issue any equity in a specific year. For all years, non-issuers are dominated by equity issuers; The percentage of equity issuers has been increasing steadily, from 80% in 1996 to 93% in 2006. Thereafter, this percentage gradually decreases back to 80% in 2015. Column 6 to 10 of Table 2 depict the amounts and relative proportions of option proceeds and other equity proceeds. In total, firms in our sample receive a daunting US$1,385.4 billion worth of equity issuance proceeds for the period 1996-2015, of which 55% arises from the exercise of ESOs (US$760.9 billion), while the remaining 45% represents other equity proceeds amounting to US$624.5 billion.[18] This implies that ESO exercises have become an important means through which firms issue equity.

[18]In nominal dollars, the equity issuance proceeds of our sample firms sum to US$1,315.9 billion, which is made up of US$729.4 billion of option proceeds and US$586.5 billion of other equity proceeds.

## VI. Empirical Results

### A. Contemporaneous Allocation of Equity Issuance Proceeds

We start by examining how firms allocate to different uses, equity issuance proceeds, along with internal cash flow and debt issuance proceeds. That is, we estimate equations (3) to (8) as part of an integrated set of regressions and report the results in column (1) to (5) of Table 3. Specifically, the coefficient of each use on *EI* reflects the amount of overall equity issuance proceeds spent on that use and are all statistically significant at the 1% level. By virtue of the cash flow identity, all the coefficients on *EI* sum to unity. For brevity, coefficients of *Oth* are not reported as they are not significantly different from zero. The *t*-statistics are computed using standard errors robust to both heteroskedasticity and clustering at the firm level.

[Insert Table 3 Here]

Panel A presents the results for our full sample period. Column (1) to (5) depict the allocations of overall equity issuance proceeds to investment, cash savings, equity repurchases, debt retirement, and dividends, respectively. In a nutshell, a dollar of capital raised from equity issues in general is spent as follows. 37 cents are set aside for investment, 46.5 cents are saved as cash, 1.4 cents are used to repurchase equity, 14.8 cents are allocated to debt retirement, and 0.3 cents are paid as dividends. Importantly, cash savings constitutes the most prominent use of equity issuance proceeds. On the other hand, internal cash flow is also mainly used for investment and cash savings. That said, it is not as greatly saved as equity issuance proceeds; Only 36.1 cents per dollar of internal cash flow are saved. On a side note, debt issuance proceeds are mainly used to roll over debt given that 65.8 cents of a dollar of debt capital is used to retire debt on average, while most of the remainder (27.7 cents) are invested. Only a trivial 4.6 cents per dollar of debt issuance proceeds is saved as cash.

Next, we separate equity issuance proceeds into funds raised from the exercise of ESOs, and those raised from other equity issues, and re-estimate the said equations. Column (6) to (10) of Table 3 report the resulting estimates and contrast the spending patterns of option proceeds particularly with those of internal cash flow and other equity proceeds. In general, the amount and timing of proceeds collected from the exercise of employee stock options are typically uncertain. On the other hand, those of conventional cash flow and other equity proceeds can be estimated with a certain degree of accuracy.[19]

In view of the different degree of uncertainty concerning option proceeds versus conventional cash flow and other equity proceeds, we would expect firms to allocate these funds differently. In fact, Arkes et al. (1994) find that cash flows that are unexpected tend to be spent more readily than those that are anticipated. They posit that it is this unexpectedness that 'is responsible for their heightened proclivity to be spent' (p.331); It takes time to plan for the expenditure of unanticipated cash inflows, and until a budget is decided upon, these monies are uncommitted and available for discretionary uses. In contrast, the budgeting of anticipated funds occurs before the monies are received such that when they eventually arrive, they are not available to be spent on other uses.

On average, firms save as much as 70.1 cents per dollar of option proceeds and allocate 23.2 cents to investment. 20.8 cents are returned to shareholders via equity repurchase, in line with the conjecture that firms, concerned about the earnings dilution brought about by the exercise of ESOs, shift resources towards equity repurchase. In addition, firms reduce their

[19] Option proceeds originate from employees exercising their stock options and purchasing the underlying stock of their employer firms at the designated option strike price. Given that employees are likely to have stock options with different exercise prices, dissimilar risk attitude and diverse expectations of future stock price performance, proceeds received by firms from the exercise of employee stock options are typically uncertain, both in terms of amount and timing. Conventional cash flow is generated through the firms' operating activities. As the firms operate during the normal course of business, they would be able to observe the amount of business transactions that have occurred. As such, the amount and timing of cash flow can be estimated with a certain degree of accuracy. Other equity proceeds are typically raised through events such as initial public offerings, seasoned equity offerings and private placements. As such, the timing (e.g. IPO date or SEO issuance dates) and amount (e.g. IPO or SEO issue prices) of other equity proceeds are usually pre-determined.

debt repurchase activities by 14.9 cents per dollar of option proceeds and pay out a minimal 8 cents as dividends. In contrast, a typical dollar of conventional cash flow (other equity proceeds) is spent as follows. 39.5 (37.8) cents are invested, 35.4 (45.1) cents are parked as cash, 6.6 (0.2) cents are used to buy back equity, 17.5 (16.6) cents are dedicated to debt reduction, and only 1.1 (0.2) cents are paid out as dividends. Importantly, although these three sources of funds entail different saving rates, cash savings emerge as one of the most fundamental uses of funds. Hence, we conclude that although option proceeds are relatively more ad-hoc and discretionary, firms do not have a greater tendency to spend them away. Rather, they save the monies more greatly than they do with conventional cash flow and other equity proceeds.

In comparing the two types of equity issuance proceeds, we construe that there are likely differences in the allocation of option proceeds versus other equity proceeds to equity repurchase and debt reduction because the dilution effect and leverage impact of IPOs, SEOs, and private placements are more readily anticipated, and possibly catered for, than that of ESO exercises. Indeed, we find that firms repurchase equity more extensively after the exercise of ESOs (20.8 cents) than they do after other equity issuances (0.2 cents). They also cut back on debt repurchases only after ESOs are exercised.

As discussed previously, the amounts of other equity proceeds computed before year 2004 include some tax elements of option proceeds because the tax benefits associated with the exercise of ESOs are not separately reported during those prior years. To address the implication that this classification issue may have on our results, we re-run equations (3) to (8) but replace option proceeds with the sum of option proceeds and tax benefits (i.e., option-plus-tax benefits proceeds), and other equity proceeds with the difference between total equity issuance proceeds and option-plus-tax benefits proceeds. Since tax benefits are separately reported only after 2004, we perform a subperiod analysis for the years 2006-2015. Column (1) to (5) of Table 3 Panel B presents the results. As a comparison, we run the regressions in terms of option proceeds and other equity proceeds for the same subperiod and depict them in column (6) to (10) of the same panel. Our inferences are generally unaffected by the subtlety in the classification of proceeds. Cash savings remains as the most prominent use of option-plus-tax benefits proceeds, followed by investment and equity repurchase. That said, the rate of saving is somewhat reduced from 58.7 cents per dollar of option proceeds to 54.5 cents per dollar of option-plus-tax benefits proceeds.

In examining the allocation of equity issuance proceeds to different uses, we note that the misvaluation of a firm's stock could be correlated with its financial policy, thereby leading to potential endogeneity issues. That said, the focus of our analysis is to examine what firms do with the proceeds collected from the exercise of employee stock options and not to establish causality with respect to the incidence of option proceeds and their uses. Therefore, to a certain extent, the concern for endogeneity is mitigated. Moreover, the market valuation of a firm's stock does not uniformly affect the exercise of all employee stock options; Employees have diverse personal circumstances, dissimilar attitude to risk, and different expectations of future stock price movements. Given that stock options are typically granted to employees at different points in time, the exercise prices of their stock options are unlikely to be the same for all employees. The unsynchronized nature of employee stock option exercises therefore helps to mitigate endogeneity issues.

As a robustness check, we explicitly control for mispricing and re-estimate equations (3) to (8). Specifically, we measure firm misvaluation i.e., the nonfundamental component of asset prices using four mispricing proxies. First, we follow Baker, Stein, and Wurgler (2003) and Baker, Taliaferro, and Wurgler (2006) and use future realized stock returns to capture firm misvaluation. Second, we use discretionary accruals as a proxy for mispricing.[20] Third, we

[20] Polk and Sapienza (2009) posit that discretionary accruals measure the extent to which a firm has abnormal noncash earnings and find that firms with high discretionary accruals have relatively low future stock returns, suggesting that they are relatively overvalued.

decompose the market-to-book ratio into fundamental and nonfundamental components based on Rhodes-Kropf, Robinson, and Viswanathan (2005) and use the latter component to proxy for misvaluation. Last, we employ the investor sentiment index of Baker and Wurgler (2006) as a proxy for market-wide misvaluation. In unreported results, we find that the rates of option proceeds allocation to all uses does not change significantly after explicitly controlling for equity mispricing using the various measures of firm misvaluation. In addition, we identify sample firms that are under- versus over-valued and examine their option proceeds allocation decisions. There is generally no statistically significant difference in the way under- and overvalued firms allocate their option proceeds across all measures of mispricing.

**B. Dynamic Allocation of Equity Issuance Proceeds**

To examine the extent to which option proceeds received in a given year are ultimately spent in later years, we next examine the dynamic allocation of equity issuance proceeds by adding to equations (3) to (8), lagged values (from *t*-2 to *t*-1) of all sources of funds, including option proceeds and other equity proceeds. For ease of interpretation, we scale all the lagged variables by total assets at *t*-1 i.e., the same deflator for all contemporaneous sources-of-funds variables. Since we require firms to have at least two years of history for these variables, the number of observations now reduces from 24,570 to 17,367. To make our results comparative, we estimate for our reduced sample, regression equations (3) to (8) both with and without the lagged sources-of-funds variables. Column (1) to (5) of Table 4 Panel A depict the results without lagged values, whereas column (6) to (10) present the results with lagged values.

[Insert Table 4 Here]

We find that the coefficient estimates on all sources-of-funds variables does not fluctuate very much from those in Panel A of Table 3, suggesting that reducing the sample size does not vastly alter our results. Particularly, the coefficient of cash savings on concurrent *OP* remains both economically and statistically significant after controlling for lagged variables. In fact, the magnitude of the coefficient is stable both with (0.691) or without (0.632) lagged variables. Importantly, the coefficient on $OP_{t\text{-}1}$ is negative and statistically significant (coefficient = -0.263; *t*-statistic = -3.4). That is, while firms save 69.1 cents per dollar of option proceeds in the year of ESO exercise, they reduce their cash holdings by 26.3 cents in the following year and redirect them mainly to equity repurchase (20.8 cents). This is consistent with the conjecture of Arkes et al. (1994) that firms take time to plan for the spending of ad-hoc funds. However, we find that firms do not spend the money away before they are committed for specific uses. Rather, they save a large portion of it. The statistically insignificant coefficient of cash savings on $OP_{t\text{-}2}$ implies that firms do not further adjust their cash holdings two years after the exercise of ESOs. Taken together, the coefficients of cash savings on option proceeds from *t*-2 to *t* suggest that firms receiving a dollar of option proceeds this year will still have 46 cents (= 69.1 – 26.3 + 3.2) as cash two years later. Cash saving is therefore the most important use of option proceeds.

In contrast, the cash savings from other equity proceeds are relatively more permanent given that they are not heavily drawn down in subsequent years; The magnitude of the coefficients of cash savings on $EI_{t\text{-}1}\text{-}OP_{t\text{-}1}$ and $EI_{t\text{-}2}\text{-}OP_{t\text{-}2}$ is minimal i.e., -0.021 and -0.01, respectively. That is, consistent with the hypothesis of McLean (2011) that firms largely save equity capital for precautionary motives, our sample firms save as much as 44.4 cents per dollar of other equity proceeds in the year of equity issuance. Furthermore, two years after the equity issuance, firms still retain more than 90% of the cash saved. Therefore, cash savings is the most prominent use of not only option proceeds but also other equity proceeds. In fact, overall equity issuance proceeds entail the highest saving rate among all sources of funds; Over the three-year window, firms only save an average of 21.3 cents out of a dollar of internal cash flow, and 3.5 cents per dollar of debt issuance proceeds.

For additional perspective, we show that on a per dollar basis, firms invest 52.9 cents of internal cash flow, 29.2 cents of option proceeds, 45.9 cents of other equity proceeds, and 20.9 cents of debt issuance proceeds during the three-year period. Moreover, among all sources of funds, option proceeds are the most greatly used to repurchase equity; Over the three-year window, 40.4 cents per dollar of option proceeds are collectively used for equity repurchase. Panel B of Table 4 presents the corresponding subperiod regression results where we adjust option proceeds to include the related tax benefits. Our inferences generally remain unchanged despite the change in proceeds classification and the resulting sample size reduction.

As a robustness check, we re-estimate the regression results in column (6) to (10) of Table 4 Panel A and B using the "event-year" Fama-MacBeth (1973) approach i.e., we run Fama-MacBeth regressions by event year *t*, i.e., the number of years a firm is in our sample, rather than by calendar year. This ensures that in measuring the lagged amounts of option proceeds and other equity proceeds, we have sample firms with the same length of history for each cross-sectional regression at event year *t*. In unreported results, we show that the Fama-MacBeth regressions are qualitatively similar to those reported in the said columns.

**C. Financial Constraint and Allocation of Equity Issuance Proceeds**

To date, there is very little theoretical guidance on how firms with varying degree of financial constraint would allocate equity issuance proceeds (and in particular, option proceeds) to various uses. Specifically, theory has no clear predictions about how firms that are more financially constrained would invest or save when they have additional financial resources. For example, Kaplan and Zingales (1997) show that even in a one-period model, investment-cash flow sensitivities do not necessarily increase with the degree of financial constraint. Thus, our analysis establishes empirical evidence informing theory.

To examine the spending pattern of option proceeds in light of the two alternative theories of corporate financing, namely the asymmetric information model and the agency model, we identify firms with different degree of financial constraint, and evaluate their allocations of option proceeds to various uses. That is, we use five different measures to gauge the degree of financial constraint faced by our sample firms. They include firm size, as proxied by the natural logarithm of total assets, *Ln*(*Assets*), the financial constraint index of Hadlock and Piece (2010) (*HP*), the financial constraint index of Whited and Wu (2006) (*WW*), the dividend paying status, and the availability of a credit rating.[21] In other words, a firm is classified as being more (less) financially constrained in a given year if its *Ln*(*Assets*) is below (above) the 30th percentile, the value of its *HP index* or *WW index* is above (below) the 70th percentile, it pays (no) dividends, or it is not assigned (is assigned) a credit rating.

The asymmetric information model assumes that managers act in the interest of their shareholders but experience capital rationing in the market because investors are worried about adverse selection due to information asymmetry. Accordingly, we would expect the availability of option proceeds to ease the financial woes of firms that are financially constrained. That is, these firms would tap on their option proceeds for investment and take the opportunity to save the proceeds to avoid being capital rationed upon in the future. Moreover, since they are financially constrained, they would either not return the option proceeds to shareholders in the form of dividends, and equity repurchase or do so only if its financial constraint has been eased

[21] The *HP* index measures the degree of financial constraint faced by a firm as a function of its age and size. That is, *HP* = -0.737× *Ln*(*Assets*) + 0.043×(*Ln*(*Assets*))$^2$ - 0.040×*Age*. Hadlock and Pierce (2010) argue that in many contexts, their index is a more reasonable measure of a firm's degree of financial constraint than are other types of constraint measures, such as the index of constraints by Kaplan and Zingales (1997). The *WW* index is based on a structural model that avoids the measurement errors associated with Tobin's *Q* in traditional tests. Specifically, *WW* = -0.091×*Cash Flows/Assets* - 0.062×*Dividend Payer* + 0.021×long-term debt*/Assets* - 0.044×*Ln*(*Assets*) + 0.102×industry median *Sale Growth* - 0.035×*Sale Growth*. By construction, the higher the scores of the *HP* index or *WW* index, the more financially constrained are the firms.

by the inflow of option proceeds. We would also expect them to cut back on debt repurchase in face of the dilutive effect of exercised ESOs.

On the other hand, the agency model assumes that managers may not always act to the benefit of their shareholders when there is a conflict of interest between managers and shareholders. In the spirit of this model, we would expect managers to spend option proceeds on the investment projects they like, rather than return the cash to shareholders. Moreover, they would not significantly accumulate the cash on their balance sheets, since doing so will make their firms attractive to potential acquirers. The direction on debt is however, unclear because the model is consistent with managers either repurchasing debt with option proceeds to mitigate the disciplinary effect of debt or increasing borrowing for empire-building purposes, given that cash inflows from the exercise of ESOs increase their debt capacity.

[Insert Table 5 Here]

Regression equations (3) to (8) are then re-estimated for the more financially constrained (*Con*) and less financially constrained (*UCon*) firms combined. For each explanatory variable, an interaction term with the respective financial constraint measure is added to the regressions to identify any allocation differences between the two groups of firms. The results are reported in Table 5. For brevity, we only tabulate the coefficients on *OP* and *EI-OP*; The coefficients on other sources of funds are omitted as they are similar to those reported in Table 3. In general, our empirical results lend greater support to the asymmetric information model than to the agency model. Specifically, only the investment of more financially constrained firms is sensitive to the availability of option proceeds. For firms that are less financially constrained, the allocation of option proceeds to investment is not statistically significant across all measures of financial constraint; These firms rely mainly on other equity proceeds for their investment needs since they are by definition, relatively less cash strapped, and most likely have little difficulty raising external capital.

As predicted by the asymmetric information model, we find that more financially constrained firms save more in terms of both option proceeds and other equity proceeds than do less financially constrained firms. The incremental savings of option proceeds are however, not statistically significant for all but one measure of financial constraint (i.e., dividend paying status). In other words, firms with different degree of financial constraint save option proceeds at similar high rates. This is inconsistent with the agency model, which would predict less financially constrained firms to also spend away their option proceeds on investment projects, and not keep the cash on their balance sheet at high levels.

Contrastingly, less financially constrained firms repurchase equity in substantially greater amounts than do more financially constrained firms, and this difference is statistically significant across all alternative measures of financial constraint. For example, large firms buy back 58.2 cents worth of equity with every dollar of option proceeds, whereas small firms only devote 6.7 cents of option proceeds to equity repurchase. Given their financial abundance, less financially constrained firms are likely to have little use of their option proceeds for investment or other purposes. Therefore, to the extent that their managers act in the interest of shareholders, the cash is likely to be returned to their shareholders via either equity repurchase or cash dividends. Moreover, given that more financially constrained firms are likely to consider equity repurchase only after their financial constraint is eased by the inflow of option proceeds, it is reasonable that the coefficient of equity repurchase on *OP* is relatively smaller for these firms.

On a side note, there is only weak evidence for differences in the allocation of option proceeds and other equity proceeds to debt reduction and dividends by firms with different degree of financial constraint. In particular, the results are mixed in that less financially constrained firms could pay relatively more or less dividends, depending on the measure of financial constraint used. We therefore conclude that firms, which are more likely to have no immediate use of their option proceeds (i.e., less financially constrained firms), save a relatively large portion of the proceeds as cash, and return most of the remaining proceeds to their shareholders via equity repurchase. In other words, there is some empirical support for the asymmetric information model, but limited evidence on the agency model of managerial behavior in explaining how U.S. firms allocate their option proceeds to different uses during the period 1996-2015.

Building on the analysis of Acharya, Almeida, and Campello (2007), we further examine the allocation of option proceeds by firms with different degree of correlation between option proceeds and investment opportunities. Specifically, the authors find that firms whose operating cash flow is highly correlated with their investment opportunities have no propensity to save cash and tend to allocate their cash flow to debt reduction. In contrast, firms with low correlation between cash flow and investment opportunities tend to allocate their cash flow to cash holdings. Accordingly, we compute the correlation between option proceeds and investment opportunities using two alternative measures of investment opportunities i.e., the industry level median R&D expenditure and three-year-ahead sales growth rate. We then assign sample firms into groups of high and low hedging needs and examine their respective allocations of option proceeds. The said results are reported in Table 6.

[Insert Table 6 Here]

Under the first correlation measure, we find that firms with high hedging needs tend to allocate more option proceeds to cash holdings than firms with low hedging needs. In contrast, firms with high hedging needs allocate relatively less option proceeds to cash holdings under the second correlation measure. These differences in rate of allocation are however, not statistically significant. There is also no statistical evidence that firms with low hedging needs allocate relatively more to debt repurchase. A possible explanation for the lack of statistical evidence is that firms tend to receive both option proceeds and conventional cash flow when they are doing operationally well. With the abundance of cash flow, firms with high hedging needs may therefore feel a reduced urge to allocate option proceeds in a way that transfer these funds across time. In fact, Table 6 reveals that for both measures of correlation, firms with high hedging needs allocate more cash flow to cash holdings than firms with low hedging needs. In contrast, the latter firms allocate relatively more cash flow to debt repurchase, consistent with the findings of Acharya, Almeida, and Campello (2007).

### D. Corporate Governance and Allocation of Equity Issuance Proceeds

To further examine our results in the spirit of the agency model, we investigate whether firms with varying degree of corporate governance spend their option proceeds differently. In general, firms are subject to significant market scrutiny when they raise equity capital from the public. They need to not only fulfill stringent profitability and financial reporting requirements but also justify the uses of the capital raised. On the other hand, proceeds received from employees upon the exercise of employee stock options are subject to relatively fewer regulatory oversight. As such, firms have relatively greater discretion on the uses of employee stock option proceeds; There is therefore a possibility that these funds might be squandered away. For example, managers might use the proceeds to build empires or accumulate cash buffer instead of returning them to shareholders (in the form of equity repurchase or dividends) when there are no profitable investment opportunities to pursue. By examining the impact of corporate governance on the allocation of employee stock option proceeds, our analysis thus provides empirical evidence on the agency costs of employee stock option proceeds.

In doing so, we employ seven measures of corporate governance to classify firms based on the strength of their corporate governance. They include dedicated institutional ownership, institutional ownership, board independence, director representation on the board, the governance index of Gompers, Ishii, and Metrick (2003) (*GINDEX*), the entrenchment index of Bebchuk, Cohen, and Ferrell (2009) (*EINDEX*), and CEO duality. Each year, a firm is said to have low (high) corporate governance if its dedicated institutional ownership, institutional ownership, proportion of independent directors, or log number of directors is below the 30th (above the 70$^{th}$) percentile, its *GINDEX* is above the 70th (below the 30th) percentile, its *EINDEX* is more than or equal to 4 (less than 2) or when its chief executive officer (CEO) is (not) the chairperson of its board.

Dedicated institutional ownership refers to the proportion of shares held by dedicated institutional investors with long investment horizon and large stock holdings (Bushee 1998, 2001). Institutional ownership is defined using data from Thomson Financial and the associated institutional investor classification is from Brian Bushee.[22] Board independence refers to the proportion of independent directors on the board, whereas director representation refers to the log number of directors on the board. *GINDEX* is constructed using 24 anti-takeover provisions that measure the ability of managers to restrict shareholder activism. Specifically, *GINDEX* adds one point to a firm for each of its anti-takeover provisions, which restrict shareholder rights, thereby increasing managerial entrenchment. Unlike *GINDEX*, *EINDEX* is constructed based on only six provisions, and firms are given a score (from zero to six), depending on the number of provisions that they have in a specific year.[23] Data for board independence, *GINDEX*, and *EINDEX* are obtained from Risk Metrics. CEO duality refers to the situation in which the CEO of a firm serves concurrently as the chairman of the board.

[Insert Table 7 Here]

Regression equations (3) to (8) are re-estimated for firms with low corporate governance (*Low*) and firms with high corporate governance (*High*) combined. To identify any

[22] We thank Brian Bushee for his data, made available at the following URL link. http://accounting.wharton.upenn.edu/faculty/bushee/IIclass.html.
[23] The six provisions are staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, supermajority requirements for mergers, and charter amendments.

allocation differences between the two groups of firms, we add to the regressions, an interaction term with the respective corporate governance measure for each explanatory variable. Table 7 presents the associated regression outputs. In analyzing these results, we note that according to Jensen (1986), even when firms have poor investment opportunities, entrenched managers would retain the corporate cash to serve their personal interests, rather than return the cash to shareholders via equity repurchase or dividends. Therefore, if the agency model explains the allocation behavior of option proceeds, then ceteris paribus, we would expect firms with low corporate governance to hoard more cash or spend more of it on investment projects than do firms with high corporate governance. Moreover, firms with low corporate governance would be expected to allocate relatively less option proceeds to equity repurchase and dividends.

We find that firms with varying degree of corporate governance generally do not allocate option proceeds to investment and cash savings differently; Across the seven corporate governance measures, differences in the allocation to investment and cash savings are either statistically insignificant or only marginally significant. While firms with high corporate governance repurchase relatively more equity, this is only so for four out of the seven measures. Moreover, among these four measures, the incremental equity repurchase is only statistically significant for two measures i.e. board independence (coefficient = -0.288; *t*-statistic = -2.2) and director representation on the board (coefficient = -0.603; *t*-statistic = -4.5). For example, firms with high corporate governance, measured as having high board independence, repurchase an additional 28.8 cents worth of equity per dollar of option proceeds received. This increment is however, only significant at the 5% level. As a side note, there is almost no statistically significant difference in the allocation of option proceeds to debt repurchase and only weak evidence for a difference in the allocation to dividends.

In sum, we find that the agency model cannot explain how firms put option proceeds to various uses. In fact, firms that are said to have more entrenched managers invest and save their option proceeds just as do firms with less entrenched managers. While firms with high corporate governance return relatively more of their option proceeds to shareholders via equity repurchase, this increment is neither statistically significant nor consistent across all measures of corporate governance. To add on, the results for dividends are mixed in that, depending on the corporate governance measure used, firms with high corporate governance do not necessary return relatively more option proceeds to shareholders in the form of dividends.

### E. Employee Stock Option Proceeds and Cash Holdings

To recapitulate, we find that firms save a large portion of the overall proceeds raised from equity issuance during the period 1996-2015. The liquidity improvement brought about by the exercise of ESOs enables these firms to save significant amounts of option proceeds in the year of receipt. Moreover, this short-term effect on cash savings does not completely reverse as firms do not spend all the savings in subsequent years. In this section, we examine how equity issuance proceeds (particularly option proceeds) contribute to corporate cash holdings. Following Bates et al. (2009), we regress the cash-to-assets ratios of our sample firms on a set of variables, which they deemed as determinants of cash holdings. Like the authors, we allow the intercept of the regressions to change in the 2000s by incorporating the necessary indicator variable into the regressions. In addition, we include equity and debt issuance proceeds as explanatory variables of cash holdings. Table 8 depicts the associated results.

In column (1) of Table 8, we replicate the results of Bates et al. (2009) as depicted in column (1) of their Table 3 Panel B. It is noteworthy that the magnitude of our coefficients does not exactly match those of Bates at el. (2009) because the latter construct their sample for the period 1980-2006. Limited by the data availability of ESOs, we can only examine firms during the years 1996-2015. That said, our coefficients generally have the same signs as theirs.

Furthermore, in unreported results, we construct a comparable sample by closely following their data rules and replicate their results with similar coefficient estimates.

[Insert Table 8 Here]

Column (2) of Table 8 presents the results with equity and debt issuance proceeds as additional explanatory variables. Given the high saving rate of equity issuance proceeds documented by McLean (2011) as well as our analysis, the coefficient on *EI* is expectedly positive and statistically significant (coefficient = 0.245; *t*-statistic = 5.3). In contrast, the availability of debt issuance proceeds reduces firms' needs to hold cash; The coefficient on *DI* is negative and significant at the 1% level (coefficient = -0.064; *t*-statistic = -6.0). Economically, these results imply that after controlling for the various determinants of cash holdings, a one standard deviation increase in overall equity issuance proceeds predicts an average increase in cash-to-assets ratio of 0.011 for firms in our sample. On the other hand, a one standard deviation increase in debt issuance proceeds entails a reduction in the average cash-to-assets ratio of 0.01.

To disentangle the effects of option proceeds and other equity proceeds on cash holdings, we include the two types of proceeds as separate regressors and re-run the associated regressions. Column (3) of Table 8 shows that both types of proceeds have an important impact on corporate cash holdings. However, the magnitude differs depending on whether the proceeds are generated by the exercise of ESOs or by other equity issuance. Ceteris paribus, a one standard deviation increase in option proceeds predicts an average increase in the cash-to-assets ratio of 0.029 whereas a similar increase in other equity proceeds produces an average increase of 0.006. In contrast, a one standard deviation increase in debt issuance proceeds reduces the average cash-to-assets ratio by only 0.01.

To further evaluate the impact of option proceeds on cash holdings, we compute the hypothetical cash-to-assets ratios that would prevail if firms did not save their option proceeds. In doing so, we note that the cash holdings and total assets of sample firms evolve as follow.

$$Cash_t = Cash_{t-1} + \Delta Cash_{[t-1,t]}$$

$$Assets_t = Assets_{t-1} + \Delta Assets_{[t-1,t]}$$

In each time t, the change in cash ($\Delta Cash_{[t-1,t]}$) is decomposed into two components i.e., the amount of option proceeds allocated to cash ($Cash^{OP}$), and all other cash additions ($Cash^{Oth}$) such that $\Delta Cash_{[t-1,t]} = \Delta Cash^{OP}_{[t-1,t]} + \Delta Cash^{Oth}_{[t-1,t]}$ , whereby $\Delta Cash^{OP}_{[t-1,t]}$ is computed by first running regression equation (4) on an annual basis to obtain the average yearly saving rates of option proceeds i.e., $\beta_2^{\Delta C}$. The amount of option proceeds allocated to cash in a specific year is therefore given by multiplying the option proceeds received for that year by the associated saving rate. At any time t, the hypothetical cash-to-assets ratio is therefore:

$$Cash\ Ratio_i^{Hypo} = \frac{Cash_1 + \sum_{i=2}^{t} \Delta Cash_i^{Oth}}{Assets_t - \sum_{i=2}^{t} \Delta Cash_i^{OP}}$$

where $Cash_1$ is the starting amount of cash i.e., the cash holdings of a specific firm for the first year it is in the sample.

[Insert Figure 2 Here]

Figure 2 plots the annual mean and median values of the actual and hypothetical cash-to-assets ratios for our sample firms, thereby contrasting the differences caused by the saving of option proceeds and illustrating the time trend of cash holdings. Since savings from option proceeds made up a part of cash holdings, the hypothetical cash-to-assets ratio is therefore lower than the actual ratio. That said, the hypothetical mean cash-to-assets ratio is only marginally lower than the actual ratio during the early sample years, suggesting that the saving of option proceeds does not contribute much to the time trend of cash holdings during these years. However, with the increasing use of ESOs by our sample firms, the gap between actual and hypothetical cash-to-assets ratios widens over time, so much so that in 2015, the hypothetical mean ratio would be as much as 39.3% lower than the actual mean ratio if firms did not save their option proceeds. We therefore conclude that, to a large extent, the accumulation of option proceeds as cash helps to explain the observed cash-to-assets ratios of our sample of nonfinancial U.S. firms.

### F. Alternative Classification of Equity Issuance Proceeds by McKeon (2015)

In this section, we examine how accurate the classification rule of McKeon (2015) is in imputing the amounts of option proceeds and other equity proceeds for our sample firms. Specifically, McKeon (2015) uses the relative size of equity issues to separate employee-initiated issues from firm-initiated ones. He defines employee-(firm-) initiated equity issues as those with issue size less (greater) than 2% (3%) of market equity, the so-called *ISSUE%* rule.[24] Implicit in this rule is the assumption that a firm can only be classified as having issued in a specific year, either employee- or firm-initiated equity, but not both. For example, a firm receiving an annual amount of option proceeds exceeding 3% of its market equity is mistakenly deemed by the rule as having issued only firm-initiated equity. Given that equity issues with a size between 2% to 3% of market equity are deemed as ambiguous and disregarded by McKeon (2015), the rule also misses out on firms with moderate amounts of option proceeds and/or other equity proceeds.

[24] McKeon (2015) uses the Compustat Fundamentals Quarterly file to compute the quarterly equity issuance proceeds of a firm by deducting from the current year-to-date value, the previous quarter value of the proceeds from the sale of common and preferred stock, as reported in Compustat variable, *SSTKY*. To isolate the amount of proceeds from common equity issuance, he subtracts preferred equity issuance proceeds from the overall equity issuance proceeds, whereby preferred equity issuance proceeds are calculated as the increase in the value of Compustat variable, *PSTKQ* (or *PSTKRQ* where missing). He then computes the ratio of common equity issuance proceeds to end-of-period market equity for each firm-quarter observation and refers to this variable as *ISSUE*%.

Unlike McKeon (2015), we explicitly collect data on ESOs from various sources, including the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. We therefore offer a relatively more accurate estimate of the proceeds raised from employee-initiated equity issues by our sample firms. We illustrate that applying the *ISSUE%* rule to our data results in misclassifications between the two types of proceeds, leading to inaccurate inferences about the allocation of option proceeds and other equity proceeds. That said, in defining other equity proceeds as the difference between total equity issuance proceeds and proceeds from the exercise of ESOs, we could also be potentially classifying proceeds from other employee-initiated issues (such as stock incentive and profit sharing plans) as other equity proceeds. However, we believe that such a misclassification, if any, will lead to an underestimation of the amounts of option proceeds and bias us against documenting the importance of option proceeds. Moreover, stock issued to employees under such plans are solely at the discretion of managers and may therefore be more appropriately classified as other equity issues, what McKeon (2015) deems as firm-initiated issues.

[Insert Table 9 Here]

Panel A of Table 9 evaluates the *ISSUE%* rule with respect to our sample data. Specifically, column (1) to (3) list the actual amounts of option proceeds and other equity proceeds received by our sample firms for the period 1996-2015. Column (4) and (5) depict respectively, the annual amounts of option proceeds and other equity proceeds with issue size between 2% and 3% of market equity, which are deemed as ambiguous and disregarded by McKeon (2015). Column (6) lists the amounts of tax benefits associated with option proceeds, which McKeon (2015) did not explicitly consider as part of equity issuance proceeds; These tax grants are separately reported in Compustat since 2005.

Column (7) and (8) depict the respective amounts of option proceeds and other equity proceeds with issue size either less than 2% or more than 3% of market equity. Column (9) and

(10) depict the corresponding proceeds imputed from employee- and firm-initiated equity issues. In sum, the *ISSUE%* rule estimates an overall US$782.7 billion (GDP deflator adjusted) raised from employee-initiated equity issues, as opposed to the US$683.3 billion of option proceeds received by our sample firms.[25] Notably, firm-initiated issues sum to US$408.2 billion, in contrast to US$507.6 billion of other equity proceeds. Applying the *ISSUE%* rule to our data therefore entails misclassifications between employee- and firm-initiated issues, totaling US$99.4 billion, as tabulated in column (11).

In view that the *ISSUE%* rule necessitates firms to be classified as having issued in a specific year, either employee- or firm-initiated equity but not both, we further evaluate in Panel B of Table 9, the magnitude of misclassification arising from this implicit assumption. In doing so, we distinguish between dual and non-dual equity issuers; A firm is regarded as a dual issuer if it receives both option proceeds and other equity proceeds in a year. A firm is said to be a non-dual issuer if it receives either option proceeds or other equity proceeds. Column (1) to (4) of Table 9 Panel B illustrates the accuracy of the *ISSUE%* rule in terms of non-dual equity issues. In total, only 18.4% of the US$782.7 billion of employee-initiated issuance proceeds are indeed option proceeds received by non-dual issuers (US$143.8 billion) and only 5.2% of firm-initiated issuance proceeds relate to other equity proceeds (US$21.4 billion). For dual issuers, column (8) shows the amounts of option proceeds misclassified as firm-initiated issuance proceeds, and column (9) lists the amounts of other equity proceeds reported as employee-initiated issuance proceeds. Column (11) and (12) aggregate the misclassifications for dual and non-dual issuers; The *ISSUE%* rule produces an overall

[25] Given that the *ISSUE%* rule of McKeon (2015) requires firms to have market value of equity, we dropped 27 missing observations in computing the amounts of employee- and firm-initiated equity issues. These observations involve US$14 million of option proceeds, and US$153 million of other equity proceeds, both GDP deflator adjusted.

misclassification of employee-initiated issuance proceeds amounting to US$8.1 billion and an understatement of firm-initiated issuance proceeds worth a daunting US$107.6 billion.

Panel C of Table 9 examines the accuracy of *ISSUE%* rule in terms of the quantity of equity issues. Column (1) to (5) present the actual split between non-issuers and equity issuers, as well as dual and non-dual issuers in our sample. Column (6) to (8) show that there are as many as 1,014 issues falling between 2% and 3% of market equity, deemed as ambiguous issues according to the *ISSUE%* rule. Column (9) to (11) depict respectively, the actual number of dual equity issues, as well as non-dual issues involving either option proceeds or other equity proceeds, all with issue sizes either less than 2% or more than 3% of market equity. Column (12) and (13) tabulate the respective number of employee- and firm-initiated equity issuers based on the *ISSUE%* rule.

Importantly, a comparison of column (10) and (12) shows that only 4,382 of the 18,351 employee-initiated issues are correctly classified. In contrast, a little less than 30% of the firm-initiated issues are accurate (486 issues). Overall, among the 20,150 issues identified by the *ISSUE*% rule as being either employee- or firm-initiated, only 24.2% of them (4,382+486 issues) are accurately categorized. As many as 15,282 equity issues entail firms receiving both option proceeds and other equity proceeds. In other words, there are many dual equity issues in our sample for which the *ISSUE%* rule is unable to identify them accurately.

To assess the implication that these misclassifications have on our inferences, we replace option proceeds and other equity proceeds with the corresponding employee- and firm-initiated issuance proceeds in equation (3) to (8) and re-run the regressions. For comparative purposes, we report the results in Table 10, along with the results of regressions involving the original option proceeds and other equity proceeds. In general, the coefficients on employee- and firm-initiated issuance proceeds (*EMI* and *FI*, respectively) are vastly different from those on the corresponding option proceeds and other equity proceeds. Particularly, the cash flow identity does not hold very well in terms of the imputed amounts of equity issuance proceeds, mostly because the tax grants associated with option proceeds are not considered. As a result, while all coefficients on *Oth* are zero for the regressions in terms of option proceeds and other equity proceeds, those with respect to employee- and firm-initiated issuance proceeds are not.

[Insert Table 10 Here]

We show that investment increases by 40.5 cents per dollar of employee-initiated issuance proceeds as opposed to 25.8 cents per dollar of option proceeds. Moreover, firms save 65.9 cents from each dollar raised in employee-initiated issues whereas the saving rate of option proceeds is 71.8 cents. Similarly, there are remarkable differences in the allocation of firm-initiated issuance proceeds and other equity proceeds; Firms invest 47.4 (37.1) cents and save 60.3 (45.5) cents per dollar of firm-initiated issuance proceeds (other equity proceeds). In sum, we find that applying the *ISSUE%* rule to our sample data results in inaccurate inferences about the allocation of option proceeds and other equity proceeds for our sample firms during the period 1996-2015.

## VII. Conclusion

Employee stock options (ESOs) have become an important channel through which firms issue equity in the new millennium. Funds raised from the exercise of ESOs are ad-hoc because it is uncertain when such options will become in-the-money, and whether employees will exercise them when it is profitable to do so. We examine whether firms have a greater tendency to spend ad-hoc option proceeds than they do with other equity proceeds. In doing so, we identify the different ways in which option proceeds can be spent. Specifically, we examine the impact of both option proceeds and other equity proceeds on the firms' collective policy of investment, cash holdings, security repurchases, and dividends.

We find that firms do not have a relatively higher tendency to spend option proceeds; Option proceeds are so highly saved that cash savings emerge as the most important use of option proceeds. In contrast, other equity proceeds are saved at a lower rate than option proceeds; On average, firms save 45.1 cents per dollar of other equity proceeds and 70.1 cents per dollar of option proceeds. They also repurchase equity more extensively upon the receipt of option proceeds (20.8 cents per dollar received) than upon that of other equity proceeds (0.2 cents) and cut back on debt retirement only after ESOs are exercised.

Among the sources of funds, option proceeds are the most highly saved. That said, these savings are significantly drawn down in the year following the exercise of ESOs and redirected to equity repurchase. On the other hand, savings from other equity proceeds are relatively more permanent as they are not heavily depleted in subsequent years. Our results also do not conform to the predictions of the agency model in that less financially constrained firms largely return option proceeds to shareholders via equity repurchase. There is also no evidence that firms with different degree of corporate governance spend their option proceeds differently. Lastly, we find that equity issuance proceeds (particularly option proceeds) contribute to explaining the average cash-to-assets ratio of nonfinancial U.S. firms during the period 1996-2015.

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## Figure 1. Evolution of Equity Issuance Proceeds

This figure presents by calendar year, the aggregate amounts of equity issuance proceeds for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index for the years 1996 to 2015. Panel A depicts for the full sample period, the total equity issuance proceeds (*EI*), as well as option proceeds (*OP*) and other equity proceeds (*EI-OP*) received by our sample firms. Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. Other equity proceeds refer to total equity issuance proceeds less option proceeds and therefore, include tax benefits associated with the exercise of employee stock options (*TB*). Panel B reclassify the tax benefits as being part of option-related proceeds (*OP+TB*) and excludes firm-years for which the tax benefits are not separately reported in Compustat. Amounts are in billions of 2009 constant U.S. dollars.

**Panel A: Full Sample Period, 1996-2015** **Panel B: Subsample Period, 2006-2015**

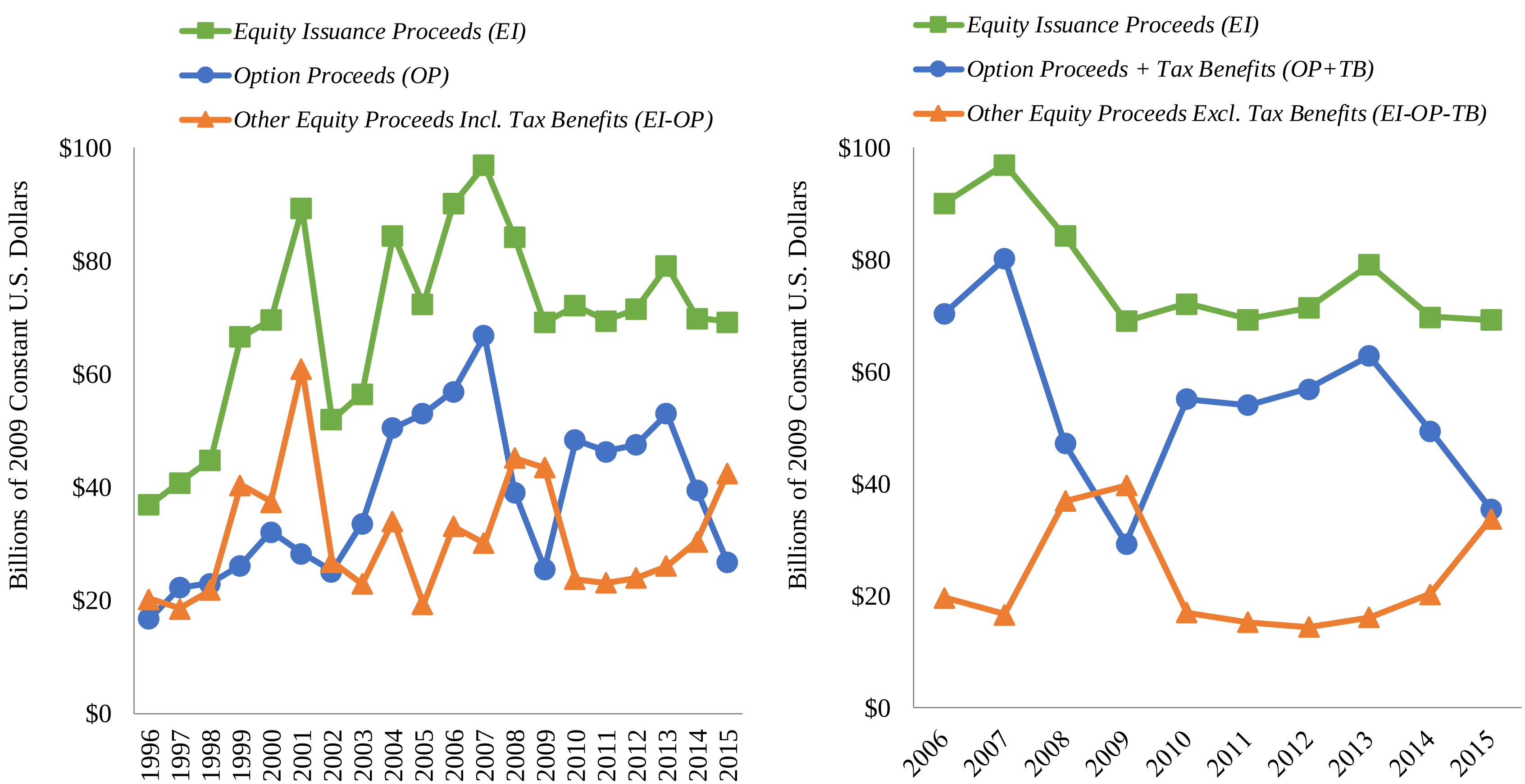
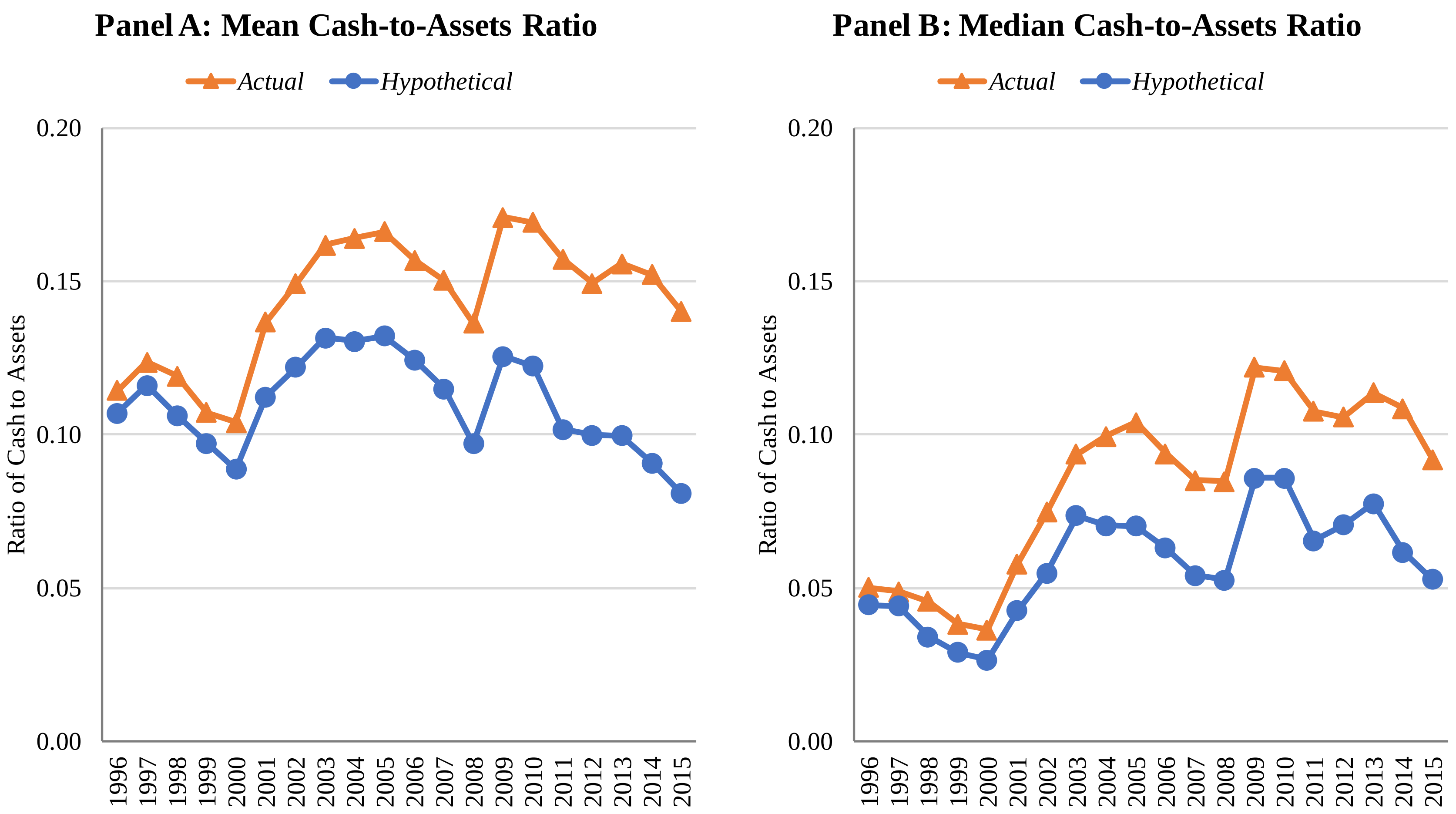


**Figure 2. The Time Trend of Cash-to-Assets Ratio**

This figure presents the yearly mean and median values of cash-to-assets ratio of firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index for the years 1996 to 2015. Cash-to-assets ratio is defined as the ratio of cash and short-term investments to book value of assets. Actual ratios refer to the cash-to-assets ratios computed based on actual data available in Compustat whereas hypothetical ratios refer to the cash-to-assets ratios that would have prevailed if firms did not save part of their option proceeds as cash. Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database.



## Table 1. Summary Statistics, 1996-2015

This table presents the descriptive statistics of our main regression variables for our sample of firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the period 1996-2015. That is, sources of funds include internal cash flow net of changes in working capital (*CF*), as well as debt and equity issuance proceeds (*DI* and *EI*, respectively). *OP* is employee stock option proceeds, collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. *EI-OP* is equity issuance proceeds less option proceeds and therefore, include tax benefits associated with the exercise of employee stock options. Uses of funds include investment (*Inv*), cash savings ($\Delta C$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* refers to the plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. All variables that made up the cash flow identity are deflated by the respective firm's beginning-of-period total assets. Appendix A depicts the definitions of these variables. Control variables include the ratio of market assets to book assets (*MB*), annual sales growth rate (*Sales growth*), log of book assets (*Ln*(*Assets*)), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility*). Negative income dummy is an indicator that equals one if a firm suffers an operating loss (*EBITDA*) in a given year, zero otherwise. Tobin's Q is the sum of book value of assets and market value of common equity less book value of common equity and deferred taxes, normalized by book value of assets.

| Variable | Description | Mean | S.D. | Min. | 25th | Median | 75th | Max. |
|---|---|---|---|---|---|---|---|---|
| Sources of Funds (Normalized by Total Assets): | | | | | | | | |
| *CF* | Internal cash flow | 0.107 | 0.097 | -0.402 | 0.056 | 0.104 | 0.159 | 0.489 |
| *EI* | Equity issuance proceeds | 0.022 | 0.064 | 0.000 | 0.0013 | 0.006 | 0.018 | 1.423 |
| *OP* | Option proceeds | 0.009 | 0.014 | 0.000 | 0.000 | 0.003 | 0.011 | 0.091 |
| *EI-OP* | Other equity proceeds | 0.014 | 0.060 | -0.007 | 0.000 | 0.0008 | 0.005 | 1.360 |
| *DI* | Debt issuance proceeds | 0.096 | 0.179 | -0.072 | 0.000 | 0.015 | 0.115 | 1.550 |
| Uses of Funds (Normalized by Total Assets): | | | | | | | | |
| *Inv* | Investment | 0.092 | 0.116 | -0.525 | 0.026 | 0.065 | 0.131 | 1.186 |
| $\Delta C$ | Change in cash | 0.015 | 0.080 | -0.250 | -0.014 | 0.003 | 0.035 | 0.720 |
| *ER* | Equity repurchase | 0.027 | 0.048 | 0.000 | 0.000 | 0.002 | 0.033 | 0.287 |
| *DR* | Debt retirement | 0.081 | 0.154 | 0.000 | 0.000 | 0.020 | 0.087 | 1.242 |
| *Div* | Dividends | 0.011 | 0.018 | 0.000 | 0.000 | 0.000 | 0.016 | 0.139 |
| *Oth* | Cash flow identity plug | 0.000 | 0.001 | -0.010 | 0.000 | 0.000 | 0.000 | 0.010 |
| Firm characteristics: | | | | | | | | |
| *NegInc* | Negative income dummy | 0.060 | 0.238 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000 |
| *Q* | Tobin's Q | 1.947 | 1.245 | 0.707 | 1.179 | 1.566 | 2.246 | 9.053 |
| *MB* | Market-to-Book ratio | 1.974 | 1.231 | 0.735 | 1.214 | 1.597 | 2.267 | 9.009 |
| *SaleG* | Sales growth | 0.088 | 0.205 | -0.507 | -0.012 | 0.071 | 0.172 | 0.997 |
| *Ln(Assets)* | Log of book value of assets | 7.208 | 1.641 | 2.975 | 6.065 | 7.073 | 8.247 | 12.017 |
| *Leverage* | Ratio of total debt to total assets | 0.214 | 0.181 | 0.000 | 0.047 | 0.198 | 0.328 | 0.812 |
| *Tangibility* | Ratio of net PPE to total assets | 0.274 | 0.216 | 0.002 | 0.106 | 0.212 | 0.386 | 0.882 |

## Table 2. Annual Amounts of Equity Issuance Proceeds

This table depicts the annual amounts of equity issuance proceeds for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the years 1996 to 2015. Column (1) reports the total number of firms in our sample, which is made up of non-issuing firms and equity issuing firms, as tabulated in column (2) and (3) of this table respectively. Column (4) and (5) report these respective firms as a percentage of the total number of sample firms. Column (6) and (7) show that equity issuance proceeds is the sum of option proceeds and other equity proceeds. Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. Other equity proceeds (*EI-OP*) refer to equity issuance proceeds (*EI*) less option proceeds (*OP*). The relative proportions of option proceeds and other equity proceeds are listed in column (9) and (10), respectively. Amounts are in billions of 2009 constant U.S. dollars.

| | (1) | (2) | (3) | (4)=(2)÷(1) | (5)=(3)÷(1) | (6) | (7) | (8)=(6)+(7) | (9)=(6)÷(8) | (10)=(7)÷(8) |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | Total Firms | Non-Issuers | Equity Issuers | Non-Issuers | Equity Issuers | *OP* | *EI-OP* | *EI* | *OP* | *EI-OP* |
| | (#) | (#) | (#) | (%) | (%) | ($) | ($) | ($) | (%) | (%) |
| 1996 | 1,276 | 255 | 1,021 | 20% | 80% | $16.7 | $20.2 | $36.9 | 45% | 55% |
| 1997 | 1,370 | 227 | 1,143 | 17% | 83% | $22.3 | $18.6 | $40.8 | 55% | 45% |
| 1998 | 1,352 | 225 | 1,127 | 17% | 83% | $23.0 | $21.9 | $44.8 | 51% | 49% |
| 1999 | 1,284 | 226 | 1,058 | 18% | 82% | $26.2 | $40.4 | $66.6 | 39% | 61% |
| 2000 | 1,251 | 234 | 1,017 | 19% | 81% | $32.2 | $37.5 | $69.6 | 46% | 54% |
| 2001 | 1,287 | 206 | 1,081 | 16% | 84% | $28.3 | $61.0 | $89.3 | 32% | 68% |
| 2002 | 1,343 | 162 | 1,181 | 12% | 88% | $25.1 | $26.9 | $52.0 | 48% | 52% |
| 2003 | 1,321 | 144 | 1,177 | 11% | 89% | $33.6 | $22.9 | $56.5 | 59% | 41% |
| 2004 | 1,302 | 103 | 1,199 | 8% | 92% | $50.4 | $34.1 | $84.5 | 60% | 40% |
| 2005 | 1,331 | 92 | 1,239 | 7% | 93% | $53.0 | $19.3 | $72.4 | 73% | 27% |
| 2006 | 1,293 | 89 | 1,204 | 7% | 93% | $57.0 | $33.1 | $90.1 | 63% | 37% |
| 2007 | 1,224 | 95 | 1,129 | 8% | 92% | $66.8 | $30.2 | $97.0 | 69% | 31% |
| 2008 | 1,248 | 160 | 1,088 | 13% | 87% | $39.1 | $45.2 | $84.3 | 46% | 54% |
| 2009 | 1,248 | 186 | 1,062 | 15% | 85% | $25.6 | $43.5 | $69.1 | 37% | 63% |
| 2010 | 1,177 | 159 | 1,018 | 14% | 86% | $48.4 | $23.8 | $72.1 | 67% | 33% |
| 2011 | 1,135 | 156 | 979 | 14% | 86% | $46.3 | $23.2 | $69.5 | 67% | 33% |
| 2012 | 1,104 | 172 | 932 | 16% | 84% | $47.5 | $24.0 | $71.5 | 66% | 34% |
| 2013 | 1,071 | 153 | 918 | 14% | 86% | $53.0 | $26.1 | $79.1 | 67% | 33% |
| 2014 | 1,001 | 162 | 839 | 16% | 84% | $39.5 | $30.4 | $69.9 | 56% | 44% |
| 2015 | 952 | 192 | 760 | 20% | 80% | $26.9 | $42.4 | $69.3 | 39% | 61% |
| Total | 24,570 | 3,398 | 21,172 | 14% | 86% | $760.9 | $624.5 | $1,385.4 | 55% | 45% |

## Table 3. The Allocation of Funds

This table reports the results of regressing each use of funds on the sources of funds. Uses include investment (*Inv*), cash savings ($\Delta C$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* is a plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. Sources include internal cash flow net of changes in working capital (*CF*), option proceeds (*OP*), other equity proceeds (*EI-OP*), and debt proceeds (*DI*). Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. *EI-OP* is equity issuance proceeds less option proceeds. Variables are demeaned by firm and scaled by book assets. Control variables include the ratio of market to book value of assets (*MB*), annual sales growth rate (*Sales growth)*, log of book assets (*Ln(Assets)*), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility)*. For brevity, coefficients of *Oth* are not reported as they are not significantly different from zero. Panel A depicts results for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the years 1996 to 2015. Panel B reclassify tax benefits of options (*TB*) as part of option-related proceeds and omits firm-years for which *TB* are not separately reported in Compustat. Regressions are run by ordinary least squares with year fixed effects. *T*-statistics are in parentheses and computed using standard errors robust to heteroskedasticity and clustering at firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively.

## Panel A: Full sample period (1996-2015)

| Dependent Variable: | (1) $Inv_{it}$ | (2) $\Delta C_{it}$ | (3) $ER_{it}$ | (4) $DR_{it}$ | (5) $Div_{it}$ | (6) $Inv_{it}$ | (7) $\Delta C_{it}$ | (8) $ER_{it}$ | (9) $DR_{it}$ | (10) $Div_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $CF_{it}$ | 0.391*** | 0.361*** | 0.071*** | 0.166*** | 0.011*** | 0.395*** | 0.354*** | 0.066*** | 0.175*** | 0.011*** |
| | (38.5) | (37.2) | (19.1) | (20.5) | (10.6) | (38.1) | (35.9) | (17.4) | (20.9) | (10.2) |
| $EI_{it}$ | 0.370*** | 0.465*** | 0.014*** | 0.148*** | 0.003** | | | | | |
| | (17.9) | (24.7) | (3.3) | (12.8) | (2.5) | | | | | |
| $OP_{it}$ | | | | | | 0.232*** | 0.701*** | 0.208*** | -0.149*** | 0.008 |
| | | | | | | (3.4) | (10.7) | (6.2) | (-3.3) | (1.0) |
| $EI_{it}$-$OP_{it}$ | | | | | | 0.378*** | 0.451*** | 0.002 | 0.166*** | 0.002** |
| | | | | | | (17.1) | (22.5) | (0.5) | (13.3) | (2.1) |
| $DI_{it}$ | 0.277*** | 0.046*** | 0.017*** | 0.658*** | 0.001*** | 0.277*** | 0.046*** | 0.017*** | 0.659*** | 0.001*** |
| | (40.1) | (11.0) | (9.5) | (89.2) | (2.6) | (40.2) | (11.0) | (9.4) | (89.5) | (2.6) |
| $MB_{it-1}$ | 0.009*** | -0.007*** | 0.003*** | -0.006*** | 0.001*** | 0.010*** | -0.007*** | 0.002*** | -0.006*** | 0.001*** |
| | (10.6) | (-7.6) | (6.3) | (-10.0) | (9.6) | (10.8) | (-8.2) | (5.3) | (-9.3) | (9.4) |
| *Sales growth*$_{it-1}$ | 0.024*** | -0.001 | -0.011*** | -0.009*** | -0.003*** | 0.024*** | -0.001 | -0.011*** | -0.010*** | -0.003*** |
| | (9.2) | (-0.4) | (-12.0) | (-4.5) | (-11.6) | (9.2) | (-0.2) | (-11.8) | (-4.7) | (-11.5) |
| *Ln*(*Assets*)$_{it-1}$ | -0.011*** | -0.004*** | 0.009*** | 0.005*** | 0.002*** | -0.011*** | -0.004*** | 0.009*** | 0.005*** | 0.002*** |
| | (-8.3) | (-4.0) | (16.3) | (5.1) | (10.1) | (-8.4) | (-3.7) | (16.8) | (4.7) | (10.1) |
| *Leverage*$_{it-1}$ | -0.136*** | -0.012** | -0.055*** | 0.213*** | -0.009*** | -0.137*** | -0.011** | -0.054*** | 0.212*** | -0.009*** |
| | (-21.9) | (-2.4) | (-20.6) | (33.7) | (-11.7) | (-21.9) | (-2.1) | (-20.2) | (33.6) | (-11.6) |
| *Tangibility*$_{it-1}$ | 0.008 | 0.054*** | -0.012*** | -0.050*** | 0.001 | 0.007 | 0.054*** | -0.011*** | -0.050*** | 0.001 |
| | (0.8) | (6.9) | (-2.9) | (-6.4) | (0.6) | (0.8) | (6.9) | (-2.9) | (-6.4) | (0.6) |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Obs* | 24,570 | 24,570 | 24,570 | 24,570 | 24,570 | 24,570 | 24,570 | 24,570 | 24,570 | 24,570 |
| $R^2$ | 0.35 | 0.25 | 0.11 | 0.68 | 0.06 | 0.35 | 0.25 | 0.11 | 0.68 | 0.06 |

**Table 3. Allocation of Funds (continue)**

**Panel B: Subsample period (2006-2015)**

| Dependent Variable: | (1) $Inv_{it}$ | (2) $\Delta C_{it}$ | (3) $ER_{it}$ | (4) $DR_{it}$ | (5) $Div_{it}$ | (6) $Inv_{it}$ | (7) $\Delta C_{it}$ | (8) $ER_{it}$ | (9) $DR_{it}$ | (10) $Div_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $CF_{it}$ | 0.380*** | 0.371*** | 0.073*** | 0.159*** | 0.016*** | 0.380*** | 0.370*** | 0.076*** | 0.155*** | 0.017*** |
| | (22.7) | (23.9) | (10.9) | (11.9) | (7.5) | (22.9) | (24.1) | (11.4) | (11.7) | (7.8) |
| $OP_{it}+TB_{it}$ | 0.415*** | 0.545*** | 0.317*** | -0.267*** | 0.006 | | | | | |
| | (4.7) | (6.4) | (6.4) | (-4.2) | (0.5) | | | | | |
| $EI_{it}-(OP_{it}+TB_{it})$ | 0.389*** | 0.461*** | -0.004 | 0.150*** | 0.001 | | | | | |
| | (9.2) | (11.5) | (-0.4) | (5.2) | (0.7) | | | | | |
| $OP_{it}$ | | | | | | 0.429*** | 0.587*** | 0.319*** | -0.283*** | -0.005 |
| | | | | | | (4.1) | (5.9) | (5.5) | (-3.8) | (-0.3) |
| $EI_{it}-OP_{it}$ | | | | | | 0.388*** | 0.459*** | 0.002 | 0.144*** | 0.002 |
| | | | | | | (9.3) | (11.6) | (0.2) | (5.1) | (1.2) |
| $DI_{it}$ | 0.255*** | 0.042*** | 0.023*** | 0.678*** | 0.002** | 0.255*** | 0.042*** | 0.023*** | 0.678*** | 0.002** |
| | (25.9) | (7.2) | (7.9) | (65.3) | (2.2) | (25.9) | (7.2) | (7.9) | (65.3) | (2.2) |
| $MB_{it-1}$ | 0.008*** | -0.006*** | 0.004*** | -0.006*** | 0.001*** | 0.008*** | -0.006*** | 0.005*** | -0.007*** | 0.002*** |
| | (5.3) | (-4.8) | (5.4) | (-5.8) | (6.7) | (5.3) | (-4.8) | (6.0) | (-6.3) | (6.9) |
| *Sales growth*$_{it-1}$ | 0.025*** | -0.002 | -0.012*** | -0.007** | -0.004*** | 0.025*** | -0.002 | -0.012*** | -0.007** | -0.004*** |
| | (6.3) | (-0.7) | (-6.7) | (-2.0) | (-9.0) | (6.3) | (-0.7) | (-6.7) | (-2.0) | (-9.1) |
| *Ln(Assets)*$_{it-1}$ | -0.011*** | -0.006*** | 0.009*** | 0.006*** | 0.002*** | -0.011*** | -0.006*** | 0.009*** | 0.006*** | 0.002*** |
| | (-5.5) | (-3.8) | (9.8) | (4.0) | (5.6) | (-5.5) | (-3.7) | (10.2) | (3.6) | (5.5) |
| *Leverage*$_{it-1}$ | -0.119*** | -0.003 | -0.062*** | 0.193*** | -0.008*** | -0.119*** | -0.003 | -0.062*** | 0.193*** | -0.008*** |
| | (-13.1) | (-0.4) | (-14.8) | (21.5) | (-5.6) | (-13.1) | (-0.4) | (-14.8) | (21.5) | (-5.6) |
| *Tangibility*$_{it-1}$ | 0.016 | 0.044*** | -0.014** | -0.045*** | -0.004** | 0.016 | 0.044*** | -0.013** | -0.045*** | -0.004** |
| | (1.2) | (3.8) | (-2.2) | (-4.1) | (-2.1) | (1.2) | (3.9) | (-2.1) | (-4.1) | (-2.1) |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Obs* | 11,453 | 11,453 | 11,453 | 11,453 | 11,453 | 11,453 | 11,453 | 11,453 | 11,453 | 11,453 |
| $R^2$ | 0.29 | 0.20 | 0.12 | 0.71 | 0.05 | 0.29 | 0.20 | 0.12 | 0.71 | 0.05 |

## Table 4. The Effects of Past Employee Stock Option Exercises on Funds Allocation

This table reports the results of regressing each use of funds on the sources of funds. Uses include investment (*Inv*), cash savings ($\Delta C$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* is a plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. Sources include internal cash flow net of changes in working capital (*CF*), option proceeds (*OP*), other equity proceeds (*EI-OP*), and debt proceeds (*DI*). Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. *EI-OP* is equity issuance proceeds less option proceeds. Variables are demeaned by firm and scaled by book assets. Control variables include the ratio of market to book value of assets (*MB*), annual sales growth rate (*Sales growth)*, log of book assets (*Ln(Assets)*), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility)*. Coefficients on control variables are not reported as they are similar to those in Table 3. Coefficients of *Oth* are also omitted since they are not significantly different from zero. Panel A depicts the results for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the period 1996-2015. Panel B reclassify tax benefits of options (*TB*) as part of option-related proceeds and excludes firm-years for which *TB* are not separately reported in Compustat. Regressions are run by ordinary least squares with year fixed effects. *T*-statistics are in parentheses and computed using standard errors robust to heteroskedasticity and clustering at firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively.

### Panel A: Full sample period (1996-2015)

| Dependent Variable: | (1) $Inv_{it}$ | (2) $\Delta C_{it}$ | (3) $ER_{it}$ | (4) $DR_{it}$ | (5) $Div_{it}$ | (6) $Inv_{it}$ | (7) $\Delta C_{it}$ | (8) $ER_{it}$ | (9) $DR_{it}$ | (10) $Div_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $CF_{it}$ | 0.383*** | 0.358*** | 0.070*** | 0.178*** | 0.011*** | 0.365*** | 0.381*** | 0.060*** | 0.185*** | 0.010*** |
| | (30.6) | (29.4) | (14.4) | (17.5) | (8.0) | (29.3) | (31.4) | (12.4) | (18.0) | (6.8) |
| $CF_{it-1}$ | | | | | | 0.085*** | -0.108*** | 0.049*** | -0.032*** | 0.005*** |
| | | | | | | (7.3) | (-9.9) | (9.9) | (-3.5) | (3.8) |
| $CF_{it-2}$ | | | | | | 0.079*** | -0.060*** | 0.015*** | -0.040*** | 0.006*** |
| | | | | | | (7.4) | (-6.2) | (3.0) | (-4.9) | (4.9) |
| $OP_{it}$ | 0.299*** | 0.632*** | 0.191*** | -0.111** | 0.003 | 0.288*** | 0.691*** | 0.143*** | -0.111** | 0.004 |
| | (3.8) | (8.2) | (4.7) | (-2.0) | (0.3) | (3.6) | (8.8) | (3.5) | (-2.0) | (0.4) |
| $OP_{it-1}$ | | | | | | 0.009 | -0.263*** | 0.208*** | 0.045 | -0.003 |
| | | | | | | (0.1) | (-3.4) | (4.9) | (0.9) | (-0.3) |
| $OP_{it-2}$ | | | | | | -0.005 | 0.032 | 0.053 | -0.105** | 0.020** |
| | | | | | | (-0.1) | (0.5) | (1.4) | (-2.2) | (2.3) |
| $EI_{it}$-$OP_{it}$ | 0.372*** | 0.452*** | -0.006 | 0.177*** | 0.004** | 0.378*** | 0.444*** | -0.002 | 0.174*** | 0.004** |
| | (13.0) | (15.9) | (-0.9) | (8.6) | (2.3) | (13.4) | (15.8) | (-0.4) | (8.5) | (2.4) |
| $EI_{it-1}$-$OP_{it-1}$ | | | | | | 0.043** | -0.021 | -0.007 | -0.015 | -0.002* |
| | | | | | | (2.1) | (-1.1) | (-1.0) | (-1.1) | (-1.7) |
| $EI_{it-2}$-$OP_{it-2}$ | | | | | | 0.038** | -0.010 | -0.008 | -0.021 | -0.002 |
| | | | | | | (2.4) | (-0.6) | (-1.6) | (-1.6) | (-1.4) |

**Table 4. The Effects of Past Option Exercises on Funds Allocation (continue)**

**Panel A: Full sample period (1996-2015)**

| Dependent Variable: | (1) $Inv_{it}$ | (2) $\Delta C_{it}$ | (3) $ER_{it}$ | (4) $DR_{it}$ | (5) $Div_{it}$ | (6) $Inv_{it}$ | (7) $\Delta C_{it}$ | (8) $ER_{it}$ | (9) $DR_{it}$ | (10) $Div_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| *Continue:* | | | | | | | | | | |
| $DI_{it}$ | 0.274*** | 0.037*** | 0.017*** | 0.670*** | 0.002*** | 0.284*** | 0.038*** | 0.019*** | 0.656*** | 0.002*** |
| | (33.2) | (7.6) | (7.6) | (78.8) | (3.2) | (34.2) | (7.5) | (8.1) | (76.8) | (3.8) |
| $DI_{it-1}$ | | | | | | -0.050*** | -0.007** | -0.009*** | 0.069*** | -0.002*** |
| | | | | | | (-8.4) | (-2.0) | (-4.6) | (11.4) | (-4.0) |
| $DI_{it-2}$ | | | | | | -0.025*** | 0.004 | -0.005*** | 0.027*** | -0.002*** |
| | | | | | | (-5.1) | (1.3) | (-2.9) | (5.7) | (-3.2) |
| *Controls* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Obs* | 17,367 | 17,367 | 17,367 | 17,367 | 17,367 | 17,367 | 17,367 | 17,367 | 17,367 | 17,367 |
| $R^2$ | 0.33 | 0.21 | 0.11 | 0.69 | 0.07 | 0.34 | 0.23 | 0.13 | 0.70 | 0.07 |

**Panel B: Subsample period (2006-2015)**

| Dependent Variable: | (1) $Inv_{it}$ | (2) $\Delta C_{it}$ | (3) $ER_{it}$ | (4) $DR_{it}$ | (5) $Div_{it}$ | (6) $Inv_{it}$ | (7) $\Delta C_{it}$ | (8) $ER_{it}$ | (9) $DR_{it}$ | (10) $Div_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $CF_{it}$ | 0.380*** | 0.381*** | 0.072*** | 0.151*** | 0.015*** | 0.361*** | 0.410*** | 0.058*** | 0.158*** | 0.013*** |
| | (20.6) | (21.7) | (9.5) | (10.9) | (6.3) | (19.4) | (23.2) | (7.7) | (11.1) | (5.2) |
| $CF_{it-1}$ | | | | | | 0.071*** | -0.111*** | 0.059*** | -0.026* | 0.007*** |
| | | | | | | (4.2) | (-7.0) | (7.8) | (-1.9) | (2.8) |
| $CF_{it-2}$ | | | | | | 0.091*** | -0.064*** | 0.011 | -0.044*** | 0.008*** |
| | | | | | | (5.9) | (-4.7) | (1.4) | (-3.9) | (3.6) |
| $OP_{it}+TB_{it}$ | 0.418*** | 0.523*** | 0.310*** | -0.258*** | 0.008 | 0.387*** | 0.602*** | 0.237*** | -0.218*** | 0.006 |
| | (4.3) | (5.5) | (5.5) | (-3.9) | (0.6) | (3.7) | (6.0) | (4.1) | (-3.2) | (0.4) |
| $OP_{it-1}+TB_{it-1}$ | | | | | | 0.035 | -0.245** | 0.203*** | -0.024 | -0.006 |
| | | | | | | (0.3) | (-2.5) | (3.6) | (-0.4) | (-0.4) |
| $OP_{it-2}+TB_{it-2}$ | | | | | | -0.033 | -0.013 | 0.063 | -0.089 | 0.022* |
| | | | | | | (-0.3) | (-0.1) | (1.3) | (-1.5) | (1.8) |

**Table 4. The Effects of Past Option Exercises on Funds Allocation (continue)**

**Panel B: Subsample period (2006-2015)**

| Dependent Variable: | (1) $Inv_{it}$ | (2) $\Delta C_{it}$ | (3) $ER_{it}$ | (4) $DR_{it}$ | (5) $Div_{it}$ | (6) $Inv_{it}$ | (7) $\Delta C_{it}$ | (8) $ER_{it}$ | (9) $DR_{it}$ | (10) $Div_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| *Continue:* | | | | | | | | | | |
| $EI_{it}$-($OP_{it}$+$TB_{it}$) | 0.410*** | 0.481*** | -0.022** | 0.127*** | 0.003 | 0.410*** | 0.473*** | -0.015 | 0.126*** | 0.004 |
| | (7.7) | (9.4) | (-2.0) | (4.2) | (1.3) | (7.8) | (9.3) | (-1.3) | (4.2) | (1.6) |
| $EI_{it-1}$-($OP_{it-1}$+$TB_{it-1}$) | | | | | | 0.055 | -0.049 | -0.003 | -0.003 | -0.000 |
| | | | | | | (1.6) | (-1.4) | (-0.2) | (-0.1) | (-0.1) |
| $EI_{it-2}$-($OP_{it-2}$+$TB_{it-2}$) | | | | | | 0.079*** | -0.051* | -0.015 | -0.011 | -0.001 |
| | | | | | | (2.8) | (-1.7) | (-1.5) | (-0.5) | (-0.4) |
| $DI_{it}$ | 0.253*** | 0.037*** | 0.022*** | 0.685*** | 0.002** | 0.267*** | 0.038*** | 0.023*** | 0.667*** | 0.003*** |
| | (23.4) | (6.0) | (6.7) | (61.7) | (2.3) | (24.7) | (5.8) | (7.0) | (60.6) | (3.3) |
| $DI_{it-1}$ | | | | | | -0.058*** | -0.008 | -0.008*** | 0.078*** | -0.004*** |
| | | | | | | (-7.1) | (-1.5) | (-3.1) | (9.8) | (-4.9) |
| $DI_{it-2}$ | | | | | | -0.023*** | 0.007 | -0.006*** | 0.025*** | -0.003*** |
| | | | | | | (-3.5) | (1.6) | (-2.7) | (3.9) | (-3.5) |
| *Controls* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Obs* | 9,553 | 9,553 | 9,553 | 9,553 | 9,553 | 9,553 | 9,553 | 9,553 | 9,553 | 9,553 |
| $R^2$ | 0.29 | 0.19 | 0.12 | 0.71 | 0.05 | 0.30 | 0.21 | 0.13 | 0.72 | 0.06 |

## Table 5. Financial Constraint and Allocation of Equity Issuance Proceeds

This table depicts the rates of allocation of option proceeds and other equity proceeds to different uses of funds, computed by regressing each use of funds on the sources of funds for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the period 1996-2015. Uses include investment (*Inv*), cash savings ($\Delta C$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* is a plug that balances the cash flow identity in the presence of reporting errors and/or rounding adjustments. Sources include internal cash flow net of changes in working capital (*CF*), option proceeds (*OP*), other equity proceeds (*EI-OP*), and debt proceeds (*DI*). Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. *EI-OP* is equity issuance proceeds less option proceeds. Variables are demeaned by firm and scaled by book assets. Control variables include the ratio of market to book value of assets (*MB*), annual sales growth rate (*Sales growth)*, log of book assets (*Ln(Assets)*), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility)*. Each year, a firm is classified as being financially less constrained if its *Ln(Assets)* is above the 70th percentile, its HP or WW index is below the 30th percentile, it pays dividends, or has a credit rating. A firm is classified as being financially more constrained if its *Ln(Assets)* is below the 30th percentile, its HP or WW index is above the 70th percentile, it pays no dividends, or has no credit rating. Regressions are estimated for the two groups of firms combined i.e. more constrained (*Con.*) and less constrained firms (*UCon.*), but with an interaction term with the respective financial constraint measure for each explanatory variable. *Diff.* collectively refers to the interaction terms with either *OP* or *EI-OP*. For brevity, only the coefficients on *OP*, and *EI–OP* are reported. The coefficients of *Oth* are also omitted as they are not significantly different from zero. Regressions are run by ordinary least squares with year fixed effects. T-statistics are in parentheses and computed using standard errors robust to heteroskedasticity, and clustering at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

### Panel A: Full sample period (1996-2015)

| | | *Inv* | | | *ΔC* | | | *ER* | | | *DR* | | | *Div* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constraint | | (1) | (2) | (1) - (2) | (3) | (4) | (3) - (4) | (5) | (6) | (5) - (6) | (7) | (8) | (7) - (8) | (9) | (10) | (9) - (10) |
| Measure: | | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* |
| *Ln(Assets)* | *OP* | 0.335*** | -0.011 | 0.345* | 0.755*** | 0.545*** | 0.209 | 0.067 | 0.582*** | -0.515*** | -0.176*** | -0.122 | -0.054 | 0.020* | 0.005 | 0.014 |
| | | (3.4) | (-0.1) | (2.0) | (7.9) | (4.3) | (1.3) | (1.6) | (6.1) | (-4.9) | (-2.9) | (-1.2) | (-0.5) | (1.7) | (0.3) | (0.6) |
| | *EI-OP* | 0.362*** | 0.605*** | -0.243*** | 0.487*** | 0.262*** | 0.225*** | 0.002 | 0.030 | -0.029 | 0.145*** | 0.111* | 0.034 | 0.004*** | -0.009 | 0.013* |
| | | (12.6) | (8.3) | (-3.1) | (18.7) | (4.4) | (3.5) | (0.4) | (1.0) | (-1.0) | (11.2) | (1.7) | (0.5) | (2.8) | (-1.4) | (2.0) |
| | *Obs* | 7,382 | 7,363 | | 7,382 | 7,363 | | 7,382 | 7,363 | | 7,382 | 7,363 | | 7,382 | 7,363 | |
| | $R^2$ | 0.32 | 0.39 | | 0.33 | 0.11 | | 0.08 | 0.17 | | 0.68 | 0.65 | | 0.06 | 0.13 | |
| *HP Index* | *OP* | 0.400*** | -0.069 | 0.469*** | 0.704*** | 0.488*** | 0.216 | 0.076* | 0.734*** | -0.658*** | -0.208*** | -0.247** | 0.039 | 0.028** | 0.094*** | -0.067** |
| | | (4.0) | (-0.5) | (2.6) | (7.3) | (3.4) | (1.2) | (1.7) | (8.2) | (-6.6) | (-3.5) | (-2.0) | (0.3) | (2.5) | (4.0) | (-2.6) |
| | *EI-OP* | 0.348*** | 0.396*** | -0.048 | 0.492*** | 0.283*** | 0.208*** | 0.010* | 0.006 | 0.003 | 0.147*** | 0.326*** | -0.179** | 0.003*** | -0.012** | 0.015*** |
| | | (12.7) | (5.4) | (-0.6) | (19.2) | (4.0) | (2.8) | (1.9) | (0.4) | (0.2) | (11.1) | (4.0) | (-2.2) | (3.1) | (-2.2) | (2.8) |
| | *Obs* | 7,153 | 7,171 | | 7,153 | 7,171 | | 7,153 | 7,171 | | 7,153 | 7,171 | | 7,153 | 7,171 | |
| | $R^2$ | 0.34 | 0.36 | | 0.34 | 0.12 | | 0.10 | 0.19 | | 0.65 | 0.67 | | 0.06 | 0.17 | |

## Table 5. Financial Constraint and Allocation of Equity Issuance Proceeds (continue)

## Panel A: Full sample period (1996-2015)

| | | *Inv* | | | *ΔC* | | | *ER* | | | *DR* | | | *Div* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constraint | | (1) | (2) | (1) - (2) | (3) | (4) | (3) - (4) | (5) | (6) | (5) - (6) | (7) | (8) | (7) - (8) | (9) | (10) | (9) - (10) |
| Measure: | | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* |
| *Continue:* | | | | | | | | | | | | | | | | |
| *WW Index* | *OP* | 0.363*** | 0.003 | 0.360* | 0.733*** | 0.479*** | 0.255 | 0.032 | 0.591*** | -0.558*** | -0.149** | -0.078 | -0.071 | 0.021** | 0.006 | 0.014 |
| | | (3.6) | (0.0) | (1.9) | (7.6) | (3.2) | (1.4) | (0.8) | (6.2) | (-5.4) | (-2.4) | (-0.8) | (-0.6) | (2.1) | (0.3) | (0.6) |
| | *EI-OP* | 0.363*** | 0.568*** | -0.205** | 0.489*** | 0.328*** | 0.162* | 0.003 | 0.055* | -0.052* | 0.143*** | 0.052 | 0.091 | 0.002** | -0.004 | 0.006 |
| | | (13.3) | (6.5) | (-2.2) | (19.5) | (3.9) | (1.9) | (0.6) | (1.8) | (-1.7) | (11.1) | (0.9) | (1.6) | (2.5) | (-0.6) | (0.9) |
| | *Obs* | 7,355 | 7,373 | | 7,355 | 7,373 | | 7,355 | 7,373 | | 7,355 | 7,373 | | 7,355 | 7,373 | |
| | $R^2$ | 0.32 | 0.42 | | 0.34 | 0.11 | | 0.08 | 0.18 | | 0.67 | 0.65 | | 0.03 | 0.13 | |
| *Dividend* | *OP* | 0.355*** | -0.097 | 0.452*** | 0.720*** | 0.464*** | 0.255* | 0.098*** | 0.659*** | -0.561*** | -0.180*** | -0.094 | -0.087 | 0.008 | 0.067*** | -0.059** |
| *Payer* | | (4.3) | (-0.8) | (3.2) | (9.1) | (4.2) | (1.9) | (2.6) | (9.3) | (-7.0) | (-3.4) | (-1.0) | (-0.8) | (1.4) | (2.8) | (-2.4) |
| *Dummy* | *EI-OP* | 0.364*** | 0.487*** | -0.123 | 0.467*** | 0.338*** | 0.129** | 0.005 | 0.005 | -0.000 | 0.162*** | 0.175*** | -0.012 | 0.002*** | -0.004 | 0.006 |
| | | (15.6) | (6.5) | (-1.6) | (22.0) | (5.6) | (2.0) | (1.0) | (0.3) | (-0.0) | (12.0) | (4.9) | (-0.3) | (2.9) | (-0.6) | (0.9) |
| | *Obs* | 13,127 | 11,443 | | 13,127 | 11,443 | | 13,127 | 11,443 | | 13,127 | 11,443 | | 13,127 | 11,443 | |
| | $R^2$ | 0.34 | 0.39 | | 0.29 | 0.13 | | 0.10 | 0.16 | | 0.66 | 0.72 | | 0.03 | 0.14 | |
| *Credit* | *OP* | 0.371*** | -0.166 | 0.537*** | 0.685*** | 0.631*** | 0.053 | 0.121*** | 0.556*** | -0.435*** | -0.201*** | 0.002 | -0.203* | 0.024*** | -0.022 | 0.047*** |
| *Rating* | | (4.5) | (-1.5) | (3.9) | (8.7) | (5.4) | (0.4) | (3.1) | (8.8) | (-5.9) | (-4.0) | (0.0) | (-1.8) | (2.7) | (-1.5) | (2.7) |
| *Dummy* | *EI-OP* | 0.382*** | 0.374*** | 0.007 | 0.467*** | 0.377*** | 0.090** | 0.005 | 0.011 | -0.005 | 0.142*** | 0.239*** | -0.097** | 0.003*** | -0.001 | 0.004* |
| | | (14.7) | (10.7) | (0.2) | (19.9) | (9.7) | (2.0) | (1.1) | (1.0) | (-0.5) | (11.8) | (5.8) | (-2.2) | (2.9) | (-0.4) | (1.7) |
| | *Obs* | 12,284 | 12,286 | | 12,284 | 12,286 | | 12,284 | 12,286 | | 12,284 | 12,286 | | 12,284 | 12,286 | |
| | $R^2$ | 0.35 | 0.36 | | 0.29 | 0.16 | | 0.10 | 0.16 | | 0.68 | 0.69 | | 0.06 | 0.10 | |

## Table 5. Financial Constraint and Allocation of Equity Issuance Proceeds (continue)

## Panel B: Subsample period (2006-2015)

| | | *Inv* | | | *ΔC* | | | *ER* | | | *DR* | | | *Div* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constraint | | (1) | (2) | (1) - (2) | (3) | (4) | (3) - (4) | (5) | (6) | (5) - (6) | (7) | (8) | (7) - (8) | (9) | (10) | (9) - (10) |
| Measure: | | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* | *Con* | *UnCon* | *Diff.* |
| *Ln(Assets)* | *OP+TB* | 0.536*** | 0.153 | 0.383* | 0.757*** | 0.400*** | 0.357* | 0.036 | 0.661*** | -0.625*** | -0.217** | -0.098 | -0.119 | 0.006 | -0.050* | 0.057* |
| | | (4.0) | (0.9) | (1.7) | (6.0) | (2.7) | (1.8) | (0.5) | (5.5) | (-4.5) | (-2.4) | (-0.8) | (-0.8) | (0.3) | (-1.8) | (1.7) |
| | *EI-(OP+TB)* | 0.211*** | 0.582*** | -0.370** | 0.427*** | -0.033 | 0.460*** | 0.018 | 0.113** | -0.095** | 0.111*** | -0.051 | 0.162 | 0.001 | 0.055*** | -0.054*** |
| | | (4.2) | (4.2) | (-2.5) | (8.4) | (-0.6) | (6.0) | (1.6) | (2.6) | (-2.1) | (3.8) | (-0.5) | (1.4) | (0.3) | (3.9) | (-3.9) |
| | *Obs* | 3,442 | 3,432 | | 3,442 | 3,432 | | 3,442 | 3,432 | | 3,442 | 3,432 | | 3,442 | 3,432 | |
| | $R^2$ | 0.25 | 0.33 | | 0.26 | 0.09 | | 0.08 | 0.18 | | 0.69 | 0.68 | | 0.06 | 0.11 | |
| *HP Index* | *OP+TB* | 0.532*** | 0.132 | 0.400* | 0.732*** | 0.248 | 0.484** | 0.079 | 0.804*** | -0.725*** | -0.225*** | -0.248* | 0.023 | 0.019 | 0.045 | -0.026 |
| | | (4.1) | (0.7) | (1.7) | (5.9) | (1.4) | (2.2) | (1.2) | (6.8) | (-5.4) | (-2.7) | (-1.8) | (0.1) | (1.1) | (1.4) | (-0.7) |
| | *EI-(OP+TB)* | 0.216*** | 0.396*** | -0.180 | 0.404*** | 0.159** | 0.245*** | 0.015 | 0.006 | 0.009 | 0.123*** | 0.247* | -0.124 | -0.002 | 0.021** | -0.023** |
| | | (4.2) | (3.6) | (-1.5) | (7.8) | (2.4) | (2.9) | (1.3) | (0.3) | (0.4) | (4.3) | (1.9) | (-0.9) | (-0.8) | (2.3) | (-2.4) |
| | *Obs* | 3,409 | 3,419 | | 3,409 | 3,419 | | 3,409 | 3,419 | | 3,409 | 3,419 | | 3,409 | 3,419 | |
| | $R^2$ | 0.27 | 0.30 | | 0.27 | 0.11 | | 0.09 | 0.19 | | 0.63 | 0.71 | | 0.04 | 0.15 | |
| *WW Index* | *OP+TB* | 0.558*** | -0.041 | 0.599** | 0.718*** | 0.312 | 0.407* | 0.046 | 0.636*** | -0.590*** | -0.204** | 0.144 | -0.348** | 0.019 | -0.043 | 0.062 |
| | | (4.1) | (-0.2) | (2.6) | (5.7) | (1.6) | (1.8) | (0.7) | (5.1) | (-4.2) | (-2.2) | (1.3) | (-2.4) | (1.1) | (-1.2) | (1.6) |
| | *EI-(OP+TB)* | 0.260*** | 0.521*** | -0.261 | 0.401*** | 0.168* | 0.233** | 0.005 | 0.054 | -0.049 | 0.103*** | -0.192* | 0.295*** | 0.003* | 0.089*** | -0.086*** |
| | | (5.3) | (3.0) | (-1.4) | (8.1) | (1.7) | (2.1) | (0.5) | (1.3) | (-1.2) | (3.8) | (-1.8) | (2.7) | (1.9) | (4.9) | (-4.7) |
| | *Obs* | 3,432 | 3,442 | | 3,432 | 3,442 | | 3,432 | 3,442 | | 3,432 | 3,442 | | 3,432 | 3,442 | |
| | $R^2$ | 0.27 | 0.35 | | 0.25 | 0.10 | | 0.07 | 0.21 | | 0.66 | 0.71 | | 0.03 | 0.13 | |
| *Dividend Payer* | *OP+TB* | 0.513*** | 0.105 | 0.408** | 0.729*** | 0.332** | 0.397** | 0.089 | 0.693*** | -0.604*** | -0.233*** | -0.084 | -0.148 | 0.002 | -0.005 | 0.006 |
| *Dummy* | | (4.6) | (0.7) | (2.3) | (7.1) | (2.3) | (2.2) | (1.5) | (7.6) | (-5.6) | (-3.1) | (-0.8) | (-1.2) | (0.2) | (-0.1) | (0.2) |
| | *EI-(OP+TB)* | 0.262*** | 0.489*** | -0.226** | 0.376*** | 0.149** | 0.227*** | 0.004 | 0.066 | -0.062 | 0.114*** | -0.125** | 0.240*** | 0.003** | 0.084*** | -0.081*** |
| | | (6.1) | (5.2) | (-2.2) | (8.6) | (2.4) | (3.0) | (0.4) | (1.6) | (-1.5) | (3.9) | (-2.1) | (3.6) | (2.5) | (5.2) | (-5.0) |
| | *Obs* | 5,886 | 5,567 | | 5,886 | 5,567 | | 5,886 | 5,567 | | 5,886 | 5,567 | | 5,886 | 5,567 | |
| | $R^2$ | 0.28 | 0.30 | | 0.22 | 0.12 | | 0.09 | 0.19 | | 0.65 | 0.77 | | 0.03 | 0.12 | |
| *Credit Rating* | *OP+TB* | 0.523*** | 0.133 | 0.390** | 0.690*** | 0.411*** | 0.278* | 0.108* | 0.684*** | -0.576*** | -0.241*** | -0.081 | -0.160 | 0.026* | -0.062*** | 0.089*** |
| *Dummy* | | (4.7) | (1.0) | (2.3) | (6.6) | (3.4) | (1.7) | (1.8) | (8.1) | (-5.6) | (-3.3) | (-0.7) | (-1.2) | (1.8) | (-2.9) | (3.4) |
| | *EI-(OP+TB)* | 0.277*** | 0.331*** | -0.055 | 0.375*** | 0.231*** | 0.144* | 0.012 | 0.035 | -0.023 | 0.073*** | 0.157* | -0.085 | -0.002 | 0.017*** | -0.019*** |
| | | (6.0) | (4.6) | (-0.6) | (7.9) | (3.5) | (1.8) | (1.2) | (1.6) | (-0.9) | (2.9) | (1.8) | (-0.9) | (-1.0) | (3.0) | (-3.2) |
| | *Obs* | 5,197 | 6,256 | | 5,197 | 6,256 | | 5,197 | 6,256 | | 5,197 | 6,256 | | 5,197 | 6,256 | |
| | $R^2$ | 0.27 | 0.30 | | 0.23 | 0.12 | | 0.10 | 0.17 | | 0.69 | 0.72 | | 0.05 | 0.09 | |

## Table 6. Hedging Needs and Allocation of Equity Issuance Proceeds

This table depicts the rates of allocation to various uses, computed by regressing each use of funds on the sources of funds for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the period 1996-2015. Uses include investment (*Inv*), cash savings ($\Delta C$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* is a plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. Sources include internal cash flow net of changes in working capital (*CF*), option proceeds (*OP*), other equity proceeds (*EI-OP*), and debt proceeds (*DI*). Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. *EI-OP* is equity issuance proceeds less option proceeds. Variables are demeaned by firm and scaled by book assets. Control variables include the ratio of market to book value of assets (*MB*), annual sales growth rate (*Sales growth*), log of book assets (*Ln*(*Assets*)), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility*). Two investment measures are used to compute the correlation between option proceeds and investment opportunities; The first (second) correlation measure is computed as the correlation of option proceeds and the industry-level median research and development expenditure (three-year-ahead sales growth rate), whereby a firm's industry is based on its three-digit SIC code. For both correlation measures, firms are assigned to the group with "low (high) hedging needs" if their empirical correlation is above 0.2 (below -0.2). Regressions are also estimated for the two groups of firms combined i.e. firms with high hedging needs (*High*) and firms with low hedging needs (*Low*), but with an interaction term with the respective correlation measure for each explanatory variable. *Diff*. collectively refers to the interaction terms with the respective correlation measure. For brevity, only the coefficients on *CF* and *OP* are reported. Control variables are included in the regressions but not reported. The coefficients of *Oth* are also omitted as they are not significantly different from zero. Regressions are run by ordinary least squares with year fixed effects. T-statistics are in parentheses and computed using standard errors robust to heteroskedasticity, and clustering at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

| Dependent Variable: | *Inv* | | | *ΔC* | | | *ER* | | | *DR* | | | *Div* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (1) - (2) | (3) | (4) | (3) - (4) | (5) | (6) | (5) - (6) | (7) | (8) | (7) - (8) | (9) | (10) | (9) - (10) |
| | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* |
| ***Correlation Measure 1: Industry Median R&D Investment*** | | | | | | | | | | | | | | | |
| $CF_{it}$ | 0.457*** | 0.394*** | 0.063 | 0.341*** | 0.361*** | -0.020 | 0.020 | 0.080*** | -0.060*** | 0.171*** | 0.150*** | 0.022 | 0.010* | 0.015*** | -0.004 |
| | (11.5) | (10.0) | (1.1) | (9.8) | (9.8) | (-0.4) | (1.3) | (5.4) | (-2.9) | (5.3) | (4.9) | (0.5) | (2.0) | (4.2) | (-0.7) |
| $OP_{it}$ | 0.212 | -0.330 | 0.542 | 0.811*** | 1.150*** | -0.339 | 0.306** | 0.404*** | -0.098 | -0.423 | -0.234 | -0.189 | 0.094** | 0.014 | 0.080* |
| | (0.7) | (-1.2) | (1.3) | (3.1) | (4.1) | (-0.9) | (2.3) | (3.1) | (-0.5) | (-1.6) | (-1.1) | (-0.6) | (2.4) | (0.5) | (1.7) |
| *Obs* | 1,574 | 1,794 | | 1,574 | 1,794 | | 1,574 | 1,794 | | 1,574 | 1,794 | | 1,574 | 1,794 | |
| $R^2$ | 0.42 | 0.42 | | 0.27 | 0.27 | | 0.11 | 0.14 | | 0.67 | 0.66 | | 0.10 | 0.08 | |
| ***Correlation Measure 2: Industry Median Three-Years-Ahead Sales Growth Rate*** | | | | | | | | | | | | | | | |
| $CF_{it}$ | 0.389*** | 0.433*** | -0.044 | 0.322*** | 0.337*** | -0.016 | 0.065*** | 0.057*** | 0.008 | 0.204*** | 0.163*** | 0.041 | 0.020*** | 0.009*** | 0.011* |
| | (12.3) | (14.0) | (-1.0) | (11.6) | (12.2) | (-0.4) | (5.0) | (5.3) | (0.5) | (7.0) | (6.3) | (1.1) | (4.1) | (2.7) | (1.9) |
| $OP_{it}$ | -0.145 | -0.059 | -0.086 | 1.012*** | 0.943*** | 0.069 | 0.345*** | 0.455*** | -0.110 | -0.295* | -0.341 | 0.046 | 0.084** | 0.005 | 0.079* |
| | (-0.7) | (-0.2) | (-0.3) | (5.0) | (3.5) | (0.2) | (3.1) | (3.5) | (-0.6) | (-1.8) | (-1.4) | (0.2) | (2.3) | (0.2) | (1.8) |
| *Obs* | 2,897 | 2,374 | | 2,897 | 2,374 | | 2,897 | 2,374 | | 2,897 | 2,374 | | 2,897 | 2,374 | |
| $R^2$ | 0.40 | 0.40 | | 0.24 | 0.31 | | 0.13 | 0.12 | | 0.66 | 0.73 | | 0.11 | 0.07 | |

## Table 7. Corporate Governance and Allocation of Equity Issuance Proceeds

This table depicts the rates of allocation of option proceeds and other equity proceeds to different uses of funds, computed by regressing each use of funds on the sources of funds for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the period 1996-2015. Uses include investment (*Inv*), cash savings ($\Delta C$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* is a plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. Sources include internal cash flow net of changes in working capital (*CF*), option proceeds (*OP*), other equity proceeds (*EI-OP*), and debt proceeds (*DI*). Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. *EI-OP* is equity issuance proceeds less option proceeds. Variables are demeaned by firm and scaled by book assets. Control variables include the ratio of market to book value of assets (*MB*), annual sales growth rate (*Sales growth)*, log of book assets (*Ln(Assets)*), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility)*. Each year, a firm is said to have low corporate governance if its dedicated institutional ownership, institutional ownership, proportion of independent directors, or log number of directors is below the 30$^{th}$ percentile, its *GINDEX* is above the 70$^{th}$ percentile, its *EINDEX* is greater than or equal to 4 or when its chief executive officer (CEO) is the chairperson of its board (*CEO duality*). A firm is said to have high corporate governance if its dedicated institutional ownership, institutional ownership, proportion of independent directors, or log number of directors is above the 70$^{th}$ percentile, its *GINDEX* is below the 30$^{th}$ percentile, its *EINDEX* is less than or equal to 2 or when its CEO is not the chairperson of its board. Regressions are estimated for the two groups of firms combined i.e. firms with low corporate governance (*Low*) and firms with high corporate governance (*High*), but with an interaction term with the respective corporate governance measure for each explanatory variable. *Diff.* collectively refers to the interaction terms with either *OP* or *EI-OP*. For brevity, only the coefficients on *OP*, and *EI–OP* are reported. Coefficients of *Oth* are also omitted as they are not significantly different from zero. Regressions are run by ordinary least squares with year fixed effects. T-statistics are in parentheses and computed using standard errors robust to heteroskedasticity, and clustering at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

### Panel A: Full sample period (1996-2015)

| | | *Inv* | | | *ΔC* | | | *ER* | | | *DR* | | | *Div* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Governance | | (1) | (2) | (1) - (2) | (3) | (4) | (3) - (4) | (5) | (6) | (5) - (6) | (7) | (8) | (7) - (8) | (9) | (10) | (9) - (10) |
| Measure: | | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* |
| *Dedicated* | *OP* | 0.124 | 0.320*** | -0.195 | 0.799*** | 0.588*** | 0.211 | 0.189*** | 0.213*** | -0.024 | -0.101 | -0.131 | 0.031 | -0.011 | 0.011 | -0.021 |
| *Institutional* | | (1.0) | (2.8) | (-1.1) | (6.3) | (5.4) | (1.3) | (3.2) | (3.4) | (-0.3) | (-1.2) | (-1.6) | (0.3) | (-0.8) | (0.7) | (-1.0) |
| *Ownership* | *EI-OP* | 0.369*** | 0.428*** | -0.060 | 0.435*** | 0.431*** | 0.005 | -0.000 | 0.005 | -0.005 | 0.193*** | 0.136*** | 0.057 | 0.003 | -0.001 | 0.003 |
| | | (9.5) | (11.4) | (-1.1) | (13.8) | (11.4) | (0.1) | (-0.0) | (0.5) | (-0.5) | (9.5) | (4.8) | (1.6) | (1.5) | (-0.4) | (1.4) |
| | *Obs* | 7,371 | 7,371 | | 7,371 | 7,371 | | 7,371 | 7,371 | | 7,371 | 7,371 | | 7,371 | 7,371 | |
| | $R^2$ | 0.36 | 0.35 | | 0.29 | 0.20 | | 0.12 | 0.12 | | 0.68 | 0.70 | | 0.08 | 0.05 | |
| *Institutional* | *OP* | 0.141 | 0.304*** | -0.163 | 0.764*** | 0.591*** | 0.174 | 0.228*** | 0.229*** | -0.001 | -0.120 | -0.149** | 0.029 | -0.013 | 0.024* | -0.038** |
| *Ownership* | | (1.1) | (2.7) | (-1.0) | (6.2) | (5.1) | (1.0) | (3.9) | (3.5) | (-0.0) | (-1.4) | (-2.0) | (0.3) | (-1.0) | (1.9) | (-2.0) |
| | *EI-OP* | 0.364*** | 0.428*** | -0.064 | 0.458*** | 0.461*** | -0.003 | 0.007 | -0.008 | 0.014 | 0.167*** | 0.120*** | 0.048 | 0.004*** | -0.001 | 0.005** |
| | | (10.9) | (9.6) | (-1.2) | (16.1) | (10.1) | (-0.1) | (1.1) | (-0.6) | (1.0) | (9.9) | (3.6) | (1.3) | (2.6) | (-0.4) | (2.0) |
| | *Obs* | 7,371 | 7,371 | | 7,371 | 7,371 | | 7,371 | 7,371 | | 7,371 | 7,371 | | 7,371 | 7,371 | |
| | $R^2$ | 0.36 | 0.33 | | 0.32 | 0.20 | | 0.11 | 0.12 | | 0.67 | 0.68 | | 0.08 | 0.05 | |

## Table 7. Corporate Governance and Allocation of Equity Issuance Proceeds

## Panel A: Full sample period (1996-2015)

| | | *Inv* | | | *ΔC* | | | *ER* | | | *DR* | | | *Div* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Governance | | (1) | (2) | (1) - (2) | (3) | (4) | (3) - (4) | (5) | (6) | (5) - (6) | (7) | (8) | (7) - (8) | (9) | (10) | (9) - (10) |
| Measure: | | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* |
| *Continue:* | | | | | | | | | | | | | | | | |
| *Proportion of* | *OP* | 0.346** | 0.164 | 0.182 | 0.509*** | 0.584*** | -0.075 | 0.175** | 0.463*** | -0.288** | -0.066 | -0.164 | 0.098 | 0.035* | -0.049*** | 0.085*** |
| *Independent* | | (2.3) | (1.0) | (0.8) | (3.3) | (3.8) | (-0.3) | (2.1) | (4.6) | (-2.2) | (-0.7) | (-1.5) | (0.7) | (1.7) | (-2.7) | (3.1) |
| *Directors* | *EI-OP* | 0.308*** | 0.645*** | -0.337*** | 0.494*** | 0.466*** | 0.028 | -0.001 | -0.061** | 0.060** | 0.197*** | -0.043 | 0.240*** | 0.004 | -0.006 | 0.009* |
| | | (7.1) | (6.7) | (-3.2) | (9.3) | (4.7) | (0.2) | (-0.1) | (-2.5) | (2.2) | (5.5) | (-0.6) | (3.1) | (1.3) | (-1.3) | (1.8) |
| | *Obs* | 4,549 | 4,549 | | 4,549 | 4,549 | | 4,549 | 4,549 | | 4,549 | 4,549 | | 4,549 | 4,549 | |
| | $R^2$ | 0.35 | 0.35 | | 0.21 | 0.17 | | 0.11 | 0.17 | | 0.71 | 0.64 | | 0.09 | 0.10 | |
| *Log Number of* | *OP* | 0.230* | 0.116 | 0.114 | 0.719*** | 0.378** | 0.341* | 0.086 | 0.689*** | -0.603*** | -0.058 | -0.157 | 0.099 | 0.023 | -0.025 | 0.047 |
| *Directors* | | (1.8) | (0.7) | (0.5) | (5.7) | (2.4) | (1.7) | (1.3) | (5.9) | (-4.5) | (-0.7) | (-1.2) | (0.6) | (1.5) | (-0.8) | (1.4) |
| | *EI-OP* | 0.408*** | 0.578*** | -0.169 | 0.450*** | 0.310*** | 0.141** | -0.011 | 0.055 | -0.066 | 0.152*** | 0.069 | 0.083 | 0.001 | -0.011 | 0.012 |
| | | (10.2) | (5.3) | (-1.5) | (11.5) | (6.0) | (2.2) | (-0.8) | (1.3) | (-1.5) | (3.6) | (0.9) | (0.9) | (0.4) | (-1.4) | (1.4) |
| | *Obs* | 4,549 | 4,549 | | 4,549 | 4,549 | | 4,549 | 4,549 | | 4,549 | 4,549 | | 4,549 | 4,549 | |
| | $R^2$ | 0.32 | 0.40 | | 0.23 | 0.13 | | 0.10 | 0.19 | | 0.67 | 0.68 | | 0.06 | 0.14 | |
| *G Index* | *OP* | -0.049 | 0.225* | -0.274 | 0.752*** | 0.623*** | 0.129 | 0.393*** | 0.227*** | 0.165* | -0.135 | -0.068 | -0.067 | 0.040** | -0.007 | 0.047** |
| | | (-0.3) | (1.7) | (-1.4) | (5.6) | (5.0) | (0.7) | (5.1) | (3.6) | (1.6) | (-1.1) | (-0.8) | (-0.4) | (2.0) | (-0.6) | (2.0) |
| | *EI-OP* | 0.430*** | 0.394*** | 0.036 | 0.339*** | 0.446*** | -0.107* | -0.001 | -0.001 | 0.000 | 0.238*** | 0.157*** | 0.081 | -0.006** | 0.004*** | -0.010*** |
| | | (6.3) | (10.1) | (0.5) | (6.5) | (12.6) | (-1.7) | (-0.1) | (-0.1) | (0.0) | (3.8) | (7.7) | (1.2) | (-2.1) | (3.0) | (-3.2) |
| | *Obs* | 5,438 | 5,438 | | 5,438 | 5,438 | | 5,438 | 5,438 | | 5,438 | 5,438 | | 5,438 | 5,438 | |
| | $R^2$ | 0.39 | 0.37 | | 0.17 | 0.28 | | 0.16 | 0.11 | | 0.68 | 0.71 | | 0.09 | 0.07 | |
| *E Index* | *OP* | 0.137 | 0.284*** | -0.147 | 0.958*** | 0.583*** | 0.375* | 0.463*** | 0.195*** | 0.267** | -0.508*** | -0.071 | -0.437** | -0.050** | 0.008 | -0.059** |
| | | (0.6) | (3.0) | (-0.6) | (4.7) | (6.3) | (1.7) | (4.0) | (4.1) | (2.2) | (-2.8) | (-1.1) | (-2.3) | (-2.4) | (0.9) | (-2.5) |
| | *EI-OP* | 0.418*** | 0.341*** | 0.077 | 0.337*** | 0.482*** | -0.145* | -0.015 | 0.002 | -0.016 | 0.248*** | 0.173*** | 0.074 | 0.012** | 0.002* | 0.010* |
| | | (4.3) | (10.7) | (0.8) | (4.6) | (16.5) | (-1.8) | (-0.6) | (0.2) | (-0.7) | (3.1) | (9.6) | (0.9) | (2.2) | (1.9) | (1.7) |
| | *Obs* | 2,688 | 10,780 | | 2,688 | 10,780 | | 2,688 | 10,780 | | 2,688 | 10,780 | | 2,688 | 10,780 | |
| | $R^2$ | 0.38 | 0.36 | | 0.20 | 0.27 | | 0.17 | 0.11 | | 0.70 | 0.69 | | 0.10 | 0.07 | |
| *CEO Duality* | *OP* | 0.239** | 0.085 | 0.154 | 0.603*** | 0.742*** | -0.139 | 0.247*** | 0.221** | 0.026 | -0.103 | -0.039 | -0.064 | 0.013 | -0.009 | 0.022 |
| | | (2.3) | (0.6) | (0.9) | (5.6) | (5.7) | (-0.8) | (4.5) | (2.5) | (0.3) | (-1.4) | (-0.4) | (-0.5) | (1.0) | (-0.5) | (1.0) |
| | *EI-OP* | 0.465*** | 0.415*** | 0.050 | 0.408*** | 0.474*** | -0.066 | -0.012 | -0.002 | -0.009 | 0.145*** | 0.108*** | 0.036 | -0.005** | 0.005* | -0.011*** |
| | | (11.5) | (7.2) | (0.7) | (10.3) | (8.1) | (-0.9) | (-1.1) | (-0.1) | (-0.4) | (4.2) | (3.7) | (0.8) | (-2.1) | (2.0) | (-2.9) |
| | *Obs* | 10,233 | 4,929 | | 10,233 | 4,929 | | 10,233 | 4,929 | | 10,233 | 4,929 | | 10,233 | 4,929 | |
| | $R^2$ | 0.36 | 0.30 | | 0.18 | 0.19 | | 0.14 | 0.12 | | 0.67 | 0.71 | | 0.08 | 0.07 | |

## Table 7. Corporate Governance and Allocation of Equity Issuance Proceeds (continue)

## Panel B: Subsample period (2006-2015)

| | | *Inv* | | | *ΔC* | | | *ER* | | | *DR* | | | *Div* | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Governance | | (1) | (2) | (1) - (2) | (3) | (4) | (3) - (4) | (5) | (6) | (5) - (6) | (7) | (8) | (7) - (8) | (9) | (10) | (9) - (10) |
| Measure: | | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* | *Low* | *High* | *Diff.* |
| *Dedicated* | *OP+TB* | 0.605*** | 0.410** | 0.195 | 0.399** | 0.715*** | -0.317 | 0.390*** | 0.167* | 0.224* | -0.182 | -0.199* | 0.017 | -0.032 | 0.002 | -0.034 |
| *Institutional* | | (3.3) | (2.5) | (0.8) | (2.4) | (4.8) | (-1.4) | (4.1) | (1.8) | (1.7) | (-1.4) | (-1.8) | (0.1) | (-1.4) | (0.1) | (-1.1) |
| *Ownership* | *EI-(OP+TB)* | 0.223*** | 0.331*** | -0.109 | 0.289*** | 0.288*** | 0.001 | 0.007 | -0.007 | 0.014 | 0.157*** | 0.060 | 0.097 | 0.001 | -0.003 | 0.005 |
| | | (3.1) | (5.1) | (-1.1) | (4.6) | (4.6) | (0.0) | (0.4) | (-0.5) | (0.6) | (3.3) | (1.4) | (1.5) | (0.6) | (-1.3) | (1.3) |
| | *Obs* | 3,436 | 3,436 | | 3,436 | 3,436 | | 3,436 | 3,436 | | 3,436 | 3,436 | | 3,436 | 3,436 | |
| | $R^2$ | 0.30 | 0.29 | | 0.21 | 0.16 | | 0.12 | 0.13 | | 0.66 | 0.68 | | 0.07 | 0.04 | |
| *Institutional* | *OP+TB* | 0.571*** | 0.422*** | 0.150 | 0.524*** | 0.620*** | -0.096 | 0.306*** | 0.228** | 0.078 | -0.204 | -0.144 | -0.060 | -0.040 | 0.032** | -0.072** |
| *Ownership* | | (3.2) | (2.7) | (0.6) | (3.4) | (4.2) | (-0.4) | (3.5) | (2.5) | (0.6) | (-1.6) | (-1.6) | (-0.4) | (-1.5) | (2.0) | (-2.4) |
| | *EI-(OP+TB)* | 0.231*** | 0.318*** | -0.087 | 0.287*** | 0.255*** | 0.032 | 0.001 | 0.020 | -0.019 | 0.139*** | 0.054 | 0.085 | 0.004 | -0.003 | 0.007** |
| | | (3.9) | (5.1) | (-1.0) | (5.5) | (4.7) | (0.4) | (0.1) | (1.1) | (-0.8) | (3.8) | (1.1) | (1.4) | (1.5) | (-1.3) | (2.0) |
| | *Obs* | 3,436 | 3,436 | | 3,436 | 3,436 | | 3,436 | 3,436 | | 3,436 | 3,436 | | 3,436 | 3,436 | |
| | $R^2$ | 0.30 | 0.26 | | 0.21 | 0.17 | | 0.11 | 0.14 | | 0.65 | 0.67 | | 0.06 | 0.04 | |
| *Proportion of* | *OP+TB* | 0.102 | 0.280 | -0.178 | 0.899*** | 0.363** | 0.536** | 0.025 | 0.815*** | -0.790*** | 0.070 | -0.306** | 0.376** | -0.031 | -0.051** | 0.020 |
| *Independent* | | (0.5) | (1.4) | (-0.6) | (4.6) | (2.2) | (2.1) | (0.2) | (6.8) | (-4.7) | (0.6) | (-2.2) | (2.1) | (-1.2) | (-2.1) | (0.6) |
| *Directors* | *EI-(OP+TB)* | 0.196*** | 0.387*** | -0.191 | 0.295*** | 0.282* | 0.013 | 0.018 | 0.045* | -0.027 | 0.140*** | -0.057* | 0.197*** | -0.001 | 0.007 | -0.008 |
| | | (3.3) | (2.9) | (-1.3) | (5.0) | (1.9) | (0.1) | (0.6) | (1.9) | (-0.7) | (3.0) | (-1.8) | (3.5) | (-0.2) | (1.5) | (-1.1) |
| | *Obs* | 2,410 | 2,409 | | 2,410 | 2,409 | | 2,410 | 2,409 | | 2,410 | 2,409 | | 2,410 | 2,409 | |
| | $R^2$ | 0.27 | 0.30 | | 0.19 | 0.18 | | 0.12 | 0.21 | | 0.72 | 0.63 | | 0.06 | 0.15 | |
| *Log Number* | *OP+TB* | 0.207 | 0.396* | -0.189 | 0.930*** | 0.262 | 0.668** | 0.050 | 0.438*** | -0.387** | -0.052 | 0.013 | -0.065 | -0.008 | -0.127*** | 0.119*** |
| *of Directors* | | (1.2) | (1.7) | (-0.6) | (5.2) | (1.2) | (2.4) | (0.5) | (2.9) | (-2.1) | (-0.5) | (0.1) | (-0.3) | (-0.4) | (-4.6) | (3.3) |
| | *EI-(OP+TB)* | 0.233*** | 0.659*** | -0.426** | 0.391*** | -0.033 | 0.425*** | 0.006 | 0.003 | 0.003 | 0.045 | -0.012 | 0.057 | 0.000 | -0.004 | 0.005 |
| | | (3.5) | (4.0) | (-2.4) | (4.9) | (-0.3) | (2.9) | (0.2) | (0.1) | (0.1) | (0.8) | (-0.1) | (0.5) | (0.1) | (-0.6) | (0.5) |
| | *Obs* | 2,410 | 2,409 | | 2,410 | 2,409 | | 2,410 | 2,409 | | 2,410 | 2,409 | | 2,410 | 2,409 | |
| | $R^2$ | 0.27 | 0.34 | | 0.21 | 0.14 | | 0.11 | 0.22 | | 0.68 | 0.67 | | 0.07 | 0.13 | |
| *G Index* | *OP+TB* | 0.112 | 0.454** | -0.342 | 0.515*** | 0.756*** | -0.241 | 0.396*** | 0.206* | 0.191 | 0.045 | -0.318** | 0.362 | -0.015 | -0.042* | 0.026 |
| | | (0.6) | (2.1) | (-1.2) | (2.8) | (4.0) | (-0.9) | (2.6) | (1.8) | (1.0) | (0.3) | (-2.0) | (1.6) | (-0.7) | (-1.8) | (0.8) |
| | *EI-(OP+TB)* | 0.237*** | 0.220*** | 0.018 | 0.311*** | 0.373*** | -0.062 | 0.004 | -0.013 | 0.016 | 0.140** | 0.022 | 0.118 | -0.001 | -0.002 | 0.000 |
| | | (3.2) | (2.7) | (0.2) | (3.6) | (4.9) | (-0.5) | (0.1) | (-0.4) | (0.4) | (2.0) | (0.4) | (1.3) | (-0.2) | (-0.3) | (0.0) |
| | *Obs* | 2,338 | 2,338 | | 2,338 | 2,338 | | 2,338 | 2,338 | | 2,338 | 2,338 | | 2,338 | 2,338 | |
| | $R^2$ | 0.28 | 0.23 | | 0.16 | 0.21 | | 0.17 | 0.13 | | 0.69 | 0.75 | | 0.09 | 0.08 | |
| *E Index* | *OP+TB* | 0.096 | 0.486*** | -0.390 | 0.649*** | 0.584*** | 0.065 | 0.629*** | 0.202** | 0.427** | -0.296 | -0.164 | -0.132 | -0.027 | -0.033** | 0.006 |
| | | (0.3) | (3.3) | (-1.2) | (2.7) | (4.5) | (0.2) | (3.9) | (2.4) | (2.3) | (-1.6) | (-1.5) | (-0.6) | (-1.2) | (-2.2) | (0.2) |
| | *EI-(OP+TB)* | 0.263* | 0.241*** | 0.023 | 0.048 | 0.370*** | -0.322** | 0.005 | -0.018 | 0.022 | 0.315** | 0.033 | 0.281** | 0.011** | -0.003 | 0.015** |
| | | (1.8) | (3.3) | (0.1) | (0.4) | (5.5) | (-2.3) | (0.1) | (-0.8) | (0.5) | (2.4) | (0.8) | (2.0) | (2.1) | (-0.9) | (2.2) |
| | *Obs* | 1,235 | 4,425 | | 1,235 | 4,425 | | 1,235 | 4,425 | | 1,235 | 4,425 | | 1,235 | 4,425 | |
| | $R^2$ | 0.29 | 0.25 | | 0.18 | 0.18 | | 0.19 | 0.14 | | 0.71 | 0.73 | | 0.12 | 0.06 | |
| *CEO Duality* | *OP+TB* | 0.120 | 0.447*** | -0.327 | 0.769*** | 0.663*** | 0.107 | 0.256*** | 0.161 | 0.096 | -0.049 | -0.064 | 0.015 | -0.013 | -0.062*** | 0.049* |
| | | (0.8) | (2.7) | (-1.5) | (5.1) | (4.6) | (0.5) | (3.1) | (1.6) | (0.7) | (-0.6) | (-0.6) | (0.1) | (-0.7) | (-3.1) | (1.8) |
| | *EI-(OP+TB)* | 0.405*** | 0.316*** | 0.089 | 0.231*** | 0.232*** | -0.001 | 0.003 | 0.022 | -0.020 | 0.011 | 0.044 | -0.033 | -0.005 | 0.006* | -0.010** |
| | | (6.6) | (3.9) | (0.9) | (3.7) | (2.8) | (-0.0) | (0.1) | (1.0) | (-0.6) | (0.2) | (1.4) | (-0.5) | (-1.3) | (1.7) | (-2.0) |
| | *Obs* | 4,647 | 3,384 | | 4,647 | 3,384 | | 4,647 | 3,384 | | 4,647 | 3,384 | | 4,647 | 3,384 | |
| | $R^2$ | 0.30 | 0.26 | | 0.18 | 0.15 | | 0.16 | 0.12 | | 0.68 | 0.69 | | 0.07 | 0.08 | |

## Table 8. Equity Issuance Proceeds and Cash Holdings

This table depicts the results of ordinary least squares regressions estimating the determinants of cash holdings for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the period 1996-2015. The dependent variable is the ratio of cash and short-term investments to book value of assets (*Cash/Assets*). Explanatory variables include equity and debt issuance proceeds (*EI* and *DI*, respectively), options proceeds (*OP*), other equity proceeds (*EI-OP*), cash flow risk (*Industry sigma*), market to book ratio (*Market to book*), the natural log of book value of total assets in 2009 dollars (*Real size*), the ratio of cash flow to total assets (*Cash flow/assets*), the ratio of net working capital to total assets (*NWC/assets*), the ratio of capital expenditure to total assets (*Capex*), the ratio of total debt to book value of total assets (*Leverage*), the ratio of research and development expense to sales (*R&D/sales*), an indicator variable that equal one if the firm paid a common dividend in that year, and zero otherwise (*Dividend dummy*), the ratio of expenditures on acquisitions to total assets (*Acquisition activity*), and a dummy variable for the 2000s along with their corresponding interaction terms. *Industry sigma* is defined as the mean of standard deviations of the cash-to-assets ratio over 10 years for firms in the same industry, as defined by the two-digit Standard Industry Classification (SIC) code. Cash flow is defined as EBITDA less the sum of interest expense, taxes, and common dividends. Total debt is the sum of long-term debt and current liabilities. T-statistics are in parentheses and computed using standard errors robust to both heteroskedasticity, and clustering at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

| | (1) *Cash/Assets* | | (2) *Cash/Assets* | | (3) *Cash/Assets* | |
|---|---|---|---|---|---|---|
| Dependent Variable: | Estimate | Interaction 2000s | Estimate | Interaction 2000s | Estimate | Interaction 2000s |
| *EI* | | | 0.245*** | -0.003 | | |
| | | | (5.3) | (-0.0) | | |
| *OP* | | | | | 2.653*** | -0.669* |
| | | | | | (8.4) | (-1.7) |
| *EI-OP* | | | | | 0.149*** | -0.062 |
| | | | | | (3.4) | (-1.1) |
| *DI* | | | -0.064*** | -0.025* | -0.066*** | -0.022* |
| | | | (-6.0) | (-1.9) | (-6.2) | (-1.7) |
| *Intercept* | 0.276*** | 0.039 | 0.272*** | 0.039 | 0.272*** | 0.034 |
| | (12.2) | (1.4) | (12.3) | (1.5) | (13.5) | (1.4) |
| *Industry sigma* | 0.331*** | -0.253*** | 0.317*** | -0.235*** | 0.262*** | -0.181*** |
| | (7.2) | (-5.5) | (7.3) | (-5.3) | (6.6) | (-4.5) |
| *Market to book* | 0.013*** | 0.012*** | 0.011*** | 0.012*** | 0.007*** | 0.010*** |
| | (5.1) | (3.6) | (4.6) | (3.4) | (3.0) | (2.8) |
| *Real size* | -0.015*** | 0.001 | -0.015*** | 0.001 | -0.015*** | 0.001 |
| | (-6.9) | (0.2) | (-7.3) | (0.2) | (-7.9) | (0.4) |
| *Cash flow/assets* | -0.053 | 0.001 | -0.025 | -0.017 | -0.053 | -0.016 |
| | (-1.5) | (0.0) | (-0.7) | (-0.4) | (-1.4) | (-0.3) |
| *NWC/assets* | -0.128*** | -0.066 | -0.128*** | -0.057 | -0.133*** | -0.050 |
| | (-3.0) | (-1.0) | (-3.2) | (-0.9) | (-3.7) | (-0.9) |
| *Capex* | -0.344*** | -0.245*** | -0.341*** | -0.225*** | -0.338*** | -0.203*** |
| | (-7.1) | (-4.1) | (-7.2) | (-3.9) | (-7.7) | (-3.7) |
| *Leverage* | -0.256*** | -0.017 | -0.228*** | -0.014 | -0.211*** | -0.017 |
| | (-19.9) | (-1.1) | (-17.1) | (-0.9) | (-16.1) | (-1.1) |
| *R&D/sales* | 0.212*** | -0.076 | 0.203*** | -0.072 | 0.197*** | -0.070 |
| | (4.3) | (-1.4) | (4.4) | (-1.4) | (4.4) | (-1.5) |
| *Dividend dummy* | -0.054*** | 0.005 | -0.052*** | 0.004 | -0.048*** | 0.001 |
| | (-13.9) | (1.0) | (-13.8) | (0.8) | (-13.2) | (0.3) |
| *Acquisition activity* | -0.247*** | -0.063** | -0.229*** | -0.034 | -0.210*** | -0.056** |
| | (-11.1) | (-2.4) | (-9.7) | (-1.2) | (-9.0) | (-2.0) |
| *Obs* | 22,116 | | 22,116 | | 22,116 | |
| *Adjusted* $R^2$ | 0.444 | | 0.453 | | 0.465 | |

## Table 9. The Accuracy of *ISSUE%* Rule by McKeon (2015)

Panel A compares the actual amounts of equity issuance proceeds with those imputed based on the *ISSUE%* rule of McKeon (2015) for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the period 1996-2015. Column (1) shows that equity issuance proceeds is the sum of option proceeds and other equity proceeds, as depicted in column (2) and (3) respectively. Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. Column (4) and (5) list the respective amounts of option proceeds and other equity proceeds with issue size between 2% to 3% of market equity and are disregarded by McKeon (2015). Column (6) depicts the tax benefits associated with employee stock options (*TB*), which started to be separately reported in Compustat since 2005. Column (9) and (10) list the amounts of employee- and firm-initiated equity issues (*EMI* and *FI*, respectively). *EMI* (*FI*) refers to equity issues with size smaller (greater) than 2% (3%) of market equity, the so-called *ISSUE%* rule. Amounts are in billions of 2009 constant U.S. dollars.

## Panel A: Comparison of Actual Data with those imputed by *ISSUE%* Rule

| | Based on Actual Data | | | Omitted by McKeon (2015) | | | Based on Actual Data | | Based on *ISSUE%* Rule | | *EMI* vs. *FI* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1)=(2)+(3) | (2) | (3) | (4) | (5) | (6) | (7)=(2)-(4) | (8)=(3)-(5)-(6) | (9) | (10) | (11)=\|(7)-(9)\| or |
| Year | *EI* | *OP* | *EI-OP* | *OP'* | *(EI-OP)'* | *TB* | *OP** | *(EI-OP)** | *EMI* | *FI* | (11)=(8)-(10) |
| 1996 | $36.9 | $16.7 | $20.2 | $0.9 | $0.8 | | $15.8 | $19.4 | $20.0 | $15.1 | $4.2 |
| 1997 | $40.8 | $22.3 | $18.6 | $1.3 | $0.9 | | $21.0 | $17.7 | $27.3 | $11.4 | $6.3 |
| 1998 | $44.8 | $23.0 | $21.9 | $1.1 | $1.7 | | $21.8 | $20.2 | $30.0 | $12.1 | $8.1 |
| 1999 | $66.6 | $26.2 | $40.4 | $2.5 | $1.9 | | $23.7 | $38.5 | $34.7 | $27.6 | $11.0 |
| 2000 | $69.6 | $32.2 | $37.4 | $2.7 | $1.3 | | $29.4 | $36.1 | $35.2 | $30.3 | $5.8 |
| 2001 | $89.3 | $28.3 | $61.0 | $1.7 | $1.8 | | $26.5 | $59.2 | $32.2 | $53.5 | $5.7 |
| 2002 | $52.0 | $25.1 | $26.9 | $1.6 | $1.5 | | $23.5 | $25.3 | $27.7 | $21.2 | $4.2 |
| 2003 | $56.5 | $33.6 | $22.9 | $2.4 | $1.2 | | $31.3 | $21.7 | $36.5 | $16.4 | $5.3 |
| 2004 | $84.5 | $50.4 | $34.0 | $4.3 | $1.0 | | $46.2 | $33.1 | $52.2 | $27.1 | $6.0 |
| 2005 | $72.4 | $53.0 | $19.3 | $4.3 | $0.6 | $0.7 | $48.7 | $18.0 | $53.7 | $13.1 | $5.0 |
| 2006 | $90.1 | $57.0 | $33.1 | $7.5 | $2.8 | $13.4 | $49.5 | $16.9 | $52.1 | $14.3 | $2.6 |
| 2007 | $97.0 | $66.8 | $30.2 | $8.6 | $1.7 | $13.4 | $58.2 | $15.1 | $55.0 | $18.3 | -$3.2 |
| 2008 | $84.3 | $39.1 | $45.1 | $5.9 | $1.3 | $8.2 | $33.2 | $35.6 | $33.6 | $35.3 | $0.3 |
| 2009 | $69.1 | $25.6 | $43.5 | $0.8 | $1.3 | $3.8 | $24.8 | $38.5 | $30.0 | $33.3 | $5.2 |
| 2010 | $72.0 | $48.4 | $23.7 | $11.6 | $0.8 | $6.8 | $36.7 | $16.1 | $38.9 | $14.0 | $2.2 |
| 2011 | $69.5 | $46.3 | $23.2 | $6.7 | $1.1 | $7.8 | $39.6 | $14.3 | $41.2 | $12.7 | $1.6 |
| 2012 | $71.5 | $47.5 | $24.0 | $5.3 | $1.5 | $9.5 | $42.2 | $13.0 | $51.3 | $3.9 | $9.1 |
| 2013 | $79.1 | $53.0 | $26.1 | $7.4 | $1.2 | $9.9 | $45.6 | $15.1 | $51.7 | $9.0 | $6.1 |
| 2014 | $69.9 | $39.5 | $30.4 | $0.8 | $0.2 | $10.1 | $38.7 | $20.1 | $47.1 | $11.7 | $8.4 |
| 2015 | $69.3 | $26.9 | $42.4 | $0.2 | $0.0 | $8.7 | $26.7 | $33.7 | $32.4 | $28.0 | $5.7 |
| Subtotal | $1,385.3 | $760.9 | $624.4 | $77.6 | $24.5 | $92.2 | $683.3 | $507.6 | $782.7 | $408.2 | $99.4 |
| Omitted by McKeon (2015) due to missing market equity: | | | | | | | | | | | |
| | $0.167 | $0.014 | $0.153 | | | | | | | | |
| Total | $1,385.4 | $760.9 | $624.5 | | | | | | | | |

## Table 9. The Accuracy of *ISSUE%* Rule by McKeon (2015) (continue)

Panel B contrasts the actual amounts of option proceeds (*OP*) and other equity proceeds (*EI-OP*) received by our sample firms with the imputed amounts of employee-initiated issues (*EMI*) and firm-initiated issues (*FI*), respectively. A firm is regarded as a dual equity issuer if it receives both option proceeds and other equity proceeds in a specific year. A firm is said to be a non-dual equity issuer if it receives in a specific year, either option proceeds or other equity proceeds, but not both. Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. *EI-OP* is equity issuance proceeds less option proceeds. *EMI* (*FI*) refers to equity issues with size smaller (greater) than 2% (3%) of market equity, the so-called *ISSUE%* rule. Amounts are in billions of 2009 constant U.S. dollars.

### Panel B: *OP* versus *EMI* and *EI-OP* versus *FI* (Dollar Amounts)

| | Non-Dual Equity Issues | | | | | Dual Equity Issues | | | | | All Equity Issues | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11)=(3)+(8) | (12)=(4)+(9) |
| Year | *OP reported as EMI* | *EI-OP reported as FI* | *OP reported as FI* | *EI-OP reported as EMI* | *Total Non-Dual Issues* | *OP reported as EMI* | *EI-OP reported as FI* | *OP reported as FI* | *EI-OP reported as EMI* | *Total Dual Issues* | *OP reported as FI* | *EI-OP reported as EMI* |
| 1996 | $4.5 | $0.3 | $0.1 | $0.0 | $4.9 | $11.2 | $14.7 | $0.0 | $4.4 | $30.2 | $0.1 | $4.4 |
| 1997 | $7.6 | $0.2 | $0.0 | $0.1 | $8.0 | $13.3 | $11.2 | $0.0 | $6.2 | $30.6 | $0.0 | $6.3 |
| 1998 | $8.7 | $0.3 | $0.2 | $0.1 | $9.3 | $12.9 | $11.5 | $0.0 | $8.3 | $32.8 | $0.2 | $8.4 |
| 1999 | $5.2 | $0.2 | $0.0 | $0.1 | $5.4 | $18.5 | $27.4 | $0.0 | $10.9 | $56.8 | $0.0 | $11.0 |
| 2000 | $7.0 | $0.0 | $0.6 | $0.1 | $7.8 | $21.8 | $29.6 | $0.0 | $6.4 | $57.7 | $0.6 | $6.4 |
| 2001 | $6.3 | $0.1 | $0.4 | $0.0 | $6.8 | $19.8 | $53.0 | $0.0 | $6.0 | $78.9 | $0.4 | $6.0 |
| 2002 | $9.3 | $0.9 | $0.3 | $0.0 | $10.5 | $13.9 | $20.1 | $0.0 | $4.4 | $38.4 | $0.3 | $4.4 |
| 2003 | $10.4 | $1.1 | $0.3 | $0.1 | $11.9 | $20.6 | $15.0 | $0.0 | $5.5 | $41.1 | $0.3 | $5.6 |
| 2004 | $15.5 | $0.4 | $0.9 | $0.0 | $16.8 | $29.8 | $25.8 | $0.0 | $6.9 | $62.5 | $0.9 | $6.9 |
| 2005 | $15.6 | $0.0 | $0.3 | $0.0 | $15.9 | $32.9 | $12.8 | $0.0 | $5.2 | $50.9 | $0.3 | $5.2 |
| 2006 | $3.9 | $2.4 | $1.0 | $0.0 | $7.2 | $44.7 | $10.9 | $0.0 | $3.6 | $59.2 | $1.0 | $3.6 |
| 2007 | $6.1 | $1.1 | $0.0 | $0.0 | $7.2 | $48.9 | $14.0 | $3.2 | $0.0 | $66.1 | $3.2 | $0.0 |
| 2008 | $4.0 | $2.4 | $0.0 | $0.0 | $6.4 | $29.2 | $32.9 | $0.0 | $0.4 | $62.4 | $0.0 | $0.4 |
| 2009 | $6.8 | $2.7 | $0.0 | $0.1 | $9.5 | $18.0 | $30.6 | $0.0 | $5.2 | $53.8 | $0.0 | $5.2 |
| 2010 | $6.9 | $1.8 | $0.1 | $0.0 | $8.8 | $29.7 | $12.0 | $0.0 | $2.3 | $44.0 | $0.1 | $2.3 |
| 2011 | $3.8 | $1.0 | $0.0 | $0.0 | $4.8 | $35.9 | $11.7 | $0.0 | $1.6 | $49.1 | $0.0 | $1.6 |
| 2012 | $7.7 | $0.4 | $0.0 | $0.5 | $8.7 | $34.5 | $3.5 | $0.0 | $8.6 | $46.5 | $0.0 | $9.1 |
| 2013 | $6.3 | $1.1 | $0.5 | $0.2 | $8.1 | $38.8 | $7.3 | $0.0 | $6.4 | $52.6 | $0.5 | $6.6 |
| 2014 | $4.3 | $2.1 | $0.0 | $0.0 | $6.4 | $34.4 | $9.6 | $0.0 | $8.4 | $52.4 | $0.0 | $8.4 |
| 2015 | $4.1 | $2.7 | $0.0 | $0.0 | $6.9 | $22.6 | $25.2 | $0.0 | $5.7 | $53.5 | $0.0 | $5.8 |
| Total | $143.8 | $21.4 | $4.9 | $1.3 | $171.4 | $531.4 | $378.7 | $3.2 | $106.3 | $1,019.5 | $8.1 | $107.6 |

## Table 9. The Accuracy of *ISSUE%* Rule by McKeon (2015) (continue)

Panel C contrasts the actual numbers of equity issues involving option proceeds (*OP*) and other equity proceeds (*EI-OP*) received by our sample firms with the imputed numbers of employee-initiated issues (*EMI*) and firm-initiated issues (*FI*), respectively. A firm is a non-issuer if it did not issue equity in a specific year. A firm is a dual issuer if it receives option proceeds and other equity proceeds in a year. A firm is a non-dual issuer if it receives in a year, either option proceeds or other equity proceeds. Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. *EI-OP* is equity issuance proceeds less option proceeds. *EMI* (*FI*) refers to equity issues with size smaller (greater) than 2% (3%) of market equity, the so-called *ISSUE%* rule.

### Panel C: *OP* versus *EMI* and *EI-OP* versus *FI* (Number of Issues)

| | Based on Actual Data | | | | | Omitted by McKeon (2015) due to 2%≥*ISSUE*%≤3% | | | Based on Actual Data | | | Based on *ISSUE%* Rule | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9)=(3)-(6) | (10)=(4)-(7) | (11)=(5)-(8) | (12) | (13) |
| Year | *Total Firms* | *Non-Issuers* | *Dual Issuers* | *Non-Dual Issuers (OP only)* | *Non-Dual Issuers (EI-OP only)* | *Dual Issuers* | *Non-Dual Issuers (OP only)* | *Non-Dual Issuers (EI-OP only)* | *Dual Issuers* | *Non-Dual Issuers (OP only)* | *Non-Dual Issuers (EI-OP only)* | *EMI* | *FI* |
| 1996 | 1,276 | 255 | 689 | 304 | 28 | 43 | 11 | 1 | 646 | 293 | 27 | 845 | 121 |
| 1997 | 1,370 | 227 | 773 | 346 | 24 | 42 | 11 | 0 | 731 | 335 | 24 | 974 | 116 |
| 1998 | 1,351 | 224 | 794 | 315 | 18 | 54 | 6 | 1 | 740 | 309 | 17 | 961 | 105 |
| 1999 | 1,282 | 226 | 746 | 287 | 23 | 44 | 5 | 2 | 702 | 282 | 21 | 896 | 109 |
| 2000 | 1,249 | 234 | 652 | 316 | 47 | 36 | 7 | 4 | 616 | 309 | 43 | 839 | 129 |
| 2001 | 1,286 | 205 | 748 | 306 | 27 | 44 | 7 | 2 | 704 | 299 | 25 | 889 | 139 |
| 2002 | 1,342 | 161 | 787 | 361 | 33 | 53 | 9 | 0 | 734 | 352 | 33 | 973 | 146 |
| 2003 | 1,321 | 144 | 774 | 386 | 17 | 40 | 6 | 0 | 734 | 380 | 17 | 1,019 | 112 |
| 2004 | 1,300 | 102 | 799 | 389 | 10 | 71 | 13 | 0 | 728 | 376 | 10 | 991 | 123 |
| 2005 | 1,331 | 92 | 842 | 391 | 6 | 75 | 16 | 0 | 767 | 375 | 6 | 1,064 | 84 |
| 2006 | 1,288 | 84 | 1,084 | 113 | 7 | 83 | 3 | 0 | 1,001 | 110 | 7 | 1,030 | 88 |
| 2007 | 1,222 | 94 | 1,013 | 101 | 14 | 73 | 8 | 0 | 940 | 93 | 14 | 969 | 78 |
| 2008 | 1,243 | 156 | 957 | 98 | 32 | 47 | 2 | 1 | 910 | 96 | 31 | 947 | 90 |
| 2009 | 1,247 | 185 | 885 | 114 | 63 | 21 | 1 | 0 | 864 | 113 | 63 | 932 | 108 |
| 2010 | 1,176 | 159 | 849 | 141 | 27 | 35 | 1 | 1 | 814 | 140 | 26 | 925 | 55 |
| 2011 | 1,133 | 154 | 824 | 130 | 25 | 41 | 2 | 2 | 783 | 128 | 23 | 885 | 49 |
| 2012 | 1,103 | 171 | 788 | 112 | 32 | 34 | 1 | 1 | 754 | 111 | 31 | 862 | 34 |
| 2013 | 1,071 | 153 | 792 | 107 | 19 | 30 | 2 | 2 | 762 | 105 | 17 | 845 | 39 |
| 2014 | 1,001 | 162 | 722 | 97 | 20 | 9 | 1 | 0 | 713 | 96 | 20 | 791 | 38 |
| 2015 | 951 | 191 | 648 | 81 | 31 | 9 | 1 | 0 | 639 | 80 | 31 | 714 | 36 |
| Subtotal | 24,543 | 3,379 | 16,166 | 4,495 | 503 | 884 | 113 | 17 | 15,282 | 4,382 | 486 | 18,351 | 1,799 |
| Omitted by McKeon (2015) due to missing market equity: | | | | | | | | | | | | | |
| | 27 | 19 | 2 | 2 | 4 | | | | | | | | |
| Total | 24,570 | 3,398 | 16,168 | 4,497 | 507 | | | | | | | | |

## Table 10. Allocation of Funds with *ISSUE%* Rule

This table reports the results of regressing each use of funds on the sources of funds for firms that ever exist in the S&P 1500 index and/or Nasdaq 100 index during the period 1996-2015. Uses include investment (*Inv*), cash savings ($\Delta C$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* is a plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. Sources include internal cash flow net of changes in working capital (*CF*), option proceeds (*OP*), other equity proceeds (*EI-OP*), and debt proceeds (*DI*). Employee stock option data are collected from the SEC 10-K filings, Compustat, Capital IQ, and IRRC dilution database. Other equity proceeds refer to equity issuance proceeds less option proceeds. *EMI* (*FI*) refers to employee-(firm-)initiated equity issues with size smaller (greater) than 2% (3%) of market equity, the so-called *ISSUE%* rule. Variables are demeaned by firm and scaled by book assets. Control variables include the ratio of market to book value of assets (*MB*), annual sales growth rate (*Sales growth)*, log of book assets (*Ln(Assets)*), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility)*. Regressions are run by ordinary least squares with year fixed effects. *T*-statistics are in parentheses and computed using standard errors robust to heteroskedasticity and clustering at firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively.

| Dependent Variable: | (1) $Inv_{it}$ | (2) $\Delta C_{it}$ | (3) $ER_{it}$ | (4) $DR_{it}$ | (5) $Div_{it}$ | (6) $Oth_{it}$ | (7) $Inv_{it}$ | (8) $\Delta C_{it}$ | (9) $ER_{it}$ | (10) $DR_{it}$ | (11) $Div_{it}$ | (12) $Oth_{it}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $CF_{it}$ | 0.389*** | 0.370*** | 0.071*** | 0.164*** | 0.010*** | -0.005 | 0.391*** | 0.364*** | 0.066*** | 0.169*** | 0.010*** | 0.000 |
| | (33.5) | (32.4) | (16.9) | (18.2) | (8.7) | (-0.9) | (33.9) | (32.8) | (15.6) | (18.7) | (8.4) | (1.3) |
| $EMI_{it}$ | 0.405*** | 0.659*** | 0.029 | 0.037 | -0.003 | -0.127*** | | | | | | |
| | (4.7) | (8.0) | (0.7) | (0.7) | (-0.2) | (-4.1) | | | | | | |
| $FI_{it}$ | 0.474*** | 0.603*** | 0.028*** | 0.222*** | 0.004*** | -0.331*** | | | | | | |
| | (18.1) | (23.6) | (4.4) | (12.1) | (2.9) | (-16.2) | | | | | | |
| $OP_{it}$ | | | | | | | 0.258*** | 0.718*** | 0.181*** | -0.168*** | 0.011 | -0.000 |
| | | | | | | | (3.4) | (9.7) | (5.0) | (-3.4) | (1.2) | (-0.4) |
| $EI_{it}$-$OP_{it}$ | | | | | | | 0.371*** | 0.455*** | 0.006 | 0.165*** | 0.003** | 0.000* |
| | | | | | | | (16.2) | (22.0) | (1.4) | (12.9) | (2.6) | (1.8) |
| $DI_{it}$ | 0.277*** | 0.047*** | 0.017*** | 0.653*** | 0.001* | 0.005*** | 0.279*** | 0.049*** | 0.017*** | 0.654*** | 0.001* | 0.000 |
| | (36.9) | (9.7) | (8.2) | (79.8) | (1.9) | (4.4) | (37.2) | (10.2) | (8.1) | (80.1) | (1.8) | (0.6) |
| $MB_{it-1}$ | 0.010*** | -0.006*** | 0.002*** | -0.006*** | 0.001*** | -0.002*** | 0.009*** | -0.007*** | 0.002*** | -0.006*** | 0.001*** | -0.000 |
| | (10.3) | (-5.8) | (5.4) | (-8.3) | (8.2) | (-5.7) | (9.9) | (-7.4) | (4.8) | (-8.3) | (8.0) | (-1.6) |
| $Sales\ growth_{it-1}$ | 0.022*** | -0.000 | -0.012*** | -0.008*** | -0.003*** | 0.002 | 0.022*** | 0.001 | -0.012*** | -0.008*** | -0.003*** | -0.000 |
| | (7.6) | (-0.0) | (-12.0) | (-3.7) | (-10.2) | (1.4) | (7.8) | (0.3) | (-11.7) | (-3.7) | (-10.1) | (-0.3) |
| $Ln(Assets)_{it-1}$ | -0.011*** | -0.006*** | 0.009*** | 0.005*** | 0.001*** | 0.001 | -0.011*** | -0.005*** | 0.010*** | 0.005*** | 0.001*** | 0.000 |
| | (-7.0) | (-4.2) | (15.5) | (4.1) | (8.5) | (1.5) | (-7.0) | (-3.7) | (15.7) | (3.8) | (8.7) | (1.2) |
| $Leverage_{it-1}$ | -0.142*** | -0.016** | -0.058*** | 0.220*** | -0.010*** | 0.005** | -0.141*** | -0.014** | -0.057*** | 0.221*** | -0.009*** | -0.000 |
| | (-19.4) | (-2.6) | (-18.4) | (30.5) | (-10.2) | (2.0) | (-19.5) | (-2.3) | (-18.1) | (30.6) | (-10.2) | (-0.5) |
| $Tangibility_{it-1}$ | 0.000 | 0.056*** | -0.010** | -0.049*** | 0.002* | 0.001 | 0.000 | 0.056*** | -0.009** | -0.049*** | 0.002* | -0.000 |
| | (0.0) | (5.9) | (-2.0) | (-5.5) | (1.7) | (0.2) | (0.0) | (6.1) | (-2.0) | (-5.5) | (1.7) | (-0.4) |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Obs* | 20,150 | 20,150 | 20,150 | 20,150 | 20,150 | 20,150 | 20,150 | 20,150 | 20,150 | 20,150 | 20,150 | 20,150 |
| $R^2$ | 0.34 | 0.23 | 0.11 | 0.68 | 0.06 | 0.26 | 0.35 | 0.26 | 0.11 | 0.68 | 0.06 | 0.00 |

## Appendix A. 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 investment (*Inv*), the change in cash holdings ($\Delta C$), the change in working capital ($\Delta WC$), cash dividends (*Div*), cash flows (*CF*), net debt issued ($\Delta D=DI-DR$), and net equity issued ($\Delta E=EI-ER$). PPE denotes property, plant, and equipment. We include in parentheses the Compustat XPF variable names in italics.

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

# Essay Two: Is Investment-Cash Flow Sensitivity Disappearing?


## Abstract

Using conventional measures of investment and cash flow, Chen and Chen (2012) find that the investment-cash flow sensitivity of U.S. manufacturing firms has disappeared over time. We employ comprehensive investment and cash flow measures based on Compustat Statement of Cash Flows and re-examine the time trend of investment-cash flow sensitivity. Using an integrated regression framework based on the cash flow identity, we show that the sensitivities were distinctive from zero for all the sample years. The apparent disappearance of investment-cash flow sensitivity resulted from Chen and Chen (2012) using a restrictive investment measure i.e., capital expenditure. When investment is defined to include other investment, their model likewise produces non-zero sensitivities. We then show that the cash flow sensitivities of non-capital expenditure investments offset, to some extent, the decreasing capital expenditure-cash flow sensitivity such that the overall investment-cash flow sensitivity has not disappeared over time. By not considering non-capital expenditure items as part of investment, the resulting estimates of investment-cash flow sensitivity are biased downwards.



**JEL classification**: G01; G31; G32
**Keywords**: Investment-cash flow sensitivity; Cash flow allocation

## I. Introduction

The link between investment and financing decisions has long been extensively researched upon in the corporate finance literature. Specifically, the change in investment given a change in the availability of a firm's cash flow has come to be classically known as the investment-cash flow sensitivity. This notion is said to link the investment policy of a firm with its financing decisions and reflect the allocation of cash flow to investment. To date, there has been numerous studies examining both the reasons behind the sensitivity of investment to the availability of cash flow, as well as the strength of the said relation. In particular, the literature documents different magnitude of investment-cash flow sensitivity, differing in terms of data, model specification, and definitions of investment and cash flow used.

In their pioneering work on the cash flow sensitivity of investment, Fazzari, Hubbard, and Petersen (1988) put forth that the intensity of investment-cash flow sensitivity captures the degree to which a firm is financially constrained. Kaplan and Zingales (1997) however argue that less financially constrained firms exhibit higher sensitivity than do more financially constrained firms, and construe that investment-cash flow sensitivity is unlikely a measure of financial constraint. On the other hand, Cleary (1999) finds that more creditworthy firms exhibit higher investment-cash flow sensitivity than do firms that are less creditworthy. Almeida, and Campello (2007), Almeida, Campello, and Galvao Jr. (2010), and Erickson and Whited (2012) estimate the investment-cash flow sensitivity of U.S. manufacturing firms but obtain diverse results, ranging from -0.11 to 0.38 for years between 1967 and 2008. Baker, Stein, and Wurgler (2003), Rauh (2006), and Hennessy, Levy, and Whited (2007) derive sensitivity estimates that lie between 0.04 to 1.12 for time periods ranging from 1968 to 2003.

Most notably, Chen and Chen (2012) (C&C (2012), hereafter) find that the investment-cash flow sensitivity of U.S. manufacturing firms has 'extensively decline and completely disappeared' over the years (p.394). They regard this decline and disappearance as a puzzle because the results cannot be explained by changes in sample composition, corporate governance, or market power. To shed light on this so-called puzzle, we examine the research methodology of C&C (2012) and analyze what might have produced their results. In general, we ask the basic questions of how investment and cash flow should be measured, and how the resulting investment-cash flow sensitivity should be estimated. That is, we investigate whether the conventional investment and cash flow variables are adequate measures of the underlying investing activities and cash flow situation of a typical firm and examine the implications that these measures have on the estimation of investment-cash flow sensitivity. We then employ comprehensive measures of investment and cash flow based on variables from Compustat Statement of Cash Flows (*SCF*, hereafter), and re-examine the time trend of investment-cash flow sensitivity.

Following C&C (2012), as well as the convention in the literature, we define investment as capital expenditure, reported in the *SCF*. We measure conventional cash flow as the sum of income before extraordinary items, depreciation and amortization, all of which are based on Compustat Income Statement. In determining how investment and cash flow can be comprehensively measured, we look to the *SCF* for guidance because by construction, it is designed to capture all the cash transactions of a firm. In fact, cash flows reported in the *SCF* are already conveniently classified according to the type of activities that give rise to those transactions i.e., operating, investing, and financing activities. It therefore seems intuitive that we define investment as the net cash outflow from investing activities, and cash flow as the operating cash flow reported in the *SCF*. In this way, we cater for investing and cash flow items that are important but not accounted for by the conventional measures.

Specifically, comprehensive investment is defined as the sum of capital expenditure, acquisitions, and other investment, less the sale of property, plant, and equipment. Other investment refers to the net purchase or sale of financial assets such as marketable securities, debt and equity holdings, finance receivables, and operating leases. Relative to conventional investment, comprehensive investment is a more holistic measure of a firm's investing activities because it encompasses a broader range of assets for which a firm can possibly invest in. This wider definition therefore has the advantage of being able to cater for firms who might have investment policies with different orientation towards physical versus financial assets.

Similarly, comprehensive cash flow accounts for more operating activities that could produce cash flows to a firm, as well as adjusts for more non-cash items than do conventional cash flow, so as to provide a more accurate measure of the cash flow situation of a firm. In fact, Lewellen and Lewellen (2016) find that the conventional measure of cash flow has become noisy over time because it erroneously incorporates non-cash expenses such as asset write-downs, restructuring charges, employee stock compensation, and deferred taxes, which have become increasingly important in recent years.

Traditionally, investment-cash flow sensitivity is estimated with a standalone regression whereby investment is regressed on cash flow, and a proxy for investment opportunities. This approach is used by Fazzari, Hubbard, and Petersen (1988) in their pioneering work on investment-cash flow sensitivity and has since been adopted by many researchers in their analyses of the cash flow sensitivity of investment. They include Kaplan and Zingales (1997), Cleary (1999), Baker, Stein, and Wurgler (2003), Rauh (2006), and C&C (2012), just to name a few. As an alternative approach to estimating investment-cash flow sensitivity, we follow Chang et al. (2004) and set up the cash flow identity based on the *SCF*. That is, we define six main uses of cash flow (i.e., investment, cash savings, working capital needs, equity repurchase, debt retirement, and dividends), and equate them with the cash flow. With this identity, we are then able to construct an integrated regression framework, in which we simultaneously estimate six empirical models, regressing each use of funds on cash flow. The respective coefficient on cash flow therefore indicates the sensitivity of that specific use of funds to the availability of cash flow. The variable of our interest, investment-cash sensitivity is therefore the coefficient of investment on cash flow.

It is noteworthy that such an integrated framework of regressions has the methodological advantage of offering a complete view of the cash flow activities of a firm as it simultaneously tracks all uses of cash flow, which are interrelated among one another by virtue of the cash flow identity. Specifically, it offers the intuitive interpretation that a change in investment-cash flow sensitivity must be met by an offsetting change in the cash flow sensitivity of other uses since all such uses must sum to the cash flow itself. Following Frank and Goyal (2003) and Chang et al. (2014), we use the *SCF* data to define all variables in the cash flow identity. Using a common data source has the advantage of achieving an almost balanced cash flow identity for all our sample firms.[26]

Our time-series analysis reveals that conventional investment has become a restrictive measure of investment as firms increasingly make non-capital expenditure investments in recent years. That is, although capital expenditure seems to capture the bulk of investment made by nonfinancial U.S. firms during the 1970s and 1980s, its significance is decreasing over time, especially for manufacturing firms. In fact, we find that these firms are increasingly making other forms of investment such as acquisitions, so much so that the amount of acquisitions increased from being only 3% of total investment in 1971, to being almost 50% in 2015. In contrast, conventional cash flow is a reasonably good measure, capturing an average of more than 85% of the cash flow activities of our sample firms throughout the sample period.

Like C&C (2012), we find that the investment-cash flow sensitivity of nonfinancial U.S. firms, estimated under the traditional approach with conventional measures, has gradually

[26] In fact, Gatchev, Pulvino, and Tarhan (2010) rely on a similar cash flow identity but define its components using data from not only the *SCF*, but also the balance sheet, and income statement. As a result, their cashflow identity generally do not hold for their sample.

declined and disappeared over the sample period. On the other hand, the integrated regression framework coupled with comprehensive measures of investment and cash flow, produces estimates that have declined but not disappeared over time. Specifically, estimates of conventional investment-cash flow sensitivity range from 0.053 to 0.2 during the 1970s to 1980s, and from 0 to 0.06 during the 1990s to 2000s. In contrast, estimates of comprehensive investment-cash flow sensitivity are relatively higher, ranging from 0.229 to 0.447 during the 1970s to 1980s, and from 0.203 to 0.315 during the 1990s to 2000s.

Further analysis shows that the decreasing trend in investment-cash flow sensitivity is driven by changes in sample composition, as well as changes in allocation dynamics. That is, when we classify our sample firms into entrants and incumbents, and separately estimate the investment-cash flow sensitivity for these firms, we find that both incumbents and entrants exhibit similar pattern of cash flow allocation to investment. Moreover, the similarity in sensitivity estimates are robust to different incumbent-entrant classification schemes.

To reconcile the discrepancy between our results and those of C&C (2012) regarding the disappearance of investment-cash flow sensitivity for U.S. manufacturing firms, we employ the model specification of C&C (2012) but alternate the regression variables with conventional and comprehensive measures of investment and cash flow. We find that the disappearing sensitivity is at least in part, produced by using the conventional investment measure i.e., capital expenditure. To put things in perspective, the conventional cash flow sensitivity of conventional (comprehensive) investment is 0.163 (0.266) for the period 1971 to 1975, and 0.003 (0.06) for the period 2011 to 2015. In other words, when investment is defined to encompass both physical and financial assets, its sensitivity to cash flow is non-zero throughout the sample period, ranging from 0.056 to 0.266.

The choice of cash flow measure, on the other hand, makes no material difference to the sensitivity estimates in that alternating between conventional and comprehensive cash flows while holding fix investment as capital expenditure produces almost identical estimates of investment-cash flow sensitivity. That is, the sensitivity of capital expenditure to conventional (comprehensive) cash flow is 0.163 (0.177) for the period 1971 to 1975, and 0.003 (0.013) for the period 2011 to 2015. We therefore deduce that the disappearing sensitivity documented by Chen and Chen (2012) is produced by using capital expenditure as the primary measure of investment, which has become increasingly restrictive over the years, and to a minimal degree, by using conventional cash flow as the explanatory variable.

In fact, regardless of the regression model and measures of investment and cash flow used, the cash flow sensitivities of both acquisitions and other investment are consistently non-zero throughout the sample period, with a range between -0.027 and 0.168. To the extent that investment include these non-capital expenditure investments, the disappearing cash flow sensitivity of capital expenditure would be offset by the sensitivities of these investments, thereby producing non-zero overall investment-cash flow sensitivity. In other words, the empirical methodology of Chen and Chen (2012) would have underestimated the magnitude of investment-cash flow sensitivity for our sample firms.

Lastly, we evaluate the claim of Lewellen and Lewellen (2016) that the apparent decline in investment-cash flow sensitivity documented by C&C (2012) is due to conventional cash flow being an increasingly poor measure of cash flow over time. In doing so, we first replicate their results and note that their cash flow measure is akin to our comprehensive cash flow measure. Like the authors, we find that the estimates of investment-cash flow sensitivity fluctuate with the different cash flow measures used. We show additionally that the estimates also fluctuate with respect to the different definitions of investment. In fact, our summary statistics reveal that throughout the sample period, conventional investment diverges considerably from their alternative measures of investment. On the other hand, conventional cash flow closely tracks their measure of cash flow for many of the sample years.

While Lewellen and Lewellen (2016) shows that the correlation between conventional and comprehensive measures of cash flow has declined over time, we further show that the correlation between conventional and comprehensive investment measures has decreased by an even greater margin. In a formal regression setting, we examine the explanatory power of conventional versus comprehensive cash flow and find that conventional cash flow explains investment (and its components) just as comprehensive cash flow do. Therefore, consistent with the main results of our analysis, we find that the choice of investment measure matters more than that of cash flow measure in explaining the seemingly disappearing investment-cash flow sensitivity documented by C&C (2012).

Our paper contributes to the literature as follows. We provide important insights into the investment-cash flow sensitivity puzzle, which C&C (2012) has left unresolved. In doing so, we employ definitions of investment and cash flow that are more comprehensive than that conventionally used, thereby producing more realistic estimates of investment-cash flow sensitivity. Moreover, we offer a regression approach that has the methodological advantage of providing a complete view of the cash flow activities of a firm, given that the integrated framework simultaneously tracks all uses of cash flow based on the cash flow identity.

We show that the apparent disappearing sensitivity is, at least in part, produced by using a restrictive measure of investment i.e., capital expenditure. In fact, the magnitude of investment-cash flow sensitivity fluctuates with the choice of investment measure used. Conventional investment produces estimates that are weak and decreasing over time, while comprehensive investment produces a stronger relation between investment and cash flow. Therefore, to the extent that it is more realistic to measure investment comprehensively, the conventional approach to estimating investment-cash flow sensitivity is likely to underestimate the said sensitivity of nonfinancial U.S. firms. On the other hand, we find no evidence that conventional cash flow is the cause of the puzzle. In fact, it proves to be a reasonably good measure of cash flow over the years 1971 to 2015. Our regression analysis shows that conventional cash flow has equivalent explanatory power as do comprehensive cash flow.

The remainder of the paper is organized as follows: Section II reviews the literature on investment-cash flow sensitivity, Section III describes the data, variables and summary statistics of the sample, Section IV highlights the empirical methodology, Section V describes the empirical results, and Section VI concludes.

## II. Related Literature

The notion of investment-cash flow sensitivity first has its roots in Fazzari, Hubbard, and Petersen (1988), who construe that the intensity of this sensitivity captures the degree to which a firm is financially constrained. Specifically, firms that exhaust most of their low-cost internal funds should have a higher cash flow sensitivity to investment than do firms that have an abundance of funds to pay high dividends. In fact, they find that estimates of investment-cash flow sensitivity ranges from -0.005 to 0.67, and that these estimates are higher for firms that pay low dividends than for firms that pay high dividends. Kaplan and Zingales (1997) however, find that the least financially constrained firms have the highest investment-cash flow sensitivity. With a range of sensitivities between 0.10 and 0.80, they conclude that investment-cash flow sensitivity does not proxy for financial constraint.

Consistent with Kaplan and Zingales (1997), Cleary (1999) find that firms with high liquidity exhibit high investment-cash flow sensitivity and therefore, investment-cash flow sensitivity is unlikely a measure of financial constraint. Specifically, estimates of investment-cash flow sensitivity range from 0.06 to 0.15, and that more creditworthy firms display greater cash flow sensitivity to investment than do less creditworthy firms. Almeida, and Campello (2007), Almeida, Campello, and Galvao Jr. (2010), and Erickson and Whited (2012), all use the conventional measures of investment and cash flow to estimate the investment-cash flow sensitivity of U.S. manufacturing firms but obtain very diverse results, ranging from -0.11 to 0.38 for different time intervals i.e., between 1967 and 2008.

Baker, Stein, and Wurgler (2003) and Hennessy, Levy, and Whited (2007) both use conventional cash flow to estimate the investment-cash flow sensitivity of nonfinancial firms in Compustat but differ in terms of the investment measure used. The former considers not only the growth in book assets as investment, but also capital expenditure, research and development expenses, and selling, general, and administrative expenses. Investment-cash flow sensitivity is consequently estimated to be between 0.11 and 1.12 for the period 1980 to 1999. The latter defines investment as the sum of net capital expenditure and property, plant, and equipment, and obtain estimates ranging from 0.04 to 0.08 for the period 1968 to 2003.

Rauh (2006) obtains an investment-cash flow sensitivity estimate of 0.11 for Compustat firms during the period 1990 to 1998. He uses conventional investment in his estimation but argues that, besides depreciation and amortization, pension expense is a non-cash item that should be added back to net income in measuring cash flow. More recently, Chen and Chen (2012) use conventional measures of investment and cash flow to estimate investment-cash flow sensitivity for U.S. manufacturing firms, and find the sensitivity to be declining over time, so much so that it has 'completely disappeared in recent years' (p.394). Lewellen and Lewellen (2016) attribute this apparent phenomenon to the choice of cash flow measure used in estimating the sensitivity. Specifically, they argue that conventional cash flow has become a poor measure over time such that it produces diminishing estimates of investment-cash flow sensitivity. In fact, when cash flow is defined to include items such as asset write-downs and deferred taxes, which have become increasingly important, they find that the resulting sensitivity estimates are consistently higher than those produced by conventional cash flow.

## III. Data, Variables and Summary Statistics

### A. Data

Our sample consists of firms listed in the Compustat Industrial Annual files between 1971 and 2015. Following Frank and Goyal (2003) and Chang et al. (2014), we use the flow-of-funds (*SCF*) data to define variables that made up the cash flow identity. For firms with missing *SCF* data, we manually collect whenever possible, the data from 10-K statements that firms file with the Securities and Exchange Commission. Data on stock prices are retrieved from the Center for Research on Security Prices (CRSP) files. Dollar values are converted into 2009 constant dollars using the GDP deflator. Following common practice, we exclude 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, changes in working capital, and external financing. To minimize the sampling of financially distressed firms, we follow Almeida, Campello, and Weisbach (2004) and Almeida and Campello (2010) and exclude firm-years for which: (1) the market value of assets (GDP deflator adjusted) is less than $1 million, (2) the asset growth rate exceeds 100%, and (3) the annual amount of sales (GDP deflator adjusted) is less than $1 million. Furthermore, to ensure that the cash flow identity holds well in our data, we exclude observations for which the absolute value of the difference between the sum of all uses of cash flow, and the cash flow itself is greater than 1% of the beginning-of-period total assets. These sample filtering rules leave us with an unbalanced panel that consists of 12,163 firms and 114,560 firm-year observations.

**B. The Cash Flow Identity and Variables**

The cash flow identity, defined using Compustat flow-of-funds (*SCF*) data, posits that the sum of all uses of funds must equal to the sum of all sources of funds. That is,

$$Inv_{SCF} + \Delta C + \Delta WC + ER + DR + Div + Other = CF_{SCF} + EI + DI \quad (1)$$

where the right-hand side of equation (1) depicts the sources of funds, namely internal cash flow ($CF_{SCF}$), and proceeds from equity and debt issuances (*EI* and *DI*, respectively). The left-hand side of equation (1) comprises the uses of funds, namely investment ($Inv_{SCF}$), cash savings as measured by the change in cash holdings ($\Delta C$), working capital needs ($\Delta WC$), equity repurchase (*ER*), debt repurchase (*DR*) and cash dividends (*Div*). *Other* is a residual term that accounts for any rounding errors and misreported data that might cause the cash flow identity to be unbalanced. Defining net reduction in equity (debt) financing as the difference between total equity (debt) issues and equity (debt) repurchase i.e., $\Delta E = EI - ER$ and $\Delta D = DI - DR$, and re-arranging the cash flow identity as stated in equation (1), we have the following:

$$Inv_{SCF} + \Delta C + \Delta WC - \Delta E - \Delta D + Div + Other = CF_{SCF}. \quad (2)$$

According to the Compustat data manual, definitions of the variables in equation (1) vary depending on the format code a firm follows in reporting the *SCF* data. Appendix A details the construction of these variables based on the different format codes of the *SCF* data. Despite the varying definitions, investment according to the cash flow identity ($Inv_{SCF}$) generally refers to the sum of a firm's capital expenditure, acquisitions, and other investment (net), less the sale of its property, plant, and equipment. Other investment (net) refers to the net purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. Cash flow as per the cash flow identity ($CF_{SCF}$), is generally defined as the sum of income before extraordinary items, depreciation and amortization, extraordinary items and deferred taxes, and other operating cash flow. All variables are scaled by the beginning-of-period book assets and winsorized at the top and bottom 1% of their distributions every year to mitigate the effect of outliers.

In replicating the results of C&C (2012), we define Tobin's Q as the sum of a firm's capital stock and the difference between its market and book values of assets, divided by its capital stock. Capital refers to a firm's net property, plant and equipment. Market value of assets is the sum of a firm's market value of equity, total liability, and preferred stock, minus deferred taxes, whereby market value of equity is the product of the number of common shares outstanding and the fiscal year closing stock price. Following C&C (2012) and common practice, we define conventional investment ($Inv_{Con}$) as a firm's capital expenditure reported in the *SCF*. Conventional cash flow ($CF_{Con}$) is the sum of income before extraordinary items, depreciation and amortization, all of which are based on Compustat Income Statement. Both conventional measures of investment and cash flow are deflated by a firm's beginning-of-period capital and winsorized annually at the 1st and 99th percentiles of their distributions.

### C. Summary Statistics

Table 1 reports the descriptive statistics of our sample. The mean values of conventional investment ($Inv_{Con}^A$) and comprehensive investment ($Inv_{SCF}$) are 0.068 and 0.084 respectively, suggesting that the average size of conventional investment is less than that of comprehensive investment. Given that acquisitions and other investment (net) made up the difference between $Inv_{Con}^A$ and $Inv_{SCF}$, we infer that for an average firm, non-capital expenditure-related investments made up a significant portion of $Inv_{SCF}$. Similarly, since $CF_{SCF}$ is a more comprehensive measure of cash flow than conventional cash flow ($CF_{Con}^A$), it is not surprising that the mean value of $CF_{SCF}$ (0.088) is higher than that of $CF_{Con}^A$ (0.064). The mean values of Tobin's Q (6.548) and the market-to-book ratio (1.6) suggest that on average, our sample firms do have investment opportunities to pursue. The 25th percentile, median, and 75th percentile values of the residual term, *Other*, are all zero, implying that the cash flow identity holds well in our data.

[Insert Table 1 Here]

## IV. Empirical Methodology

This paper sets forth to investigate the apparent disappearance of investment-cash flow sensitivity, as documented by C&C (2012). In doing so, we examine the alternative ways in which investment and cash flow can be measured, and the different regression approaches that can be used to estimate the resulting investment-cash flow sensitivity. First, we note that C&C (2012) adopt the conventional measures of investment and cash flow and obtain their sensitivity estimates following the common practice of regressing investment on cash flow and a proxy for growth opportunities. The regression equation is as follows.

$$Inv_{Con_{it}} = \beta_0 + \beta_1 \times q_{it-1} + \beta_2 \times CF_{Con_{it}} + \theta_t + \varepsilon_{it} \qquad (3)$$

where $Inv_{Con}$ is conventional investment as measured by a firm's capital expenditure, while $CF_{Con}$ is conventional cash flow i.e., the sum of income before extraordinary items, depreciation and amortization. Both $Inv_{Con}$ and $CF_{Con}$ are deflated by the respective firm's beginning-of-period capital stock. $q$ is the Tobin's Q of the firm for the previous year and $\theta$ accounts for the year fixed effects.

Next, we examine how investment and cash flow can be more comprehensively measured relative to the conventional investment and cash flow measures. Specifically, we note that the assumption implicit within the conventional investment measure is that the only form of investment that firms make is capital expenditure. While this may be a reasonable assumption for firms during the early sample years, it is not so as firms progress through time.

In particular, we find that firms have become more oriented towards investing in financial assets as compared to physical assets. As such, an investment measure that encompasses a broader range of assets would seem more realistic than one that is more restrictive. Comprehensive investment is therefore defined to include acquisitions and other investment, in addition to capital expenditure.

In defining comprehensive cash flow, we note that conventional cash flow is based on Compustat income statement variables. We believe that using *SCF* variables to define cash flow makes more economic sense than using those from the income statement because by construction, the *SCF* is designed to record the flow of funds in a firm. A cash flow measure based on the *SCF* is therefore closer to the concept of cash flow than a measure based on the income statement. Moreover, the income statement is almost certain to include non-cash items such as accruals, impairment of goodwill and non-cash staff compensation expenses, making conventional cash flow a relatively less accurate measure of cash flow.

To estimate the resulting investment-cash flow sensitivity, we follow Chang et al. (2014) and leverage on the cash flow identity, as specified in equation (2). By virtue of this identity, we are able to estimate within an integrated regression framework, the sensitivity of each use of funds to the availability of cash flow. Specifically, under this framework, firms are assumed to make investment, cash holdings, dividend, and financing decisions jointly, subject to the constraint that uses of funds must equal sources of funds. That is, we estimate six empirical models in which we regress each use of funds (i.e., $Inv_{SCF}$, $\Delta Cash$, $\Delta WC$, $\Delta E$, $\Delta D$, and $Div$) on cash flow and lagged market-to-book ratio. The respective coefficient on cash flow therefore indicates the sensitivity of that use of funds to the availability of cash flow. Variables are demeaned by firm to remove the firm fixed effects, and appropriate time dummies are included to account for the year fixed effects. The resulting regression equations are written as follow.

$$Inv_{SCF_{it}} = \gamma_0^{Inv} + \gamma_1^{Inv} \times MB_{it-1} + \gamma_2^{Inv} \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it}^{Inv} \quad (4)$$

$$\Delta C_{it} = \gamma_0^{\Delta C} + \gamma_1^{\Delta C} \times MB_{it-1} + \gamma_2^{\Delta C} \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it}^{\Delta C} \quad (5)$$

$$\Delta WC_{it} = \gamma_0^{\Delta WC} + \gamma_1^{\Delta WC} \times MB_{it-1} + \gamma_2^{\Delta WC} \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it}^{\Delta WC} \quad (6)$$

$$\Delta E_{it} = \gamma_0^{\Delta E} + \gamma_1^{\Delta E} \times MB_{it-1} + \gamma_2^{\Delta E} \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it}^{\Delta E} \quad (7)$$

$$\Delta D_{it} = \gamma_0^{\Delta D} + \gamma_1^{\Delta D} \times MB_{it-1} + \gamma_2^{\Delta D} \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it}^{\Delta D} \quad (8)$$

$$Div_{it} = \gamma_0^{Div} + \gamma_1^{Div} \times MB_{it-1} + \gamma_2^{Div} \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it}^{Div} \quad (9)$$

$$Other_{it} = \gamma_0^{Other} + \gamma_1^{Other} \times MB_{it-1} + \gamma_2^{Other} \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it}^{Other} \quad (10)$$

where $MB_{it-1}$ is a firm's market-to-book ratio lagged one year, $Other_{it}$ is the residual term that capture any noise, which cause the cash flow identity to be unbalanced, and $\theta_t$ is the appropriate time dummy. The coefficient of our interest is therefore $\gamma_2^{Inv}$ in equation (4), given that it measures how investment changes in response to a change in cash flow availability i.e., the much sought-after investment-cash flow sensitivity.

This integrated regression framework has the methodological advantage of offering a complete view of the cash flow activities of a firm as it simultaneously tracks all uses of cash flow, which are interrelated among one another by virtue of the cash flow identity. Notably, Chang et al. (2014) show that if the cash flow identity in equation (1) and (2) holds in the data, the coefficients on cash flow should add up to unity across equations (4) - (10), and the coefficient on lagged market-to-book ratio should sum to zero across the equations. That is, $\gamma_2^{Inv} + \gamma_2^{\Delta C} + \gamma_2^{\Delta WC} + \gamma_2^{\Delta E} + \gamma_2^{\Delta D} + \gamma_2^{Div} + \gamma_2^{Other} = 1,$ and $\gamma_1^{Inv} + \gamma_1^{\Delta C} + \gamma_1^{\Delta WC} + \gamma_1^{\Delta E} + \gamma_1^{\Delta D} + \gamma_1^{Div} + \gamma_1^{Other} = 0.$ In other words, if cash flow increases by one dollar, then ceteris paribus, the changes in all uses of cash flow must sum to that dollar. However, if the shock stems from an exogenous or predetermined variable that represents neither a source nor a use of funds in the current period, then the total response across different uses of cash must sum to zero.[27] Chang et al. (2014) also demonstrate that estimating equations (4) - (10) in isolation is equivalent to estimating them as simultaneous equations so long as these model specifications incorporate the same set of right-hand-side variables.[28]

## V. Empirical Results

### A. The Investment and Cash Flow Measures

We start by addressing the basic question of how to measure investment and cash flow. Conventionally, investment is measured by capital expenditure, whereas cash flow is defined as the sum of income before extraordinary items, depreciation and amortization. Implicit in such measures of investment and cash flow is the assumption that firms only make one form of investment i.e., that of physical assets, and the only non-cash expenses that firms have are those related to depreciation and amortization. Therefore, to the extent that firms make other forms of investment such as those of financial assets or have other types of non-cash expenses such as asset write-offs and employee stock compensation expenses, these conventional measures will fall short of capturing the real magnitude of investment and cash flow.

In view of this possible deficiency in conventional variables, we follow Chang et al. (2014) and introduce comprehensive measures of investment and cash flow into our analysis. Panel A of Exhibit 1 illustrates how comprehensive investment is defined relative to conventional investment. Specifically, comprehensive investment includes not only capital expenditure as the traditional form of investment, but also acquisitions, and other investment

[27] For instance, suppose the coefficient on lagged market-to-book ratio is 0.1 in equation (4), suggesting that investment increases by 10% of capital stock if lagged market-to-book ratio 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 in lagged market-to-book ratio on other uses must sum to -10% of capital stock, all else constant.

[28] This result is not surprising in view that the simultaneous equations (4) - (10) qualify as seemingly unrelated regressions (SURs). In fact, Kruskal's (1960) theorem implies 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. This is exactly the case in our equations (4) - (10). See Greene (2012) (page 293-295) for a detailed proof.

such as the sale or purchase of financial assets. Similarly, comprehensive cash flow accounts for more operating activities that could produce cash flows to a firm, as well as adjusts for more non-cash items than do conventional cash flow, so as to provide a more accurate measure of the cash flow situation of a firm. Panel B of Exhibit 1 depicts how conventional cash flow relates to comprehensive cash flow.

[Insert Exhibit 1 Here]

Panel A of Figure 1 depicts the amounts of conventional and comprehensive investments (GDP deflator adjusted) for all nonfinancial U.S. firms in our sample. Since comprehensive investment encompasses relatively more investing items, it is not surprising that comprehensive investment is consistently greater than conventional investment for all the sample years. Having said that, capital expenditure was the main form of investment that firms made during the early sample years as conventional investment closely tracks comprehensive investment during the 1970s to 1980s. However, as time progresses, firms are increasingly making other forms of investments so much so that conventional investment diverge significantly from comprehensive investment. In 1971, the difference between conventional and comprehensive investments was only US$14.7 billion. It then grew to a significant US$260.1 billion in 1999, whereby comprehensive investment aggregate to US$719.8 billion, whereas conventional investment sum to only US$459.7 billion. In 2015, comprehensive investment is higher than conventional investment by a daunting US$231.4 billion.

[Insert Figure 1 Here]

To shed more light on these differences, we follow C&C (2012) and classify our sample firms into either the manufacturing or non-manufacturing industry. Specifically, a firm is classified into the manufacturing (non-manufacturing) industry if the first digit of its Standard Industry Classification (SIC) code (does not) equals to two or three. Panel B and C of Figure 1 depict the aggregate amounts of conventional and comprehensive investments for these two industries, respectively. In particular, we find that the divergence between the two measures of investment is mainly coming from U.S. manufacturing firms, given that conventional investment tracks comprehensive investment for non-manufacturing firms during most of the sample years. In fact, of the US$260.1 billion difference between conventional and comprehensive investment in 1999, as much as US$166.6 billion is attributed to the difference from manufacturing firms.

[Insert Figure 2 Here]

Figure 2 depicts the aggregate amounts of conventional and comprehensive cash flow (GDP deflator adjusted) for our sample firms. We find that although comprehensive cash flow is consistently greater than conventional cash flow, the margin of difference is minimal for all firms during many of the sample years, regardless of the industries they are classified into. Notably, divergence between the two measures of cash flow occurred in a few of the sample years such as 2001, 2002, 2008, and 2015.

[Insert Figure 3 Here]

To better understand these statistics, we further classify U.S. manufacturing firms into specific industries according to C&C (2012).[29] Panel A to C of Figure 3 (Figure 4) depict respectively, the aggregate amounts of investment (cash flow) for firms in the durable goods, nondurable goods, and high-tech industries. We show that firms in the durable goods and high-tech industries contributed the most to the divergence between conventional and comprehensive investments of U.S. manufacturing firms. In 1999, the difference between the

[29] That is, a firm is classified into the high-tech industry if its three-digit Standard Industry Classification (SIC) code is 283, 357, 366, 367, 382, or 384. A firm is in the durable goods industry if it is not in the high-tech industry, and the first two digits of its SIC code is between 24 and 25, or between 32 and 38, inclusive. A firm is in the nondurable goods industry if it is not in the high-tech industry, and the first two digits of its SIC code is between 20 and 23, or between 26 and 31, inclusive. Like C&C (2012), we do not include in any of the three industry groups, firms with two-digit SIC codes equal to 39 ("Miscellaneous Manufacturers").

two measures of investment for durables firms sum to US$125.0 billion i.e., 75% of the difference for all manufacturing firms in that year. For high tech firms, conventional investment has also become an increasingly poor measure over time in that the gap between conventional and comprehensive investments widen significantly as we progress through time. In 2015, these firms made significant amounts of non-capital expenditure investments; The difference between conventional and comprehensive investment sum to as much as US$102.3 billion. This implies that high-tech firms are making more acquisitions and investment in financial assets than capital expenditure, and that capital expenditure has become a relatively less relevant measure of investment over time.

[Insert Figure 4 Here]

Figure 4 simply reiterates that for many sample years, conventional cash flow is a reasonably good measure across the three industries. Notably for high-tech firms, there were a few years in which conventional cash flow fell short of comprehensive cash flow i.e., 2001, 2002, and 2008, just to name a few. Figure 5 (Figure 6) presents the annual mean investment (cash flow) ratios of all our sample firms. To provide statistics of our investment and cash flow measures that are comparable with those of previous studies, we scale our measures in three different ways.[30] In general, we find that the ratios of comprehensive investment are consistently higher than those of conventional investment. Specifically, when we follow C&C (2012) and scale investment by lagged net property, plant, and equipment, the resulting ratios become especially volatile. On the other hand, the annual mean ratios of conventional cash flow track those of comprehensive cash flow, albeit not perfectly.

[Insert Figure 5 and 6 Here]

[30] To scale their investment and cash flow measures, C&C (2012) use net property, plant, and equipment. Chang et al. (2014) use the book value of total assets, while Lewellen and Lewellen (2016) use the average net assets, where net assets are defined as total assets minus nondebt current liabilities.

## B. The Composition of Investment and Cash Flow

To evaluate the adequacy of conventional investment and cash flow in measuring the underlying investing activities and cash flow situation of our sample firms, we examine the composition of aggregate investment and cash flow during the period 1971 to 2015. Panel A of Figure 7 depicts the proportions of three main components of investment. They are net capital expenditure, acquisitions, and other investment (net), where net capital expenditure is a firm's capital expenditure less the sale of its property, plant, and equipment. We show that, although net capital expenditure constitutes 74% of investment, acquisitions and other investment also take up a sizeable 26%. In fact, our sample firms made a total of US$3.948 trillion (GDP deflator adjusted) worth of acquisitions during the sample period. Panel B of Figure 7 depicts the proportions of cash flow components, which include conventional cash flow, extraordinary items, deferred taxes and other operating cash flow. In general, conventional cash flow is a reasonably good measure, capturing as much as 86% of comprehensive cash flow in the aggregate.

[Insert Figure 7 Here]

Figure 8 depicts how the aggregate amounts of investment and cash flow components (GDP deflator adjusted) change over time. Throughout the sample period, capital expenditure remains the most significant form of investment made by our firms. In 1971, net capital expenditure sum to US$181.5 billion, and subsequently grew to US$523.3 billion in 2015. That said, it is also noteworthy that acquisitions have grown in magnitude, from being worth a mere US$5.6 billion in 1971 to as much as US$260.7 billion in 2015. Cash flow on the other hand, exhibit a different pattern; Except for a few years such as 2001, 2002, 2008, and 2015, conventional cash flow made up a dominant part of comprehensive cash flow.

[Insert Figure 8 Here]

To investigate why conventional cash flow diverges from comprehensive cash flow during the said years, we look up the 10-K statements of several sample firms. The line-by-line *SCF* data items contained therein reveal that during those years, large high-tech companies such as Cisco System Inc., Apple Inc., and Hewlett-Packard Company, reported significant amounts of employee share-based compensation expenses that are non-cash in nature. Given that such technology firms have been known to rely on employee stock options more extensively than do firms in the non-high-tech industries, it is no wonder that conventional cash flow diverges relatively more significantly from comprehensive cash flow for technology firms. In addition, there were several significant non-cash expenses, such as restructuring charges, provisions for doubtful debt, and impairment charges for intangible assets, which are accounted for by the comprehensive measure of cash flow but not by the conventional measure.

[Insert Figure 9 Here]

Figure 9 examines the relative proportions of investment components over time. Importantly, we show that although capital expenditure remains as a major component of investment, its relative proportion has decreased over time. In 1971, net capital expenditure made up 87% of comprehensive investment for all sample firms but in 2015, it amounted to only a little more than 65%. Acquisitions on the other hand, exhibit an upward trend in that it grew from being only 3% of comprehensive investment in 1971 to being as high as 34% in 2015. The change in investment composition is even more drastic when we examine firms by their industry types. Specifically, acquisitions have increased in both absolute and relative terms for firms in the manufacturing industry; They amount to US$3.8 billion (GDP deflator adjusted) in 1971 and increase to a sizeable US$154.6 billion in 2015. This corresponds to 3% versus almost 50% of comprehensive investment, respectively.

In sum, while conventional investment does not seem to be comprehensively measuring the average investing activities of nonfinancial U.S. firms in Compustat, the conventional measure of cash flow is generally a reasonable cash flow measure for these firms.

### C. The Cash Flow Sensitivity of Comprehensive Investment

Traditionally, investment-cash flow sensitivity is estimated based on a standalone regression whereby conventional investment is regressed on conventional cash flow, along with a proxy for investment opportunities. As an alternative approach, investment-cash flow sensitivity can be estimated as part of a series of regressions in which all uses of cash flow (including comprehensive investment) are individually regressed on the comprehensive measure of cash flow. Panel A of Table 2 presents the cross-sectional results of this integrated set of regressions.

[Insert Table 2 Here]

For the period 1971 to 2015, an average nonfinancial U.S. firm in Compustat allocates 28 cents of a dollar of cash flow to investment, increases cash holdings by 19.7 cents, uses 30.7 cents to meet working capital needs, reduces the use of equity and debt by 13.5 cents and 6.2 cents respectively, and pays dividend of 1.5 cents. Since the regressions are integrated by virtue of the cash flow identity, the coefficients on cash flow sum to unity, implying that an increase in the allocation of cash flow to a certain use must be offset by a corresponding decrease in the allocation to some other use(s) of cash flow. Panel A of Figure 10 illustrates the relative proportions of the cash flow sensitivities. It shows that, of all uses of cash flow, changes in net working capital and investment have the highest sensitivities to cash flow.

To better understand the investment-cash flow sensitivity estimate of 0.28, we regress the components of comprehensive investment on cash flow. Panel B of Table 2 shows that of the 28 cents of cash flow allocated to investment, a majority was used for net capital expenditure (13.7 cents), while the remainder was used for acquisitions (4.1 cents), and other investment (10.2 cents). In other words, only a little less than 50% of the investment-cash flow sensitivity is coming from conventional investment. Panel B of Figure 10 shows that acquisitions and other investment together explain 51% of the investment-cash flow sensitivity. Therefore, we deduce that using conventional investment to estimate investment-cash flow sensitivity is likely to underestimate its magnitude.

[Insert Figure 10 Here]

**D. The Cash Flow Sensitivity of Conventional versus Comprehensive Investment**

To examine the implications that alternative measures of investment and cash flow have on the estimation of investment-cash flow sensitivity, we estimate the said sensitivity for our sample firms using both conventional and comprehensive variables, and regression approaches. Panel A of Figure 11 depicts the yearly sensitivity estimates of all sample firms, whereas Panel B and C present the results for U.S. manufacturing and non-manufacturing firms, respectively. Regardless of how investment-cash flow sensitivity is estimated, we show that the cash flow sensitivity of investment has gradually decreased over time for firms in all industries. Specifically, we find that investment-cash flow sensitivity estimated using the methodology of C&C (2012) has indeed declined and disappeared over the sample period 1971-2015. However, the cash flow sensitivity of comprehensive investment estimated using the regression approach of Chang et al. (2015) has decreased but not disappeared over time. In fact, estimates of the cash flow sensitivity of comprehensive investment are consistently higher than those of conventional investment for all years, and for firms in all industries.

[Insert Figure 11 Here]

To replicate the results of C&C (2012), as well as contrast their estimates with those produced by the methodology of Chang et al. (2014), we further divide our manufacturing firms into the three industry groups (i.e., durable goods, nondurable goods, and high-tech industries), and estimate their investment-cash flow sensitivities using the variable definitions and regression approach of both C&C (2012), and Chang et al. (2014). The resulting estimates, as plotted in Figure 12, are similar to those presented in Panel B of Figure 11. That said, we find the estimates of comprehensive investment-cash flow sensitivity within each industry group to be more volatile than those estimated for the manufacturing industry as a whole.

[Insert Figure 12 Here]

In sum, we show that the conventional approach used by C&C (2012) to estimate investment-cash flow sensitivity consistently produces estimates that are lower than those produced by the comprehensive approach of Chang et al. (2014). To the extent that it is more realistic to measure investment and cash flow comprehensively and estimate investment-cash flow sensitivity based on an integrated regression framework, the conventional approach of C&C (2012) underestimates the magnitude of investment-cash flow sensitivity for our sample of nonfinancial U.S. firms during the period 1971-2015.

**E. The Cash Flow Sensitivity of Investment Components**

To understand how our results relate to those of C&C (2012), we regress each component of investment on cash flow, using the empirical methodologies of C&C (2012) and Chang et al. (2014). Specifically, the equations following the regression approach of C&C (2012) are:

$$CEx_{it} = \beta_0 + \beta_1 \times q_{it-1} + \beta_2 \times CF_{Con_{it}} + \varepsilon_{it} \tag{11}$$

$$Acq_{it} = \beta_0 + \beta_1 \times q_{it-1} + \beta_2 \times CF_{Con_{it}} + \varepsilon_{it} \quad (12)$$

$$Oth_{it} = \beta_0 + \beta_1 \times q_{it-1} + \beta_2 \times CF_{Con_{it}} + \varepsilon_{it} \quad (13)$$

where the left-hand side of equation (11) to (13) refer respectively to a firm's net capital expenditure (*CEx*), acquisitions (*Acq*), and other investment (*Oth*), such that $Inv_{SCF} = CEx + Acq + Oth$. Following C&C (2012), we normalize all regression variables by the respective firm's lagged net property, plant and equipment. The regression equations based on Chang et al. (2014) are as follow.

$$CEx_{it} = \gamma_0 + \gamma_1 \times MB_{it-1} + \gamma_2 \times CF_{SCF_{it}} + \varepsilon_{it} \quad (14)$$

$$Acq_{it} = \gamma_0 + \gamma_1 \times MB_{it-1} + \gamma_2 \times CF_{SCF_{it}} + \varepsilon_{it} \quad (15)$$

$$Oth_{it} = \gamma_0 + \gamma_1 \times MB_{it-1} + \gamma_2 \times CF_{SCF_{it}} + \varepsilon_{it} \quad (16)$$

Following Chang et al. (2014), we normalize the regression variables in equation (14) to (16) by the respective firm's lagged book value of total assets. In Figure 13, Panel A plots the yearly estimates of overall investment-cash flow sensitivity, while Panel B to D plot respectively, the cash flow sensitivities of the three investment components i.e., net capital expenditure, acquisitions, and other investment. Importantly, Panel A shows that when investment is defined to include investing items not related to capital expenditure, even the model specification of C&C (2012) produces non-disappearing investment-cash flow sensitivity for all firms in the sample. Panel B essentially reiterates the results of C&C (2012) i.e., when investment is measured by capital expenditure, and regressed on conventional cash flow, the resulting estimates of investment-cash flow sensitivity exhibit a diminishing and disappearing time trend.

Panel C and D respectively show that the cash flow sensitivities of acquisitions and other investment are non-zero for all the sample years. That is, when investment is defined to include not only capital expenditure, but also acquisitions and other investment, the resulting cash flow sensitivities of these non-capital expenditure investments offset, to a certain extent, the decreasing capital expenditure-cash flow sensitivity such that the overall investment-cash flow sensitivity does not disappear over time. In other words, under both the empirical methodologies of C&C (2012) and Chang et al. (2014), the cash flow sensitivity of capital expenditure has declined over the sample years. However, the cash flow sensitivities of non-capital expenditure investments did not. Taken together, this implies that, to the extent that investment is more accurately measured by comprehensive investment, the resulting investment-cash flow sensitivity did not disappear over time, and that the said sensitivity would have been consistently underestimated under the methodological framework of C&C (2012).

[Insert Figure 13 Here]

**F. The Time Trend in Investment-Cash Flow Sensitivity**

To recapitulate, we find that the investment-cash flow sensitivity of nonfinancial U.S. firms has been gradually decreasing over the period 1971-2015. In this section, we propose two possible explanations for the decreasing sensitivity, and evaluate their potential in explaining the observed time trend. First, the type of firms in our sample could have changed over time, such that different firms are used to estimate the investment-cash flow sensitivity for different time periods.[31] Second, the business fundamentals underlying our sample firms could have changed during the sample period, leading to changes in the way they response to investment given a change in the availability of cash flow.

[31] In fact, Fama and French (2004) document a dramatic increase in the number of firms newly listed on the major U.S. stock markets in the 1980s and 1990s. Importantly, they find that these firms are significantly different from existing listed firms in that the profitability (growth) of these entrant firms are relatively more left (right) skewed.

To disentangle the effect of changes in sample composition from that of changes in allocation dynamics, we classify our sample firms into incumbents and entrants, and estimate their respective cash flow sensitivities to investment. If the decreasing trend in investment-cash flow sensitivity is attributed to changes in the composition of our sample, then we would expect entrants, but not incumbents, to exhibit decreasing investment-cash flow sensitivity over the sample period. On the flipside, if the trend is attributed to changes in allocation dynamics, then we would expect only incumbents to experience decreasing investment-cash flow sensitivity.

We classify firms as incumbents or entrants based on their year of listing. Specifically, we adopt three classification schemes whereby firms are classified as incumbents if they are listed (1) before 1971, (2) during 1966 to 1980, or (3) during 1976 to 1990. Correspondingly, firms are regarded as entrants if they are listed during the years (1) 1971 to 1985, (2) 1981 to 1995, or (3) 1991 to 2005. We then estimate the cash flow sensitivities of investment and its components for incumbents and entrants separately. Figure 14 plots the results under the first classification scheme. Importantly, we find that incumbents and entrants exhibit similar patterns of cash flow allocation to investment; The decreasing trend in investment-cash flow sensitivity is driven by not only changes in sample composition, but also changes in allocation dynamics. In unreported results, we find that the similarity in sensitivity estimates between incumbents and entrants are robust to the second and third classification schemes.

[Insert Figure 14 Here]

In other words, the sensitivity of investment to cash flow availability has not disappeared over time. In fact, to the extent that investment-cash flow sensitivity is caused by agency problems (Jensen and Meckling (1976) and Jensen (1986)), the time trend associated with agency costs would have also declined and disappeared over the sample period.[32] However, we do not observe such a trend; Lehn, Patro, and Zhao (2007) track the evolution of the adoption of six anti-takeover provisions during the period 1970 – 1990 and find that there was a sharp increase in the adoption of these provisions in 1984.[33] In particular, poison pills and limits to amend charters were mainly adopted after 1984. Similarly, Cremers and Ferrell (2014) find that, in the 1980s, there was a substantial increase in the adoption rates of four of the six provisions in the E-Index (Bebchuk, Cohen and Ferrell (2009)).[34] That said, there was little time variation in the rates of adoption of these provisions during the 1990s. The incidence of G-Index provisions has also been generally increasing over the years 1978 to 2006.[35]

**G. Alternative Measures of Investment-Cash Flow Sensitivity**

To reconcile the discrepancy between our results and those of C&C (2012) regarding the disappearance of investment-cash flow sensitivity for U.S. manufacturing firms, we employ the regression model specification of C&C (2012) but alternate the regression variables with conventional and comprehensive measures of investment and/or cash flow. In this way, we are able to pinpoint where the discrepancy in results is coming from. Specifically, we run the following regression equations in addition to equation (3). Following C&C (2012), all regression variables are deflated by the respective firm's lagged property, plant, and equipment.

$$Inv_{SCF_{it}} = \gamma_0 + \gamma_1 \times q_{it-1} + \gamma_2 \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it} \quad (17)$$

[32] Specifically, entrenched managers could overinvest in the presence of high cash flow availability. Therefore, firms with entrenched managers who are subject to fewer corporate governance mechanisms could invest relatively more and exhibit greater investment-cash flow sensitivity.

[33] The provisions include classified boards, limits to amend charters, limits to amend by-laws, supermajority requirements, poison pills and golden parachutes.

[34] The provisions are supermajority merger, classified board, poison pill and golden parachute.

[35] The provisions include compensation plan, director indemnification contract, severance agreement, anti-greenmail, fair price requirements, business combination statute, secret ballot, cumulative voting and director liabilities.

$$Inv_{SCF_{it}} = \delta_0 + \delta_1 \times q_{it-1} + \delta_2 \times CF_{Con_{it}} + \theta_t + \varepsilon_{it} \tag{18}$$

$$Inv_{Con_{it}} = \xi_0 + \xi_1 \times q_{it-1} + \xi_2 \times CF_{SCF_{it}} + \theta_t + \varepsilon_{it} \tag{19}$$

Figure 15 summarizes the regression results for U.S. manufacturing firms in total, as well as for firms in each of the three industries, namely the durable goods, nondurable goods, and high-tech industries. In general, comprehensive (conventional) measures of investment and cash flow consistently produce the highest (lowest) estimates of investment-cash flow sensitivity, with a range from 0.114 to 0.404 (0 to 0.209), for all sample subperiods and for firms in all the manufacturing industries. Using comprehensive investment and conventional cash flow produces estimates of investment-cash flow sensitivity that lie somewhere between the highest and lowest estimates. That is, the magnitude of sensitivity drops slightly from the highest level, but does not reduces to zero, ranging from 0.041 to 0.269.

[Insert Figure 15 Here]

Importantly, the comprehensive measure of investment-cash flow sensitivity did not disappear over the sample years. Given that all investment-cash flow sensitivity estimates are produced by using the regression model specification of C&C (2012), differing only in terms of the regression variables used, the discrepancy between our results and those of C&C (2012) essentially lies in the way investment and cash flow are measured. To further evaluate the discrepancy, we examine the estimates of conventional investment-comprehensive cash flow sensitivity and find them to be almost disappearing over time. The estimates range from 0.008 to 0.222, akin to those of C&C (2012), which we replicate in Figure 15, and report as conventional estimates of investment-cash flow sensitivity. In other words, our descriptive statistics and regression results both show that the choice of cash flow measure does not significantly affect the investment-cash flow sensitivity estimates. Rather, how investment is defined significantly impact on the magnitude of investment-cash flow sensitivity of our sample firms.

Specifically, we construe that the disappearing investment-cash flow sensitivity reported by C&C (2012) are, at least in part, produced by using capital expenditure as the measure of investment. To the extent that firms make other forms of investment such as those of acquisitions and financial assets, the investment-cash flow sensitivity estimated by C&C (2012) may not be as accurate as that estimated based on the comprehensive measure of investment and the cash flow identity-based regression framework. We summarize the estimates of investment-cash flow sensitivity under the alternative measures of investment and cash flow in Table 3. Panel A depicts the results for all manufacturing firms in our sample whereas Panel B presents the results for firms in the durable goods, nondurable goods, and high-tech industries, respectively.

[Insert Table 3 Here]

Column 1 (2) of Table 3 presents the periodic investment-cash flow sensitivity, estimated using the conventional (comprehensive) measures of investment and cash flow for our manufacturing firms. The change in sensitivity as a result of using the conventional versus comprehensive measures of investment and cash flow is therefore the difference between the estimates contained in Column 1 and 2, as tabulated in Column 5. The sensitivity estimates in Column 3 (4) are estimated based on conventional (comprehensive) investment and comprehensive (conventional) cash flow. Column 6 (8) depicts the (percentage) change in sensitivity due to a change in the investment measure used. That is, the (percentage) difference between the conventional cash flow sensitivity of conventional and comprehensive investments. Column 7 (9) presents the (percentage) change in sensitivity due to a change in the cash flow measure used. That is, the (percentage) difference between the conventional and comprehensive cash flow sensitivities of conventional investment.

We show that the magnitude of investment-cash flow sensitivity fluctuates with both the investment and cash flow measures used. That said, the choice of investment matters more than that of cash flow; For all manufacturing firms in our sample, the average percentage change in investment-cash flow sensitivity as a result of a change in the investment measure used (49%) is consistently higher than that due to a change in the cash flow definition (8%). In fact, for firms in all the three industries, the choice of cash flow measure makes no material difference to the sensitivity estimates in that alternating between conventional and comprehensive cash flows, while holding fix investment as capital expenditure, produces almost identical estimates of investment-cash flow sensitivity. These regression results, along with our descriptive statistics, show that conventional cash flow is a reasonably good measure. Conventional investment on the other hand, is falling short of measuring the investment activities of our sample firms.

### H. Analysis of Lewellen and Lewellen (2016)

Lastly, we evaluate the claim of Lewellen and Lewellen (2016) that the apparent decline in investment-cash flow sensitivity documented by C&C (2012) is due to conventional cash flow being an increasingly poor measure of cash flow over time. In doing so, we first replicate their results and note that their cash flow measure is akin to our comprehensive cash flow measure. Specifically, they define cash flow as the sum of the following items: income before extraordinary items, extraordinary items and discontinued operations, depreciation and amortization, deferred taxes, equity in net loss of unconsolidated subsidiaries, losses from the sale of property, plant and equipment, and funds from other operations.[36] Notably, they employ

[36] It is noteworthy that although Lewellen and Lewellen (2016) also use the *SCF* data to define cash flow, our measure of cash flow differs from theirs in that we explicitly consider the different format codes that firms follow in reporting their *SCF* data and adjust our cash flow definition accordingly. This enables us to more precisely estimate the cash flow components. Moreover, we supplement missing *SCF* variables with hand-collected data,

several measures of investment, including net capital expenditure (*Capx1*), cash flow from investing activities as reported in the *SCF* (*Capx2*), as well as the year-on-year change in fixed assets, adjusted for noncash charges such as depreciation, and asset write-downs (*Capx3*).[37]

[Insert Figure 16 Here]

Following Lewellen and Lewellen (2016), we only consider in our analysis, nonfinancial U.S. firms larger than the 10th percentile of NYSE firms, in terms of beginning-of-period net assets. Figure 16 plots the sensitivities of *Capx1*, *Capx2*, and *Capx3* to both conventional cash flow ($CF_{Con}$), and their measure of cash flow ($CF_{LL}$). In particular, Panel A and C of Figure 16 correspond respectively to Panel A and B of their Figure 2. Like the authors, we find that estimates of investment-cash flow sensitivity fluctuate with the different cash flow measures used. However, we show additionally that the sensitivity estimates also fluctuate with respect to the different definitions of investment used. Irrespective of the cash flow measure used ($CF_{Con}$ or $CF_{LL}$), Figure 17 shows that the magnitude of investment-cash flow sensitivity varies, depending on the investment measure used.

[Insert Figure 17 Here]

To examine the adequacy of the investment and cash flow measures used in Lewellen and Lewellen (2016), we compute the summary statistics of these variables and plot them in Figure 18. Panel A and B of the figure depict for our selected sample, aggregate amounts of the investment and cash flow measures (GDP deflator adjusted), respectively. In particular, for many of the sample years, *Capx1* diverges considerably from *Capx2* and *Capx3*. On the other hand, except for a few years, $CF_{Con}$ closely tracks $CF_{LL}$. Panel C and D plot the respective average ratios of investment and cash flow. Among the three investment measures, *Capx3* has

obtained by looking up the 10-K statements that firms file with the Securities and Exchange Commission. This gives us a more complete set of data to begin with.

[37] In essence, *Capx2* is our comprehensive measure of investment ($Inv_{SCF}$).

the highest ratio throughout the sample period. This is not surprising since *Capx3* entails the broadest range of investments.[38] Notably, the annual mean ratios of *Capx3* diverge significantly from those of *Capx1*, more than *Capx2* diverge from *Capx1*. In contrast, the annual mean ratios of $CF_{Con}$ track those of $CF_{LL}$, albeit not perfectly.

[Insert Figure 18 Here]

Following Lewellen and Lewellen (2016), we compute in Figure 19, the annual standard deviation, and correlation of the cash flow measures. In addition, we compute those of investment measures, and plot them in the same figure; Panel A shows that *Capx3* has become more volatile over time, as compared to *Capx1*. In contrast, Panel B shows that, except for a few years (i.e., in 2000, 2001, 2002, and 2008) in which there are volatility spikes for $CF_{Con}$, $CF_{Con}$ and $CF_{LL}$ are comparably volatile over the sample years. Importantly, Panel C highlights that although the correlation between the two cash flow measures has been declining over time, the correlation between *Capx1* and *Capx3* has decreased by an even greater margin.

[Insert Figure 19 Here]

To further evaluate the adequacy of conventional cash flow, we examine the explanatory power of conventional versus comprehensive cash flow in a formal regression setting. Specifically, we define comprehensive cash flow in terms of conventional cash flow and various components, and regress comprehensive investment and its components on these cash flow components. Equation (20) illustrates that comprehensive cash flow is the sum of conventional cash flow ($CF_{Con}$), extraordinary items and discontinued operations (*EI*), deferred taxes (*DT*), and other cash flow (*OC*). The regressions are depicted in equations (21) to (24).

$$CF_{SCF} = CF_{Con} + EI + DT + OC \tag{20}$$

[38] In fact, *Capx3* includes not only cash acquisitions as part of investment, but also stock-for-stock transactions, which we do not consider in our comprehensive measure of investment.

$$Inv_{SCF_{it}} = \gamma_0 + \gamma_1 \times MB_{it-1} + \gamma_2 \times CF_{Con_{it}} + \gamma_3 \times EI_{it} + \gamma_4 \times DT_{it} + \gamma_5 \times OC_{it} + \theta_t + \varepsilon_{it} \quad (21)$$

$$CEx_{it} = \gamma_0 + \gamma_1 \times MB_{it-1} + \gamma_2 \times CF_{Con_{it}} + \gamma_3 \times EI_{it} + \gamma_4 \times DT_{it} + \gamma_5 \times OC_{it} + \theta_t + \varepsilon_{it} \quad (22)$$

$$Acq_{it} = \gamma_0 + \gamma_1 \times MB_{it-1} + \gamma_2 \times CF_{Con_{it}} + \gamma_3 \times EI_{it} + \gamma_4 \times DT_{it} + \gamma_5 \times OC_{it} + \theta_t + \varepsilon_{it} \quad (23)$$

$$Oth_{it} = \gamma_0 + \gamma_1 \times MB_{it-1} + \gamma_2 \times CF_{Con_{it}} + \gamma_3 \times EI_{it} + \gamma_4 \times DT_{it} + \gamma_5 \times OC_{it} + \theta_t + \varepsilon_{it} \quad (24)$$

Panel B of Table 2 presents the associated regression results. We find that for overall investment and its components, the coefficients on comprehensive cash flow approximate those on conventional cash flow; The sensitivity of overall investment to comprehensive cash flow, and to conventional cash flow are both 0.28. The sensitivities of net capital expenditure, acquisitions, and other investment to comprehensive (conventional) cash flow are 0.137 (0.134), 0.041 (0.043), and 0.102 (0.103), respectively. Therefore, we conclude that after controlling for other components of cash flow such as extraordinary items and discontinued operations, deferred taxes, and other cash flow, conventional cash flow explains comprehensive investment and its components just as much as comprehensive cash flow do.

In sum, while Lewellen and Lewellen (2016) show that conventional cash flow has become a poor measure over time and deem it as a cause for the disappearing investment-cash flow sensitivity reported by C&C (2012), we make the analysis more complete by analyzing the corresponding investment measure used to estimate the said sensitivity. In fact, consistent with the main results of our analysis, we find that although the choice of both investment and cash flow measures affect the magnitude of the resulting investment-cash flow sensitivity, the choice of investment measure matters more than that of cash flow measure in explaining the seemingly disappearing investment-cash flow sensitivity documented by C&C (2012).

## VI. Conclusion

We study the evolution of investment-cash flow sensitivity of nonfinancial U.S. firms during the period 1971 to 2015. In doing so, we examine how investment and cash flow are measured, and evaluate the adequacy of conventional variables in measuring the investment and cash flow of our sample firms. We find that while conventional cash flow is a reasonably good measure, conventional investment falls short of comprehensively measuring the firms' investing activities. Specifically, firms are increasingly making other forms of investment (such as acquisitions and financial assets) over time, so much so that capital expenditure no longer dominates the firms' investment portfolios in recent years.

Using comprehensive measures of investment and cash flow based on Compustat Statement of Cash Flows, as well as an integrated regression framework based on the cash flow identity, we show that the cash flow sensitivity of investment has declined but not disappeared over the years. Further analysis reveals that the downward time trend is driven by both changes in sample composition, and changes in allocation dynamics. We find that the cash flow sensitivity of capital expenditure has decreased over time, whereas those of acquisitions, and other investment have not; The non-zero cash flow sensitivities of non-capital expenditure investments offset, to a certain extent, the decreasing capital expenditure-cash flow sensitivity such that the overall investment-cash flow sensitivity did not disappear over time.

In sum, we provide important insights into the investment-cash flow sensitivity puzzle, which C&C (2012) has left unresolved. We show that the cash flow sensitivity of investment fluctuates with the choice of both investment and cash flow measures used and that how investment is defined matters more than how cash flow is defined. In fact, to the extent that it is more realistic to measure investment comprehensively, the empirical methodology of C&C (2012) would have underestimated the investment-cash flow sensitivity of our sample firms, thereby producing the seemingly disappearing sensitivity estimates.

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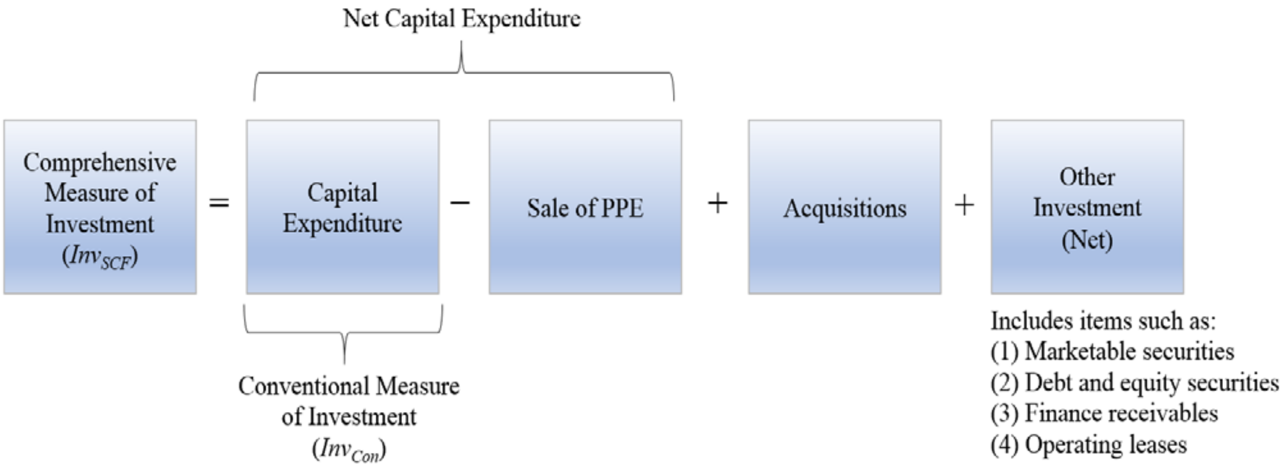
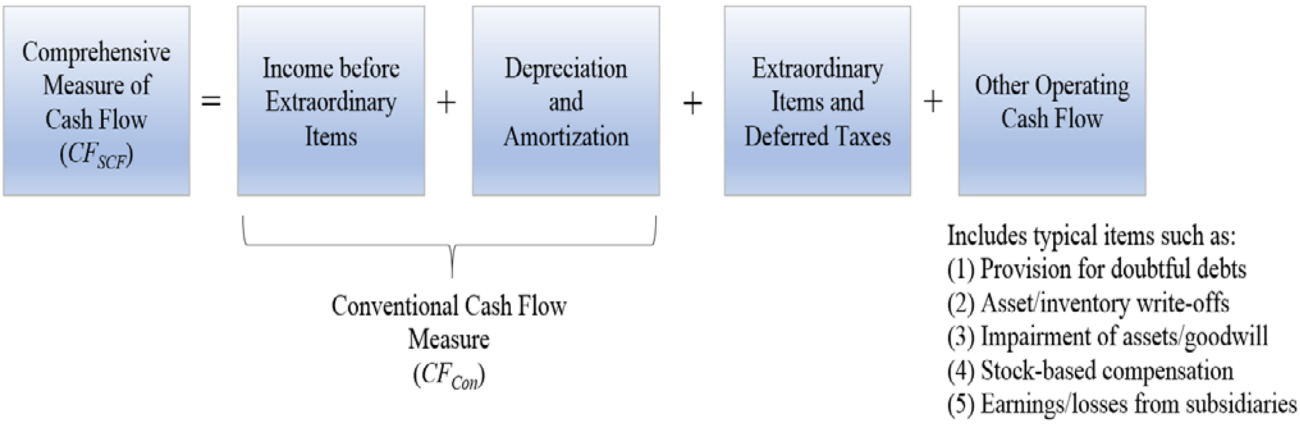
## Exhibit 1. Definitions of Investment and Cash Flow

This exhibit details how we define investment and cash flow relative to their corresponding conventional measures. Panel A illustrates that a more comprehensive measure of investment includes not only the conventional form of investment (i.e., capital expenditure), but also acquisitions, and other investment such as the sale and or purchase of marketable securities, finance receivables, as well as debt and equity holdings. Panel B contrasts the conventional measure of cash flow with our more comprehensive definition.

### Panel A: Investment

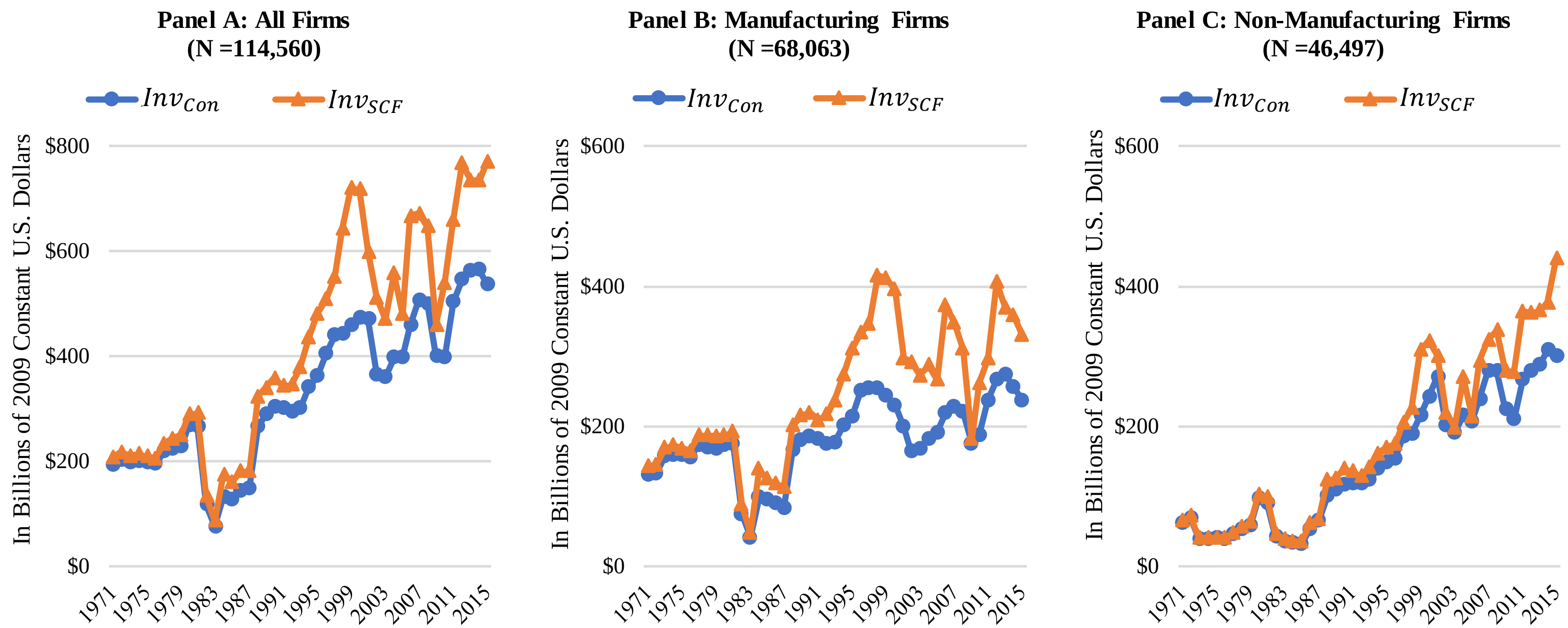



### Panel B: Cash Flow



## Figure 1. Aggregate Investment

This figure plots the aggregate investment for nonfinancial U.S. firms in Compustat, and for firms in both the manufacturing and non-manufacturing industries. A firm is classified into the manufacturing (non-manufacturing) industry if the first digit of its Standard Industry Classification (SIC) code (does not) equals to two or three. Two alternative measures are used to quantify investment; $Inv_{Con_{it}}$ is a firm's capital expenditure whereas $Inv_{SCF_{it}}$ is the sum of net capital expenditure, acquisitions, and other investment (net). Net capital expenditure is calculated as a firm's capital expenditure less the sale of its property, plant, and equipment. Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. Amounts are in billions of 2009 constant U.S. dollars.



## Figure 2. Aggregate Cash Flow

This figure plots the aggregate cash flow for nonfinancial U.S. firms in Compustat, and for firms in both the manufacturing and non-manufacturing industries. A firm is classified into the manufacturing (non-manufacturing) industry if the first digit of its Standard Industry Classification (SIC) code (does not) equals to two or three. Two alternative measures are used to quantify cash flow; $CF_{Con_{it}}$ is a firm's income before extraordinary items plus depreciation and amortization. $CF_{SCF_{it}}$ is the sum of $CF_{Con_{it}}$, deferred taxes, extraordinary and miscellaneous items, cash flow from subsidiaries and sale of assets, and other funds from operations. Amounts are in billions of 2009 constant U.S. dollars.

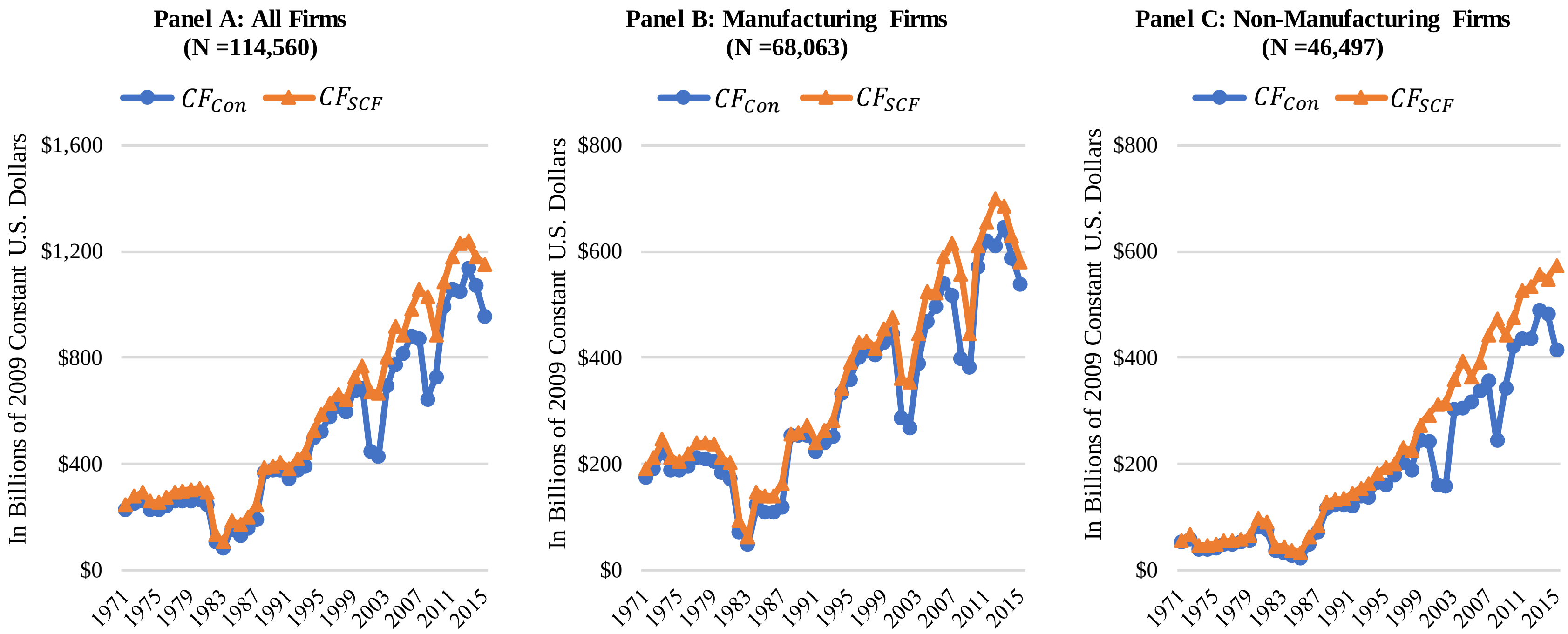
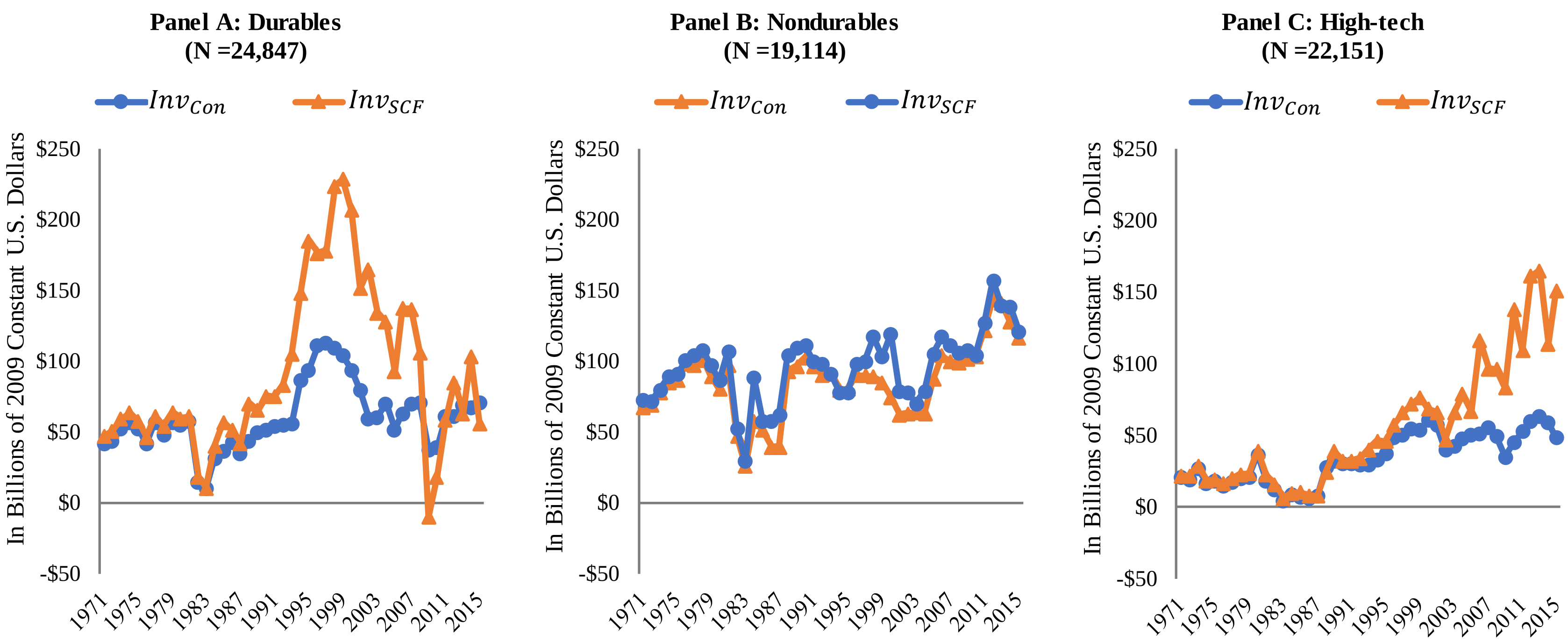


**Figure 3. Aggregate Investment (Manufacturing Firms Only)**

This figure plots the aggregate investment for U.S. manufacturing firms in Compustat, belonging to each of the three industries. A firm is classified into the high-tech industries if its three-digit Standard Industry Classification (SIC) code is 283, 357, 366, 367, 382, or 384. A firm is in the durable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 24 and 25, or between 32 and 38, inclusive. A firm is in the nondurable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 20 and 23, or between 26 and 31, inclusive. Following Chen and Chen (2012), we do not include firms with two-digit SIC codes of 39 ("Miscellaneous Manufacturers) in any of the three industry groups. Two alternative measures are used to quantify investment; $Inv_{Con_{it}}$ is a firm's capital expenditure whereas $Inv_{SCF_{it}}$ is the sum of net capital expenditure, acquisitions, and other investment (net). Net capital expenditure is calculated as a firm's capital expenditure less the sale of its property, plant, and equipment. Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. Amounts are in billions of 2009 constant U.S. dollars.



## Figure 4. Aggregate Cash Flow (Manufacturing Firms Only)

This figure plots the aggregate cash flow for U.S. manufacturing firms in Compustat, belonging to each of the three industries. A firm is classified into the high-tech industries if its three-digit Standard Industry Classification (SIC) code is 283, 357, 366, 367, 382, or 384. A firm is in the durable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 24 and 25, or between 32 and 38, inclusive. A firm is in the nondurable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 20 and 23, or between 26 and 31, inclusive. Following Chen and Chen (2012), we do not include firms with two-digit SIC codes of 39 (“Miscellaneous Manufacturers) in any of the three industry groups. Two alternative measures are used to quantify cash flow; $CF_{Con_{it}}$ is a firm’s income before extraordinary items plus depreciation and amortization. $CF_{SCF_{it}}$ is the sum of $CF_{Con_{it}}$, deferred taxes, extraordinary and miscellaneous items, cash flow from subsidiaries and sale of assets, and other funds from operations. Amounts are in billions of 2009 constant U.S. dollars.

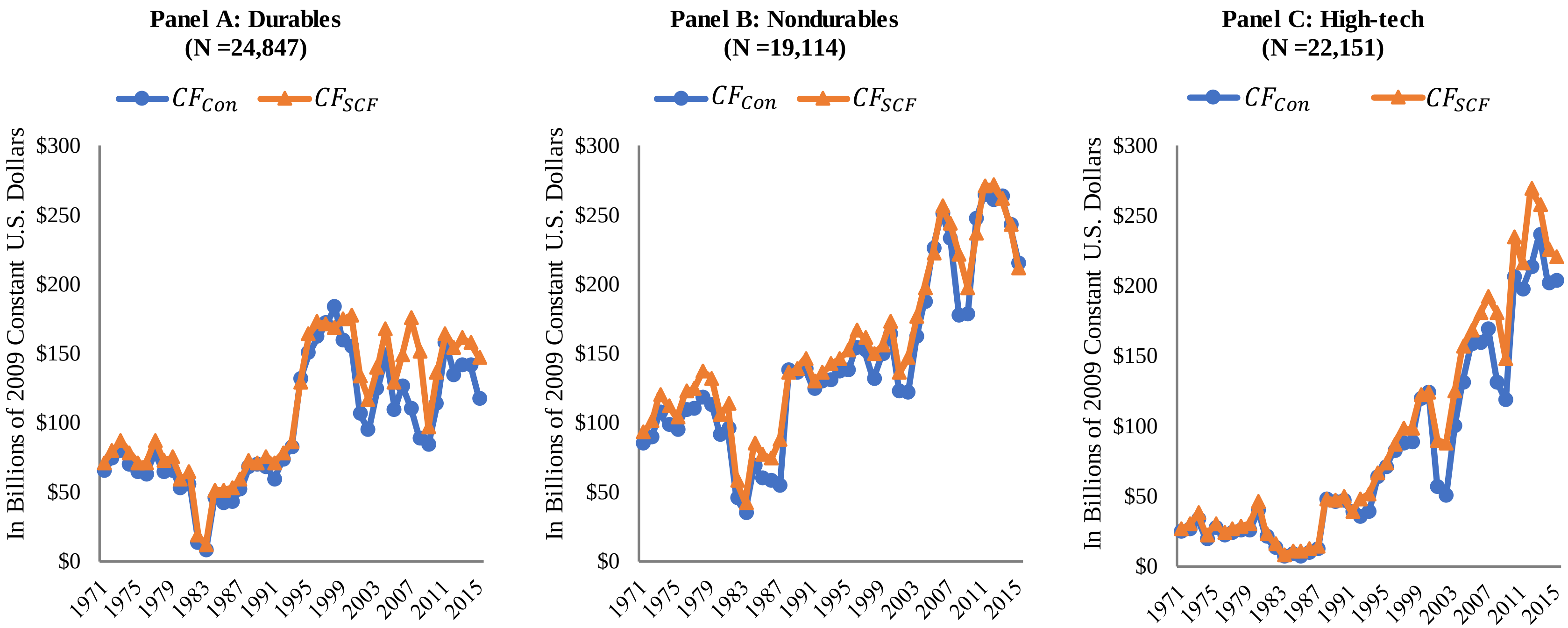
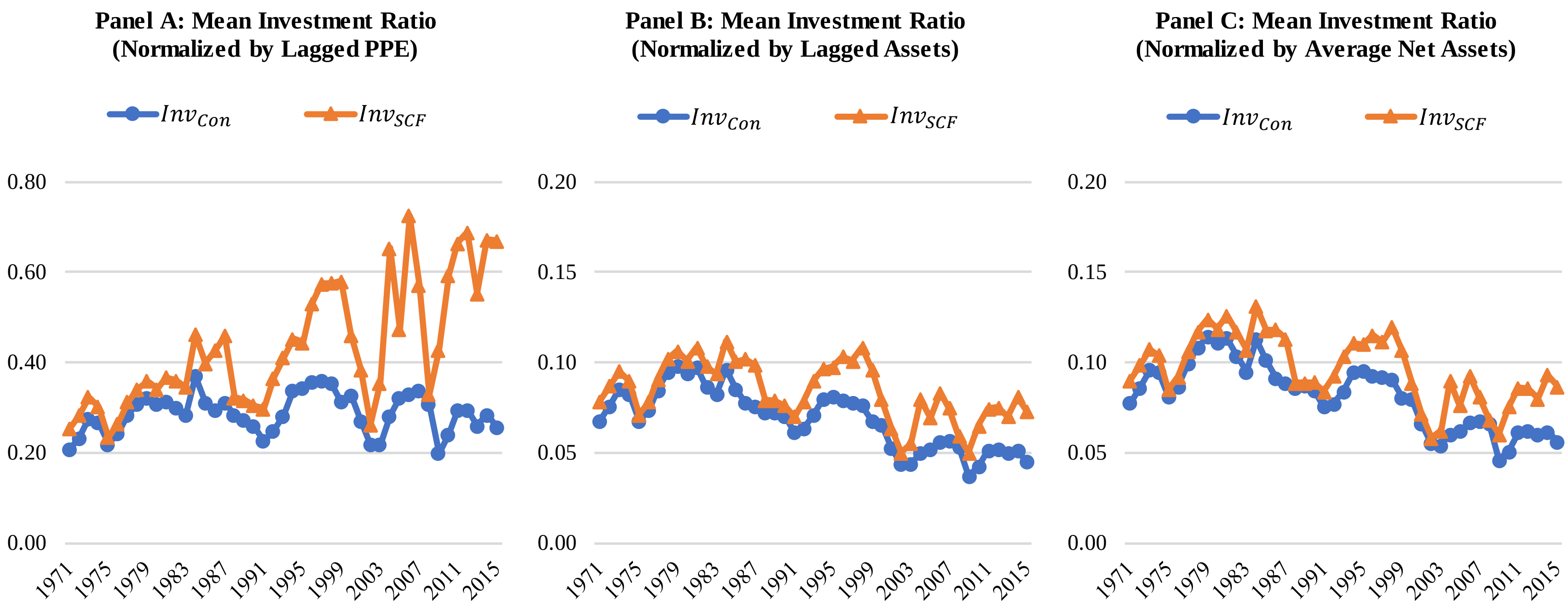


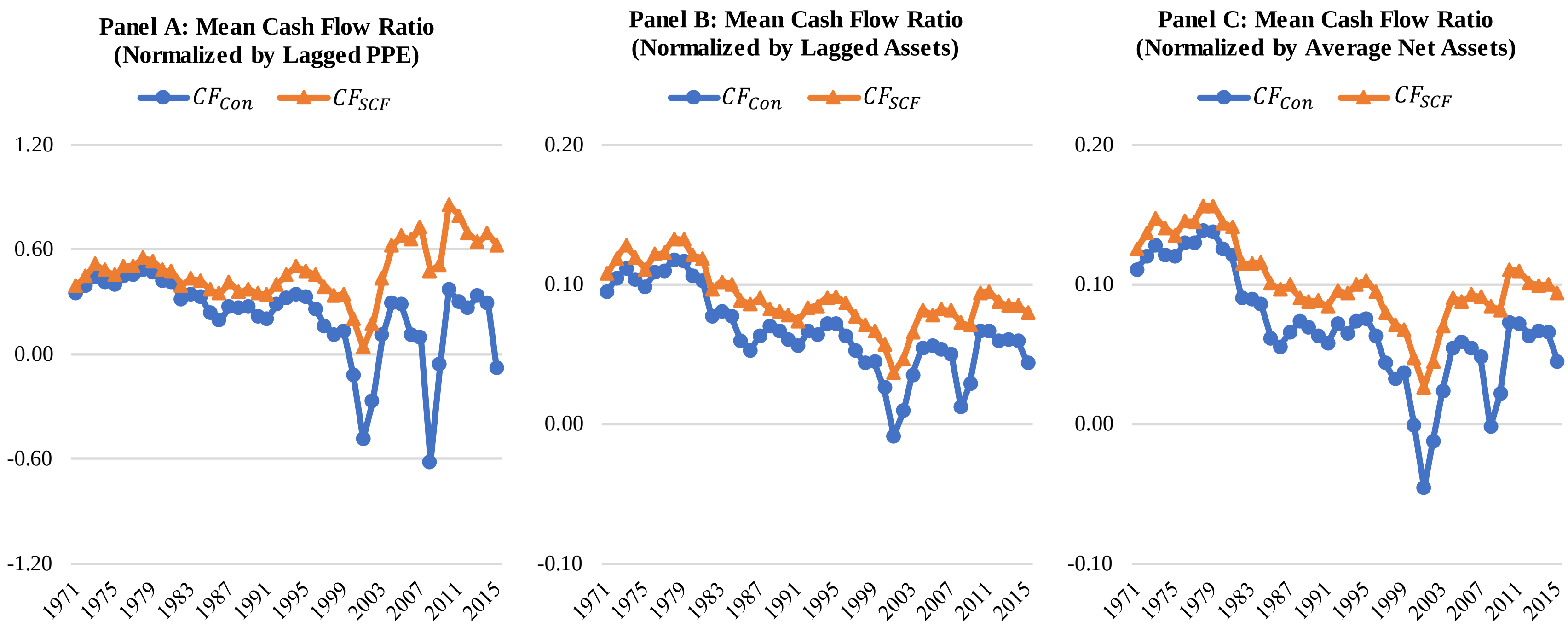
**Figure 5. Average Investment Ratio**

This figure plots the mean ratios of investment for nonfinancial U.S. firms in Compustat. Two alternative measures are used to quantify investment; $Inv_{Con_{it}}$ is a firm's capital expenditure whereas $Inv_{SCF_{it}}$ is the sum of net capital expenditure, acquisitions, and other investment (net). Net capital expenditure is calculated as a firm's capital expenditure less the sale of its property, plant, and equipment. Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. Panel A and B plot respectively, the ratios of investment to beginning-of-period net property, plant and equipment and beginning-of-period total assets whereas Panel C plots the ratios of investment to average net assets. Net assets are defined as total assets minus nondebt current liabilities.



## Figure 6. Average Cash Flow Ratio

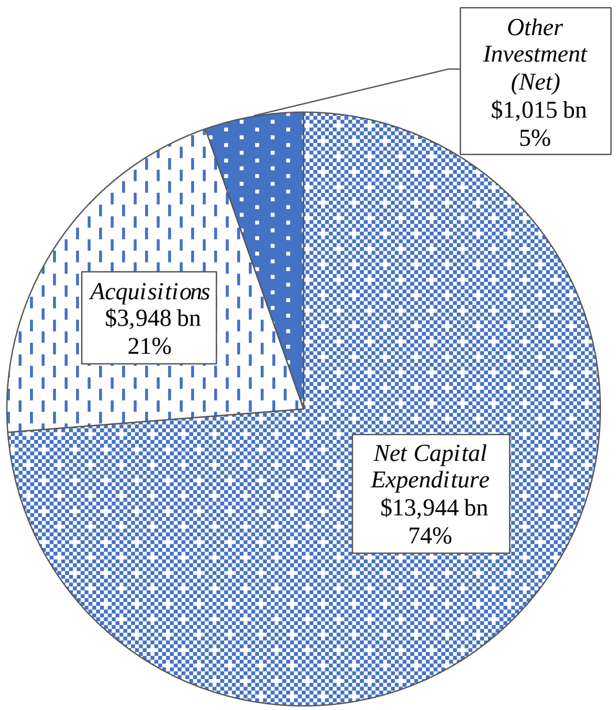
This figure plots the mean ratios of cash flow for nonfinancial U.S. firms in Compustat. Two alternative measures are used to quantify cash flow; $CF_{Con_{it}}$ is a firm's income before extraordinary items plus depreciation and amortization. $CF_{SCF_{it}}$ is the sum of $CF_{Con_{it}}$, deferred taxes, extraordinary and miscellaneous items, cash flow from subsidiaries and sale of assets, and other funds from operations. Panel A and B plot respectively, the ratios of cash flow to beginning-of-period net property, plant and equipment and beginning-of-period total assets whereas Panel C plots the ratios of cash flow to average net assets. Net assets are defined as total assets minus nondebt current liabilities.



## Figure 7. Composition of Aggregate Investment and Cash Flow, 1971-2015

This figure depicts the composition of aggregate investment and cash flow for nonfinancial U.S. firms in Compustat during the period 1971 to 2015. Panel A depicts the proportions of three main components of investment. They are net capital expenditure, acquisitions, and other investment (net). Net capital expenditure is calculated as a firm's capital expenditure less the sale of its property, plant, and equipment. Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. Panel B depicts the proportions of cash flow components, which includes conventional cash flow (*Prof+Depr*), extraordinary items, deferred taxes and other operating cash flow. Amounts are in billions of 2009 constant U.S. dollars.

**Panel A: Aggregate Investment, 1971-2015 (In 2009 Constant U.S. Dollars)**




**Panel B: Aggregate Cash Flow, 1971-2015 (In 2009 Constant U.S. Dollars)**

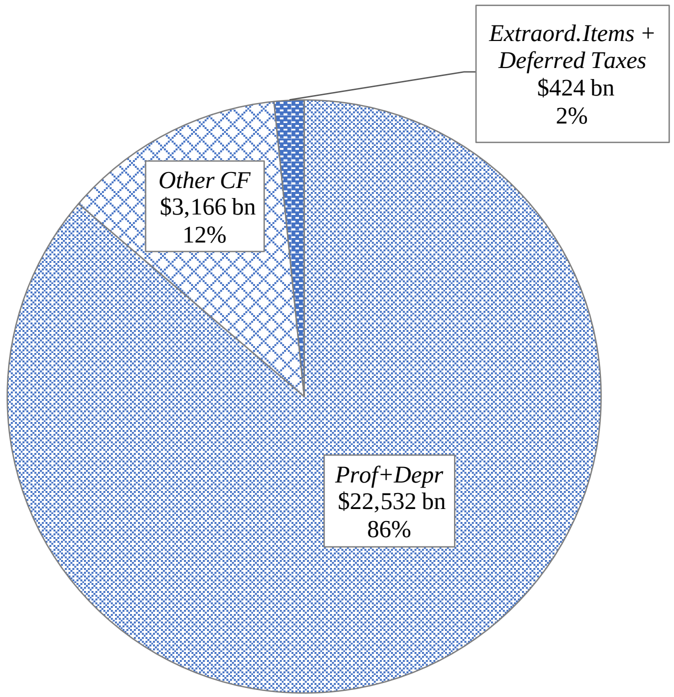
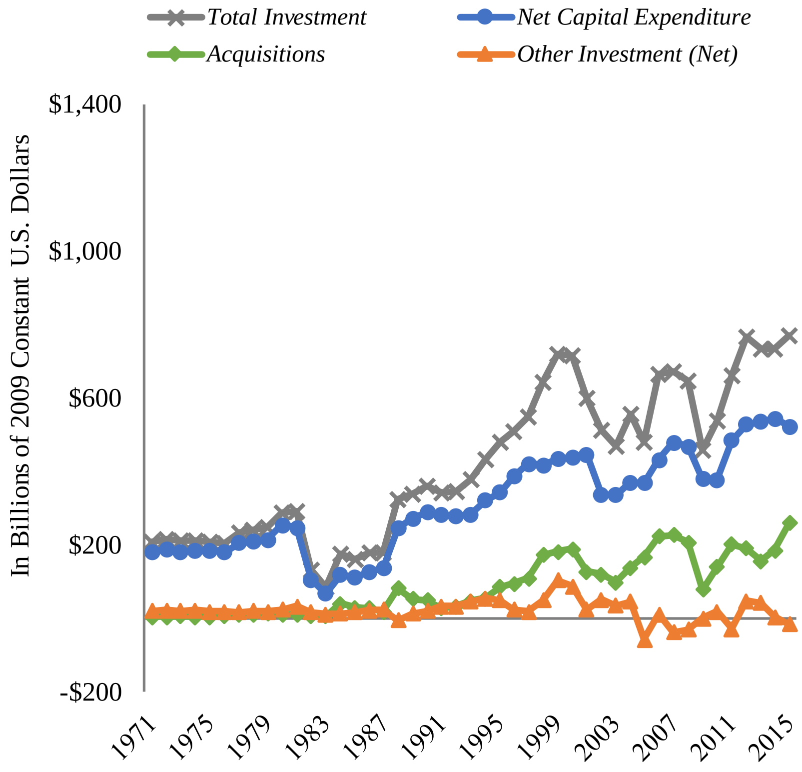


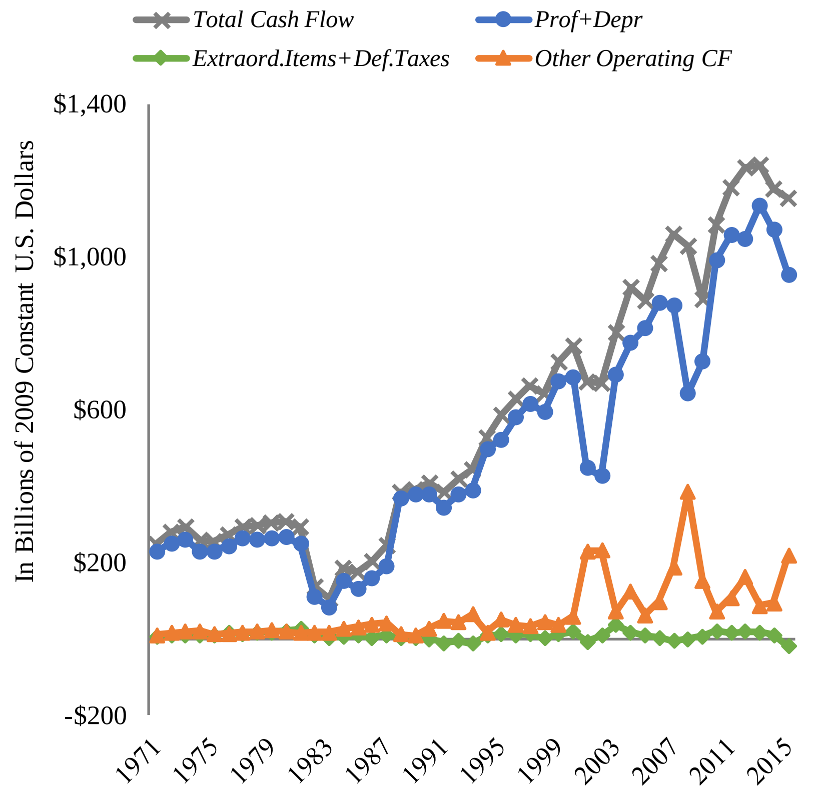
**Figure 8. Composition of Aggregate Investment and Cash Flow Over Time**

This figure plots the aggregate amounts of investment and cash flow, as well as their components, over the period 1971 to 2015. Panel A plots the time trend of investment and its components, which includes net capital expenditure, acquisitions and other investment (net). Net capital expenditure is calculated as a firm's capital expenditure less the sale of its property, plant, and equipment. Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. Panel B depicts the time trend of cash flow and its components, which includes the sum of a firm's income before extraordinary items and depreciation, extraordinary items, deferred taxes and other operating cash flow. Amounts are in billions of 2009 constant U.S. dollars.

**Panel A: Aggregate Investment and its Components**

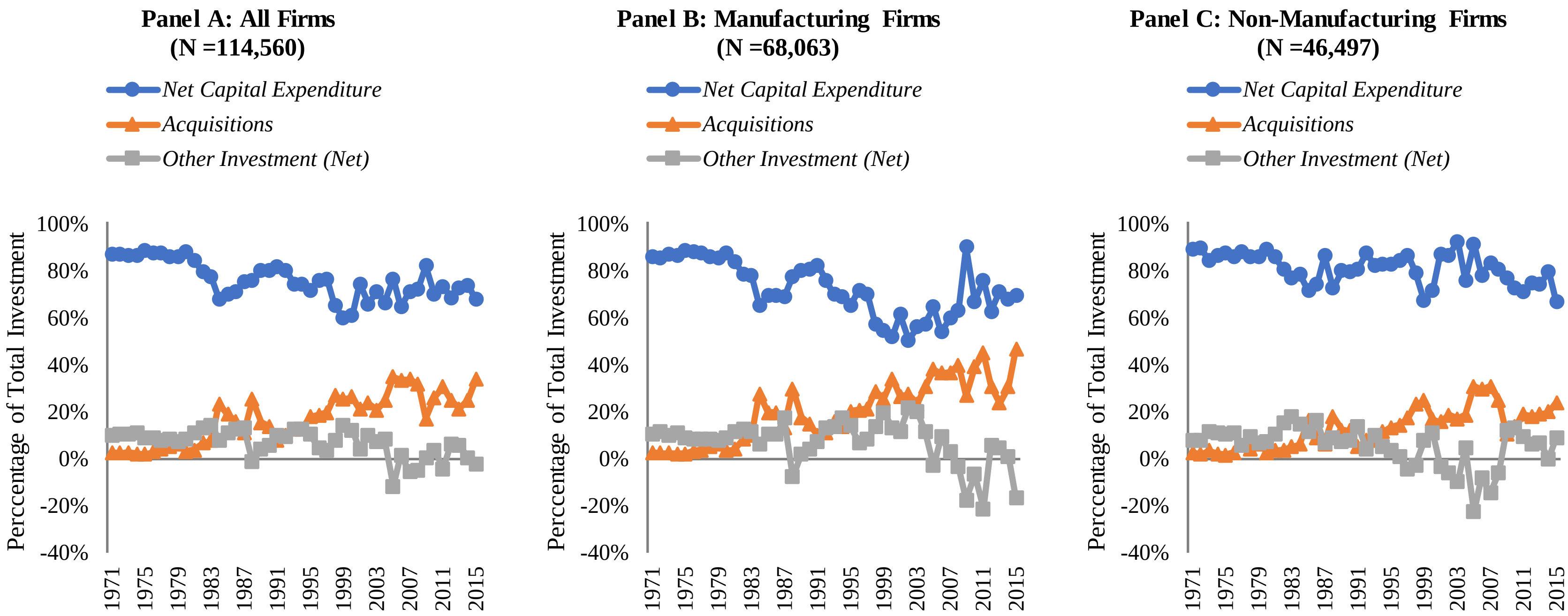



**Panel B: Aggregate Cash Flow and its Components**



## Figure 9. Composition of Investment Over Time

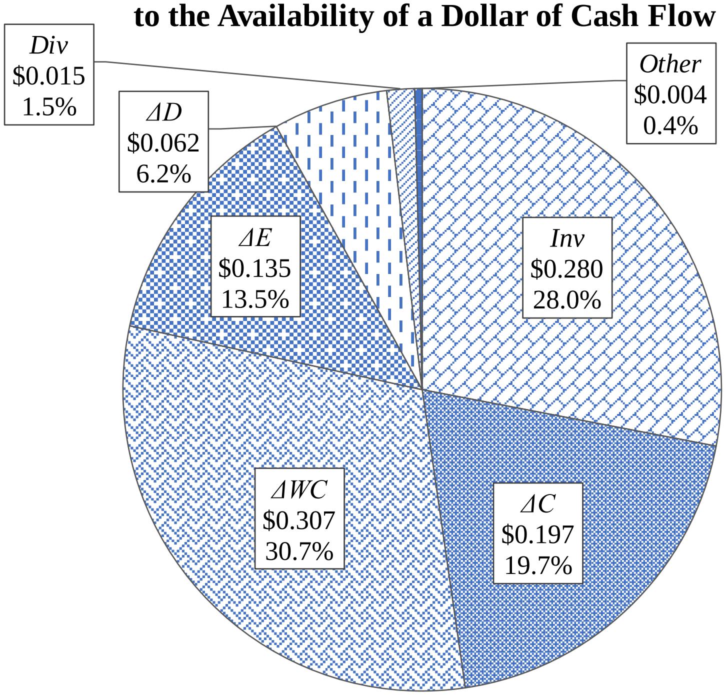
This figure plots the relative proportions of investment components for nonfinancial U.S. firms in Compustat, and for firms in both the manufacturing and non-manufacturing industries. A firm is classified into the manufacturing (non-manufacturing) industry if the first digit of its Standard Industry Classification (SIC) code (does not) equals to two or three. Components of investment includes net capital expenditure, acquisitions and other investment (net). Net capital expenditure is a firm's capital expenditure (Compustat data item 128) less the sale of its property, plant, and equipment (Compustat data item 107). Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases.



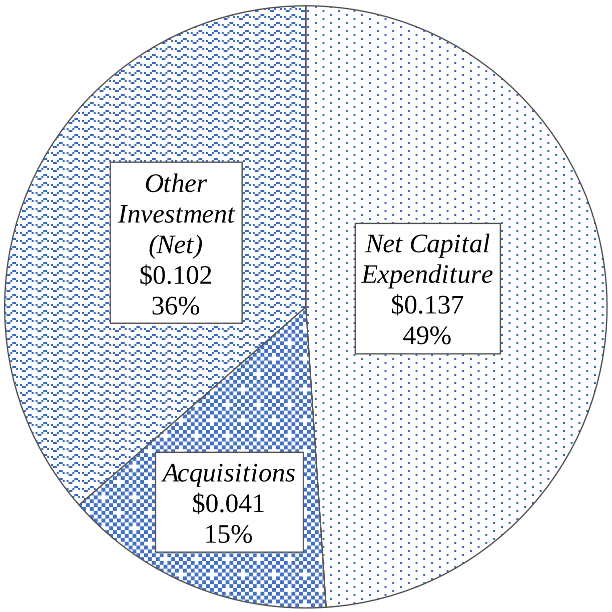
## Figure 10. Contemporaneous Allocation of Funds, 1971-2015

This figure depicts for the full sample period, the estimated allocation of cash flow to the different uses of funds namely, investment (*Inv*), cash savings *(ΔCash*), working capital needs (*ΔWC*), net equity repurchase (*ΔE*), net debt retirement (*ΔD*) and cash dividends (*Div*). In particular, Panel A highlights the average sensitivities of these uses of funds to the availability of a dollar of cash flow. Panel B displays the average sensitivities of different investment components to the availability of a dollar of cash flow. All the sensitivities are based on the regression coefficients on cash flow (*CF*), as specified in equations (4) to (9) and reported in Table 2.

**Panel A: Sensitivites of Different Uses of Funds to the Availability of a Dollar of Cash Flow**

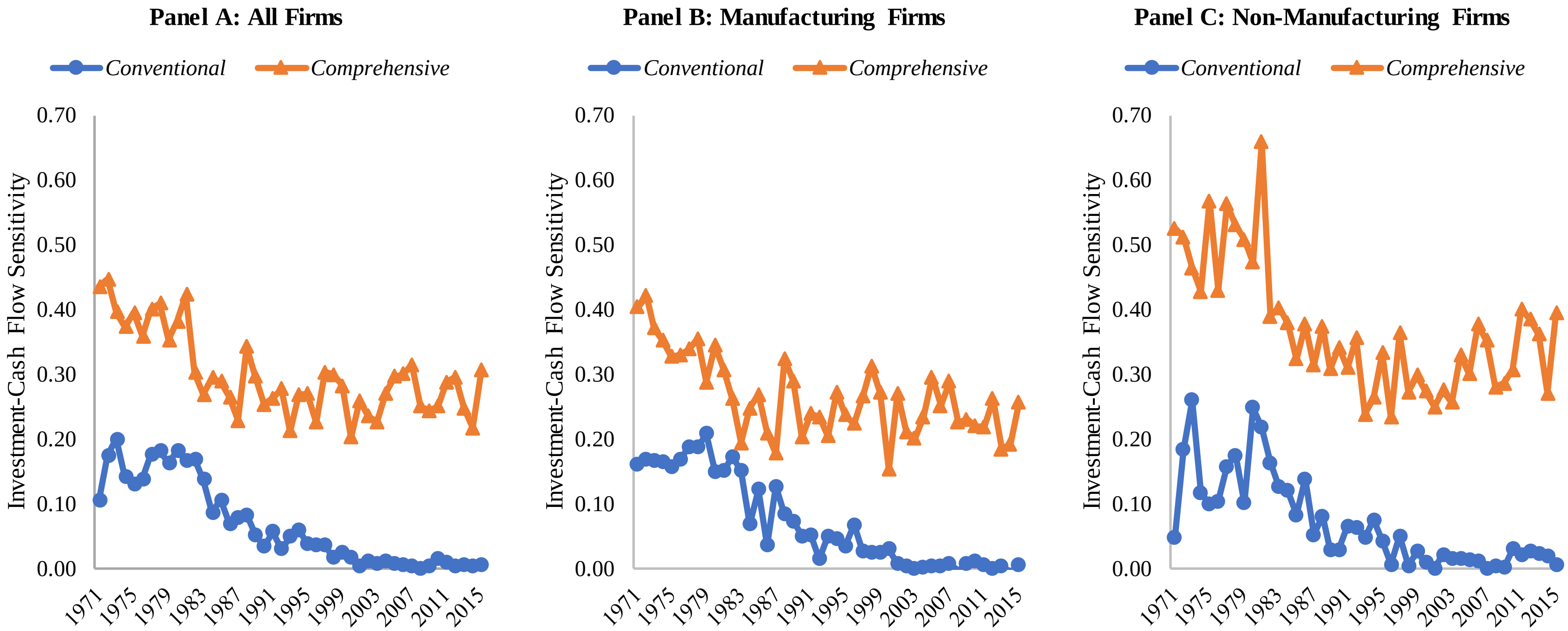



**Panel B: Sensitivites of Investment Activities to the Availability of a Dollar of Cash Flow**



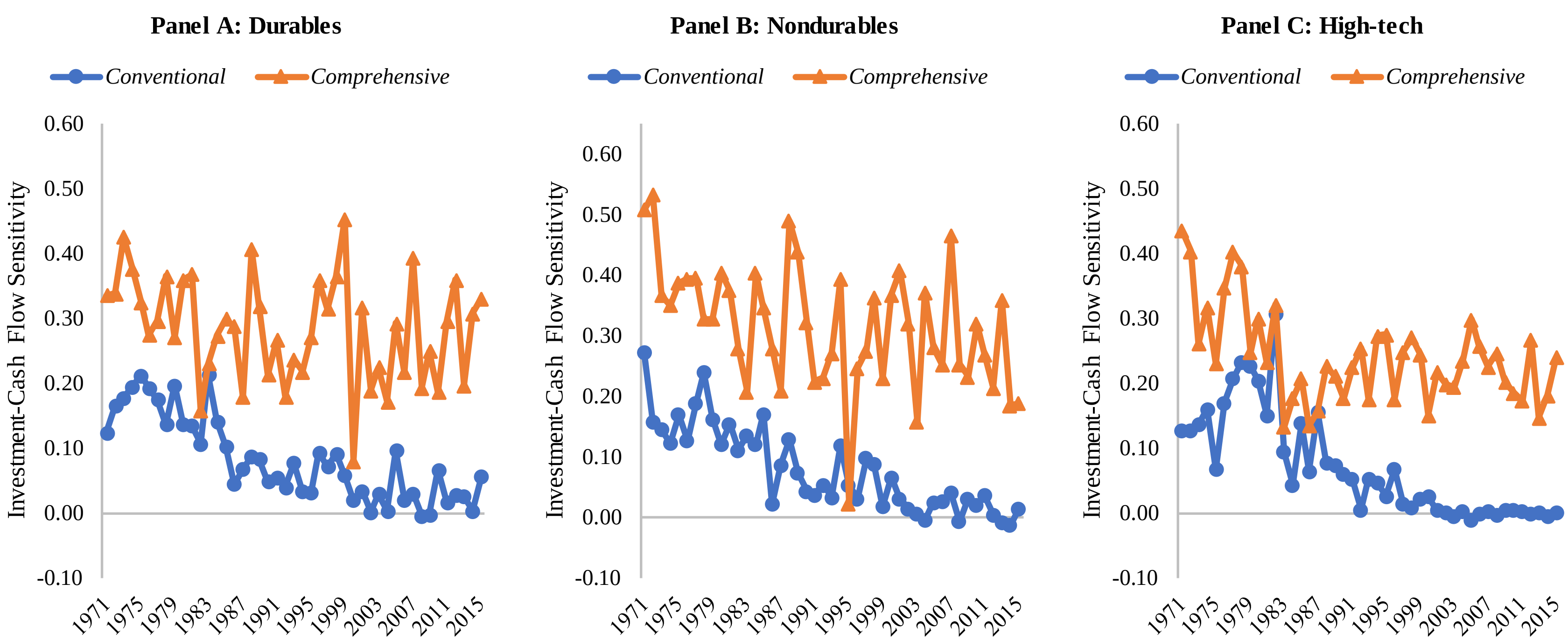
## Figure 11. Evolution of Investment-Cash Flow Sensitivity

This figure depicts the investment-cash flow sensitivities, estimated under the regression framework of Chen and Chen (2012) (C&C (2012), hereafter), as well as under the cash flow identity-based integrated regression framework of Chang et al. (2014). Panel A presents the associated sensitivities for nonfinancial U.S. firms in Compustat, whereas Panel B and C depict the respective sensitivities for firms in the manufacturing and non-manufacturing industries. A firm is classified into the manufacturing (non-manufacturing) industry if the first digit of its Standard Industry Classification (SIC) code (does not) equals to two or three.



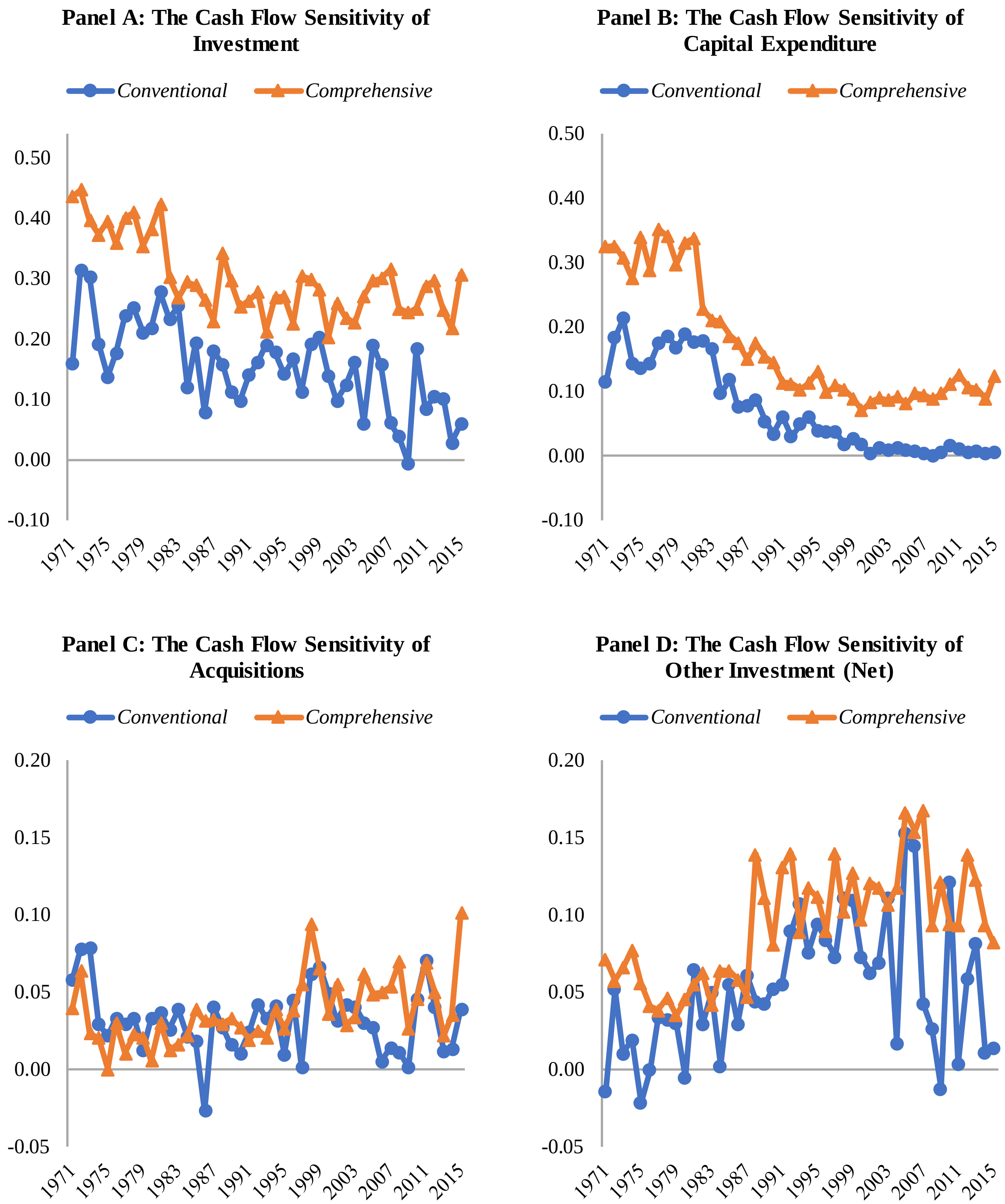
## Figure 12. Evolution of Investment-Cash Flow Sensitivity (Manufacturing Firms Only)

This figure depicts the investment-cash flow sensitivities, estimated under the regression framework of Chen and Chen (2012) (C&C (2012), hereafter), as well as under the cash flow identity-based integrated regression framework of Chang et al. (2014). Panel A and B present respectively, the sensitivities for durables and nondurables firms, whereas Panel C outlines the corresponding estimates for high-tech firms. A firm is classified into the high-tech industries if its three-digit Standard Industry Classification (SIC) code is 283, 357, 366, 367, 382, or 384. A firm is in the durable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 24 and 25, or between 32 and 38, inclusive. A firm is in the nondurable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 20 and 23, or between 26 and 31, inclusive.



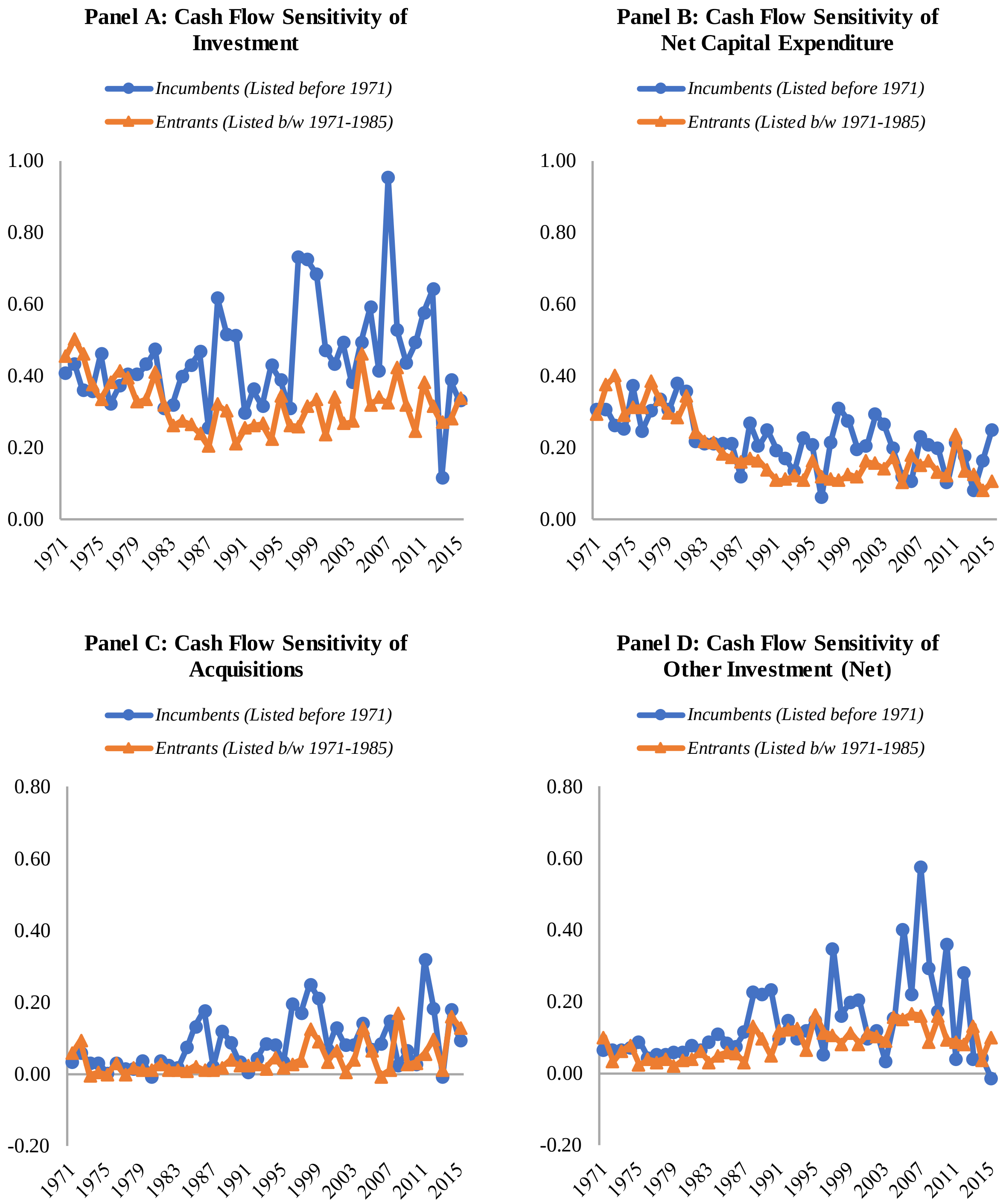
## Figure 13. Cash Flow Sensitivities of Investment Components

This figure depicts the investment-cash flow sensitivities of nonfinancial U.S. firms in Compustat, estimated under the regression framework of Chen and Chen (2012) (C&C (2012), hereafter), as well as under the cash flow identity-based integrated regression framework of Chang et al. (2014). Panel A presents the associated sensitivities for total investment, whereas Panel B to F depict the cash flow sensitivities of various investing components that made up total investment.



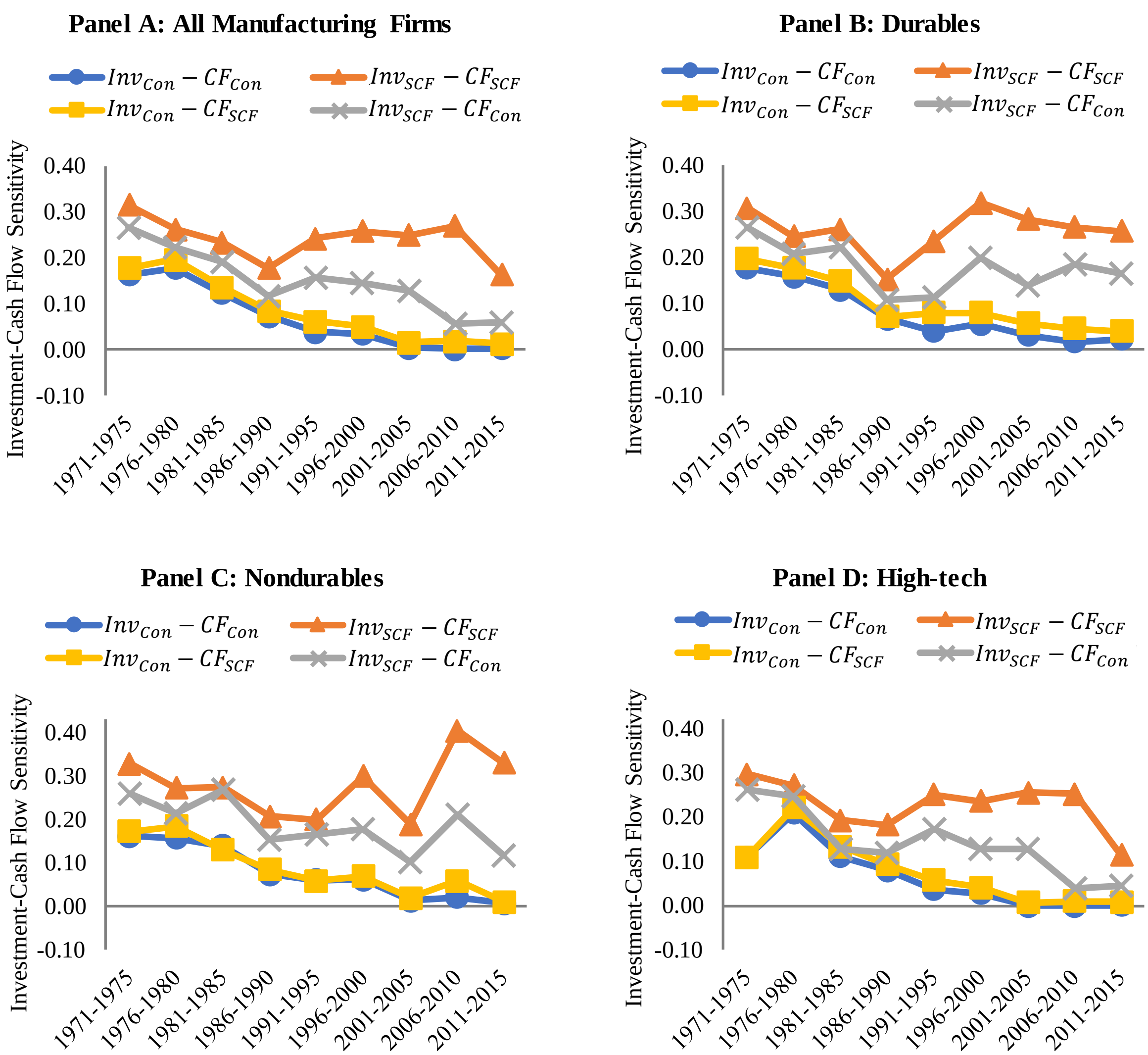
## Figure 14. Cash Flow Sensitivities of Investment Components (Incumbents vs. Entrants)

This figure depicts the investment-cash flow sensitivities of both incumbent and entrant nonfinancial U.S. firms in Compustat, estimated under the regression framework of Chen and Chen (2012) (C&C (2012), hereafter), as well as under the cash flow identity-based integrated regression framework of Chang et al. (2014). Incumbent firms refer to firms listed before 1971, while entrant firms are firms listed between 1971 to 1985. Panel A presents the associated sensitivities for total investment, whereas Panel B to D depict the cash flow sensitivities of various investing components that made up total investment.



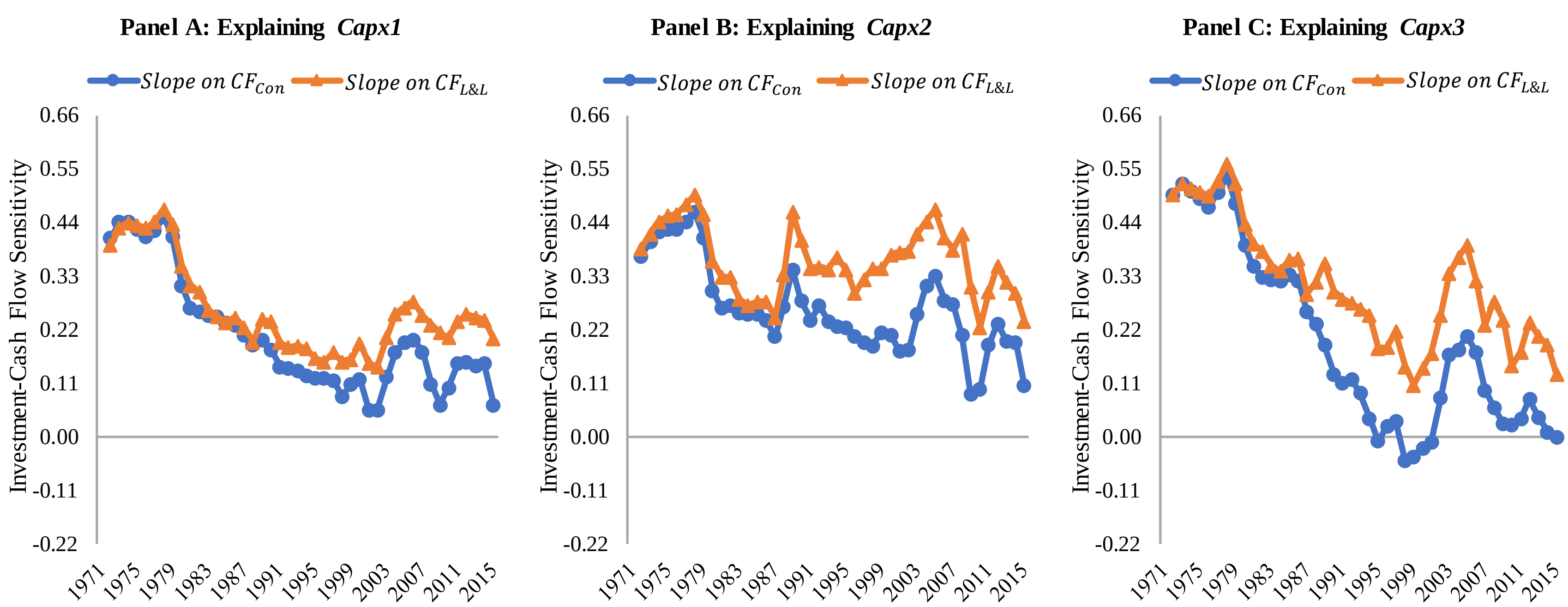
## Figure 15. Alternative Measures of Investment-Cash Flow Sensitivity

This figure is produced by running regression equation (1) of Chen and Chen (2012), but with alternative measures of investment and cash flow. That is, $Inv_{Con_{it}}$ is a firm's capital expenditure, and $Inv_{SCF_{it}}$ is the sum of net capital expenditure, acquisitions, and other investment (net). Net capital expenditure is calculated as a firm's capital expenditure less the sale of its property, plant, and equipment. Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. $CF_{Con_{it}}$is income before extraordinary items plus depreciation and amortization, and $CF_{SCF_{it}}$ is the sum of $CF_{Con_{it}}$, deferred taxes, extraordinary and miscellaneous items, cash flow from subsidiaries and sale of assets, and other funds from operations. The investment and cash flow measures are deflated by the respective firm's beginning-of-period net property, plant and equipment. The regression variables are demeaned by firm to remove the firm fixed effects. Year fixed effects ($\theta_t$) are included. The regression is estimated annually for the period 1971-2015 for U.S. manufacturing firms in Compustat, and for firms in each of the three industries. A firm is classified into the high-tech industries if its three-digit Standard Industry Classification (SIC) code is 283, 357, 366, 367, 382, or 384. A firm is in the durable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 24 and 25, or between 32 and 38, inclusive. A firm is in the nondurable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 20 and 23, or between 26 and 31, inclusive. Standard errors are heteroskedasticity consistent and clustered at the firm level.



## Figure 16. Replication of Figure 2 of Lewellen and Lewellen (2016)

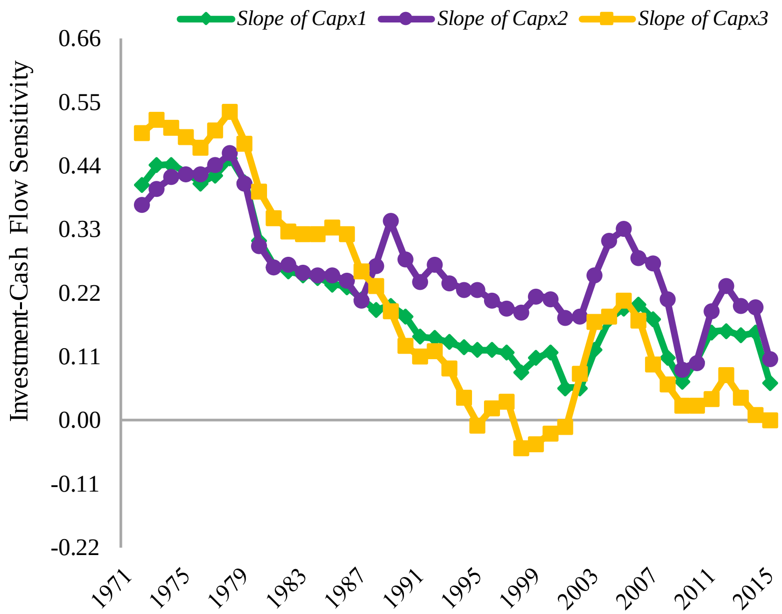
This figure replicates Figure 2 of Lewellen and Lewellen (2016) and depicts the investment-cash flow sensitivities of nonfinancial U.S. firms in Compustat, which have net assets that are larger than the 10$^{th}$ percentile of the beginning-of-period net assets of NYSE firms. The said sensitivities are estimated by regressing investment on cash flow and lagged market-to-book ratio. Following Lewellen and Lewellen (2016), we present the estimates as the two-year rolling average of the associated cash flow coefficients. Three alternative variables are used to measure investment; *Capx1* refers to net capital expenditure, *Capx2* refers to all investing activities from the Statement of Cash Flows (*SCF*, hereafter) (i.e., $Inv_{SCF}$), and *Capx3* is the sum of the change in fixed assets and depreciation, adjusted for other non-cash adjustments to fixed assets from the *SCF*. Two different measures are used to proxy for cash flow; $CF_{Con}$ is the conventional measure of cash flow, which is defined as the sum of income before extraordinary items and depreciation, whereas $CF_{L\&L}$ is the comprehensive cash flow measure, employed by Lewellen and Lewellen (2016). Specifically, it is the sum of conventional cash flow and several *SCF* items. They include extraordinary items and discontinued operations, deferred taxes, equity in net loss of unconsolidated subsidiaries, losses from the sale of property, plant and equipment, and funds from operations – other. These investment and cash flow variables are normalized by average net assets during the year, and winsorized at the top and bottom 1% of their distributions. Net assets are defined as total assets minus nondebt current liabilities. Panel A, B, and C plot respectively, the sensitivities of *Capx1*, *Capx2*, and *Capx3* with respect to both the conventional and comprehensive measures of cash flow as used by Lewellen and Lewellen (2016) in their analysis.



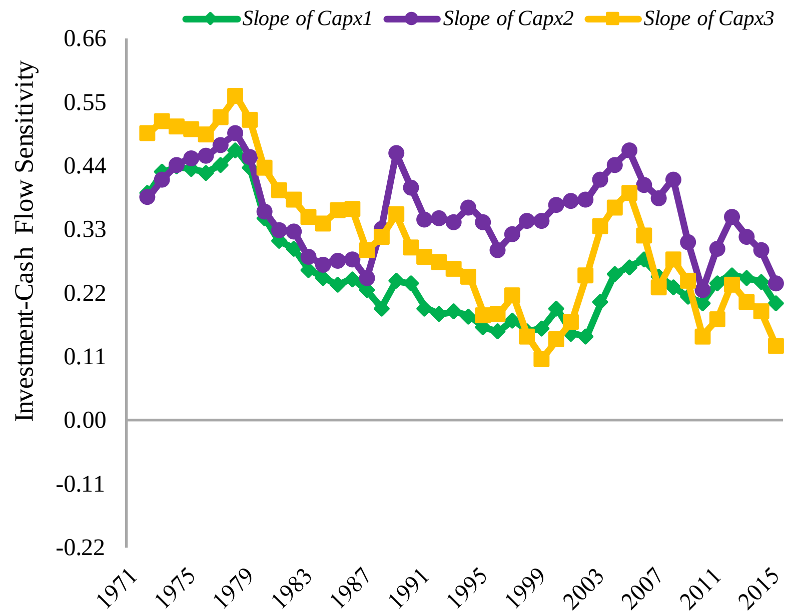
## Figure 17. Investment-Cash Flow Sensitivity Analysis Based on Lewellen and Lewellen (2016)

This figure replicates Figure 2 of Lewellen and Lewellen (2016) and depicts the investment-cash flow sensitivities of nonfinancial U.S. firms in Compustat, which have net assets that are larger than the 10th percentile of the beginning-of-period net assets of NYSE firms. The said sensitivities are respectively plotted in Panel A, with respect to conventional cash flow ($CF_{Con}$), and in Panel B, with respect to the comprehensive cash flow measure ($CF_{L\&L}$), as employed by Lewellen and Lewellen (2016). $CF_{Con}$ is the sum of income before extraordinary items and depreciation, whereas $CF_{L\&L}$ is the sum of conventional cash flow and several *SCF* items. They include extraordinary items and discontinued operations, deferred taxes, equity in net loss of unconsolidated subsidiaries, losses from the sale of property, plant and equipment, and funds from operations – other. Following Lewellen and Lewellen (2016), we estimate the investment-cash flow sensitivities by regressing investment on cash flow and lagged market-to-book ratio and present the resulting estimates as the two-year rolling average of the associated cash flow coefficients. Three alternative variables are used to measure investment; *Capx1* refers to net capital expenditure, *Capx2* refers to all investing activities from the Statement of Cash Flows (*SCF*, hereafter) (i.e., $Inv_{SCF}$), and *Capx3* is the sum of the change in fixed assets and depreciation, adjusted for other non-cash adjustments to fixed assets from the *SCF*. The investment and cash flow variables are normalized by average net assets during the year, and winsorized at the top and bottom 1% of their distributions. Net assets are defined as total assets minus nondebt current liabilities.

**Panel A: Explaining Different Measures of Investment with Conventional Cash Flow**



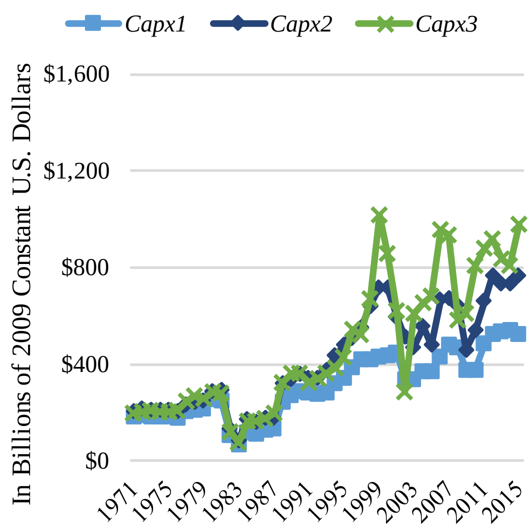

**Panel B: Explaining Different Measures of Investment with Cash Flow of Lewellen and Lewellen (2016)**



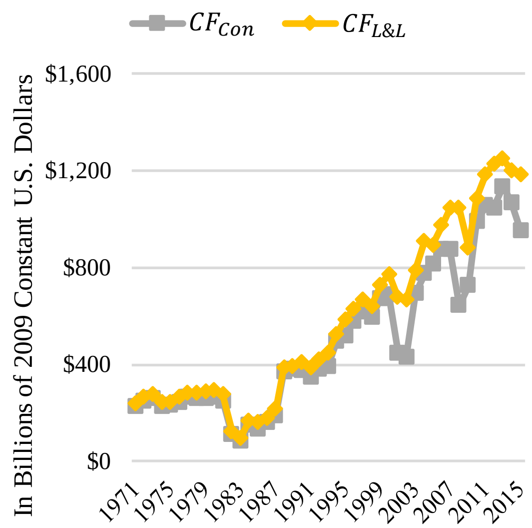
## Figure 18. Investment and Cash Flow Measures of Lewellen and Lewellen (2016)

This figure plots the summary statistics of the investment and cash flow measures, used by Lewellen and Lewellen (2016) in their investment-cash flow analysis. Panel A and B depict respectively, the aggregate amounts of investment and cash flow for nonfinancial U.S. firms in Compustat, which have net assets that are larger than the 10th percentile of the beginning-of-period net assets of NYSE firms. Amounts are in billions of 2009 constant U.S. dollars. Three alternative investment measures are used; *Capx1* refers to net capital expenditure, *Capx2* refers to all investing activities from the Statement of Cash Flows (*SCF*, hereafter) (i.e., $Inv_{SCF}$), and *Capx3* is the sum of the change in fixed assets and depreciation, adjusted for other non-cash adjustments to fixed assets from the *SCF*. Two different measures are used to proxy for cash flow; $CF_{Con}$ is the sum of income before extraordinary items and depreciation, whereas $CF_{L\&L}$ is the sum of conventional cash flow and several *SCF* items. They include extraordinary items and discontinued operations, deferred taxes, equity in net loss of unconsolidated subsidiaries, losses from the sale of property, plant and equipment, and funds from operations – other. Panel C (D) plots the annual mean ratios of the alternative measures of investment (cash flow) to average net assets. Net assets are defined as total assets minus nondebt current liabilities.

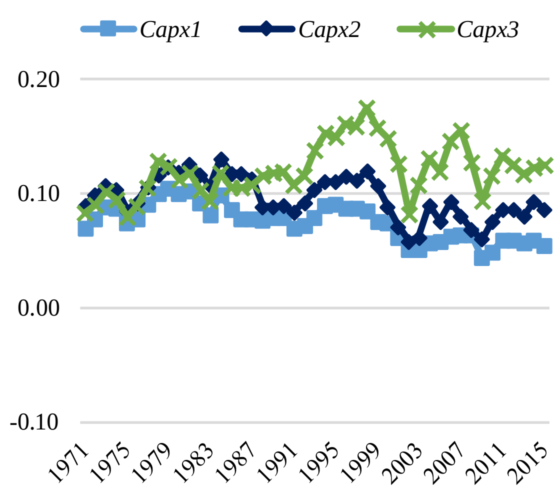
**Panel A: Aggregate Investment**



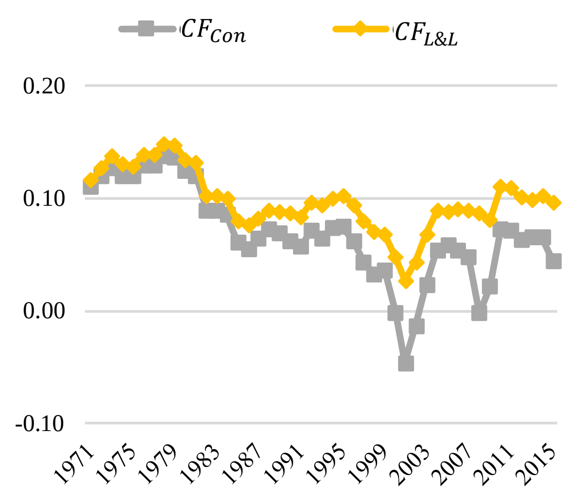

**Panel B: Aggregate Cash Flow**




**Panel C: Mean Investment Ratio (Normalized by Average Net Assets)**




**Panel D: Mean Cash Flow Ratio (Normalized by Average Net Assets)**



## Figure 19. Descriptive Statistics of Investment and Cash Flow Measures of Lewellen and Lewellen (2016)

This figure replicates Figure 1 of Lewellen and Lewellen (2016) and depicts the descriptive statistics of alternative investment and cash flow measures used in their analysis of the investment-cash flow sensitivities of nonfinancial U.S. firms in Compustat. These firms have net assets that are larger than the 10th percentile of the beginning-of-period net assets of NYSE firms. Panel A presents the annual standard deviation of both the conventional measure of cash flow ($CF_{Con}$), and the comprehensive cash flow variable ($CF_{L\&L}$), employed by Lewellen and Lewellen (2016). $CF_{Con}$ is the sum of income before extraordinary items and depreciation, whereas $CF_{L\&L}$ is the sum of conventional cash flow and several *SCF* items. They include extraordinary items and discontinued operations, deferred taxes, equity in net loss of unconsolidated subsidiaries, losses from the sale of property, plant and equipment, and funds from operations – other. Panel B presents the annual standard deviation of *Capx1* and *Capx3*; *Capx1* refers to net capital expenditure, and *Capx3* is the sum of the change in fixed assets and depreciation, adjusted for other non-cash adjustments to fixed assets from the Statement of Cash Flows. Panel C depicts the annual correlation of $CF_{Con}$ and $CF_{L\&L}$, as well as that of *Capx1* and *Capx3*.

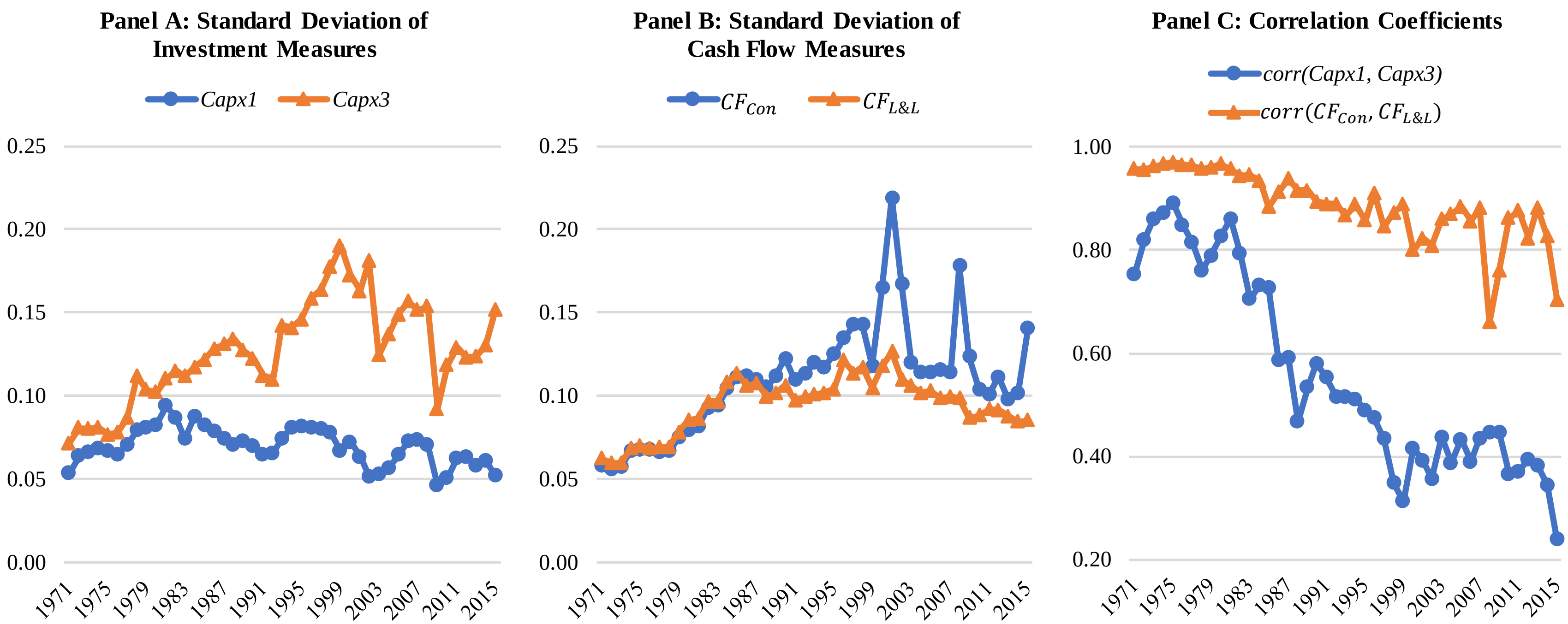


**Table 1. Summary Statistics, 1971-2015**

This table presents for our sample of nonfinancial U.S. firms in Compustat, the descriptive statistics of our main regression variables for the period 1971 to 2015. The definitions of sources and uses of funds variables are depicted in Appendix A.

| Variable | Description | Mean | S.D. | Min. | 25th | Median | 75th | Max. |
|---|---|---|---|---|---|---|---|---|
| Conventional Measures: | | | | | | | | |
| $Inv_{Con}$ | Investment/Lagged net PPE | 0.290 | 0.289 | 0.000 | 0.119 | 0.208 | 0.356 | 2.712 |
| $CF_{Con}$ | Cash flow/Lagged net PPE | 0.100 | 6.361 | -810.875 | 0.106 | 0.296 | 0.600 | 37.270 |
| $Inv_{Con}^{A}$ | Investment/Lagged total assets | 0.068 | 0.069 | 0.000 | 0.022 | 0.047 | 0.089 | 0.499 |
| $CF_{Con}^{A}$ | Cash flow/Lagged total assets | 0.064 | 0.134 | -0.773 | 0.033 | 0.087 | 0.137 | 0.372 |
| Sources of Funds (Normalized by Lagged Total Assets): | | | | | | | | |
| $CF_{SCF}$ | Internal cash flow | 0.088 | 0.126 | -1.287 | 0.048 | 0.101 | 0.154 | 0.956 |
| *EI* | Equity issuance proceeds | 0.026 | 0.090 | 0.000 | 0.000 | 0.002 | 0.011 | 2.376 |
| *DI* | Debt issuance proceeds | 0.080 | 0.161 | -0.230 | 0.000 | 0.013 | 0.098 | 1.875 |
| Uses of Funds (Normalized by Lagged Total Assets): | | | | | | | | |
| $Inv_{SCF}$ | Investment | 0.084 | 0.110 | -0.849 | 0.024 | 0.061 | 0.123 | 1.376 |
| *NetCapEx* | Net capital expenditure | 0.064 | 0.071 | -0.241 | 0.020 | 0.043 | 0.084 | 0.743 |
| *Acq* | Acquisitions | 0.017 | 0.058 | -0.009 | 0.000 | 0.000 | 0.001 | 0.863 |
| *OtherInv* | Other investment (Net) | 0.003 | 0.063 | -0.865 | -0.002 | 0.000 | 0.011 | 1.139 |
| $\Delta C$ | Change in cash | 0.006 | 0.085 | -0.440 | -0.020 | 0.001 | 0.028 | 1.139 |
| $\Delta WC$ | Change in net working capital | 0.017 | 0.082 | -0.495 | -0.020 | 0.012 | 0.051 | 0.519 |
| *ER* | Equity repurchase | 0.011 | 0.029 | 0.000 | 0.000 | 0.000 | 0.004 | 0.366 |
| *DR* | Debt retirement | 0.066 | 0.134 | 0.000 | 0.002 | 0.019 | 0.065 | 1.530 |
| *Div* | Dividends | 0.010 | 0.018 | 0.000 | 0.000 | 0.000 | 0.016 | 0.318 |
| *Other* | Cash flow identity plug | 0.000 | 0.001 | -0.010 | 0.000 | 0.000 | 0.000 | 0.010 |
| Firm characteristics: | | | | | | | | |
| *q* | Tobin's Q | 6.548 | 17.735 | -23.367 | 0.793 | 1.768 | 4.963 | 260.358 |
| *MB* | Market-to-Book ratio | 1.600 | 1.153 | 0.419 | 0.963 | 1.250 | 1.795 | 17.085 |
| *SaleG* | Sales growth | 0.091 | 0.224 | -0.765 | -0.021 | 0.081 | 0.194 | 0.942 |
| *Ln(Assets)* | Log of book value of assets | 5.316 | 2.041 | 0.426 | 3.849 | 5.201 | 6.686 | 11.387 |
| *Leverage* | Ratio of total debt to total assets | 0.235 | 0.193 | 0.000 | 0.066 | 0.213 | 0.355 | 0.884 |
| *Tangibility* | Ratio of net PPE to total assets | 0.299 | 0.216 | 0.002 | 0.130 | 0.250 | 0.419 | 0.911 |

## Table 2. Contemporaneous Allocation of Funds, 1971-2015

Based on the cash flow identity, this table presents the results of regressing each use of cash flow on the cash flow itself. The resulting coefficient on cash flow represents the sensitivity of that particular use of funds to the availability of cash flow. Defined using Compustat Statement of Cash Flows (*SCF*) data, uses of funds include investment, cash savings, working capital needs, net equity repurchase, net debt retirement, and dividends. Specifically, $Inv_{SCF_{it}}$ is the sum of a firm's net capital expenditure, acquisitions, and other investment (net). Net capital expenditure is calculated as a firm's capital expenditure less the sale of its property, plant, and equipment. Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. $CF_{SCF_{it}}$ is the sum of income before extraordinary items, depreciation and amortization, deferred taxes, extraordinary and miscellaneous items, cash flow from subsidiaries and sale of assets, and other funds from operations. $MB_{it-1}$ is the respective firm's market-to-book ratio for the previous year. $Other_{it}$ is the residual term that accounts for rounding errors and misreported data that might cause the cash flow identity not to hold. All *SCF* variables are deflated by the respective firm's beginning-of-period total assets, and demeaned by firm to remove the firm fixed effects. Year fixed effects ($\theta_t$) are included. The regression is estimated annually during the period 1971-2015 for nonfinancial U.S. firms in Compustat. Standard errors are heteroskedasticity consistent and clustered at the firm level.

**Panel A: Allocation of Cash Flow to Different Uses of Funds**

| Dependent Variable: | (1) $Inv_{it}$ | (2) $\Delta C_{it}$ | (3) $\Delta WC_{it}$ | (4) $\Delta E_{it}$ | (5) $\Delta D_{it}$ | (6) $Div_{it}$ | (7) $Other_{it}$ |
|---|---|---|---|---|---|---|---|
| $CF_{SCF_{it}}$ | 0.280*** | 0.197*** | 0.307*** | 0.135*** | 0.062*** | 0.015*** | 0.004*** |
| | (60.2) | (39.4) | (75.8) | (18.1) | (13.6) | (36.5) | (5.5) |
| $MB_{it-1}$ | 0.017*** | 0.002*** | 0.006*** | -0.016*** | -0.008*** | 0.001*** | -0.000*** |
| | (33.3) | (3.4) | (15.8) | (-21.6) | (-20.6) | (17.2) | (-2.8) |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included |
| *Obs* | 114,560 | 114,560 | 114,560 | 114,560 | 114,560 | 114,560 | 114,560 |
| $R^2$ | 0.12 | 0.05 | 0.14 | 0.06 | 0.02 | 0.04 | 0.00 |

**Panel B: Allocation of Cash Flow to Different Components of Investment**

| Dependent Variable: | (1) $Inv_{it}$ | (2) $Inv_{it}$ | (3) $CEx_{it}$ | (4) $CEx_{it}$ | (5) $Acq_{it}$ | (6) $Acq_{it}$ | (7) $Oth_{it}$ | (8) $Oth_{it}$ |
|---|---|---|---|---|---|---|---|---|
| $CF_{SCF_{it}}$ | 0.280*** | | 0.137*** | | 0.041*** | | 0.102*** | |
| | (60.2) | | (55.4) | | (20.8) | | (32.3) | |
| $CF_{Con_{it}}$ | | 0.280*** | | 0.134*** | | 0.043*** | | 0.103*** |
| | | (58.8) | | (53.8) | | (21.5) | | (31.2) |
| $EI_{it}$ | | 0.080** | | -0.038** | | -0.007 | | 0.125*** |
| | | (2.3) | | (-2.0) | | (-0.4) | | (5.6) |
| $DT_{it}$ | | 0.527*** | | 0.393*** | | 0.004 | | 0.130*** |
| | | (20.9) | | (28.2) | | (0.3) | | (8.0) |
| $OC_{it}$ | | 0.339*** | | 0.120*** | | 0.059*** | | 0.160*** |
| | | (36.3) | | (24.8) | | (11.4) | | (25.4) |
| $MB_{it-1}$ | 0.017*** | 0.017*** | 0.010*** | 0.010*** | 0.002*** | 0.002*** | 0.005*** | 0.005*** |
| | (33.3) | (33.3) | (37.5) | (37.6) | (10.6) | (10.6) | (13.0) | (13.0) |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included | Included |
| *Obs* | 114,560 | 114,560 | 114,560 | 114,560 | 114,560 | 114,560 | 114,560 | 114,560 |
| $R^2$ | 0.12 | 0.12 | 0.11 | 0.12 | 0.02 | 0.02 | 0.04 | 0.04 |

## Table 3. Understanding the Differences in Investment-Cash Flow Sensitivity Estimates

This table compares the estimates of investment-cash flow sensitivity, produced by running regression equation (1) of Chen and Chen (2012), but with alternative measures of investment and cash flow. That is, $Inv_{Con_{it}}$ is a firm's capital expenditure, and $Inv_{SCF_{it}}$ is the sum of net capital expenditure, acquisitions, and other investment (net). Net capital expenditure is calculated as a firm's capital expenditure less the sale of its property, plant, and equipment. Other investment (net) refers to the purchase or sale of other investments such as marketable securities, debt and equity holdings, finance receivables, and operating leases. $CF_{Con_{it}}$ is income before extraordinary items plus depreciation and amortization, and $CF_{SCF_{it}}$ is the sum of $CF_{Con_{it}}$, deferred taxes, extraordinary and miscellaneous items, cash flow from subsidiaries and sale of assets, and other funds from operations. The investment and cash flow measures are deflated by the respective firm's beginning-of-period net property, plant and equipment. The regression variables are demeaned by firm to remove the firm fixed effects. Year fixed effects ($\theta_t$) are included. The regression is estimated annually for the period 1971-2015 for U.S. manufacturing firms in Compustat, and for firms in each of the three industries. A firm is classified into the high-tech industries if its three-digit Standard Industry Classification (SIC) code is 283, 357, 366, 367, 382, or 384. A firm is in the durable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 24 and 25, or between 32 and 38, inclusive. A firm is in the nondurable goods industries if it is not in the high-tech industries and the first two digits of its SIC code are between 20 and 23, or between 26 and 31, inclusive. Standard errors are heteroskedasticity consistent and clustered at the firm level.

**Panel A: All Manufacturing Firms**

| Time Period | (1) $Inv_{Con}$-$CF_{Con}$ Sensitivity | (2) $Inv_{SCF}$-$CF_{SCF}$ Sensitivity | (3) $Inv_{Con}$-$CF_{SCF}$ Sensitivity | (4) $Inv_{SCF}$-$CF_{Con}$ Sensitivity | (5) = (2) - (1) Total ΔSensitivity | (6) = (4) - (1) ΔSensitivity due to Δ*Inv* Measure | (7) = (3) - (1) ΔSensitivity due to Δ*CF* Measure | (8) = (6) ÷ (5) %ΔSensitivity due to Δ*Inv* Measure | (9) = (7) ÷ (5) %ΔSensitivity due to Δ*CF* Measure |
|---|---|---|---|---|---|---|---|---|---|
| 1971-1975 | 0.163 | 0.316 | 0.177 | 0.266 | 0.152 | 0.103 | 0.014 | 68% | 9% |
| 1976-1980 | 0.177 | 0.262 | 0.197 | 0.222 | 0.085 | 0.044 | 0.019 | 53% | 23% |
| 1981-1985 | 0.124 | 0.233 | 0.137 | 0.191 | 0.109 | 0.067 | 0.012 | 61% | 11% |
| 1986-1990 | 0.074 | 0.177 | 0.085 | 0.117 | 0.103 | 0.043 | 0.011 | 42% | 10% |
| 1991-1995 | 0.039 | 0.242 | 0.062 | 0.158 | 0.202 | 0.118 | 0.023 | 58% | 11% |
| 1996-2000 | 0.036 | 0.258 | 0.050 | 0.147 | 0.222 | 0.111 | 0.015 | 50% | 7% |
| 2001-2005 | 0.005 | 0.250 | 0.016 | 0.129 | 0.245 | 0.124 | 0.011 | 51% | 5% |
| 2006-2010 | 0.002 | 0.270 | 0.019 | 0.056 | 0.268 | 0.054 | 0.017 | 20% | 6% |
| 2011-2015 | 0.003 | 0.164 | 0.013 | 0.060 | 0.161 | 0.057 | 0.010 | 35% | 6% |
| Times-series average | 0.071 | 0.239 | 0.084 | 0.154 | 0.168 | 0.083 | 0.013 | 49% | 8% |

## Table 3. Understanding the Differences in Investment-Cash Flow Sensitivity Estimates (continue)

**Panel B: Manufacturing Firms by Industries**

| Time Period | (1) $Inv_{Con}$-$CF_{Con}$ Sensitivity | (2) $Inv_{SCF}$-$CF_{SCF}$ Sensitivity | (3) $Inv_{Con}$-$CF_{SCF}$ Sensitivity | (4) $Inv_{SCF}$-$CF_{Con}$ Sensitivity | (5) = (2) - (1) Total ΔSensitivity | (6) = (4) - (1) ΔSensitivity due to Δ*Inv* Measure | (7) = (3) - (1) ΔSensitivity due to Δ*CF* Measure | (8) = (6) ÷ (5) %ΔSensitivity due to Δ*Inv* Measure | (9) = (7) ÷ (5) %ΔSensitivity due to Δ*CF* Measure |
|---|---|---|---|---|---|---|---|---|---|
| **Durables:** | | | | | | | | | |
| 1971-1975 | 0.178 | 0.308 | 0.197 | 0.266 | 0.130 | 0.088 | 0.019 | 68% | 15% |
| 1976-1980 | 0.159 | 0.246 | 0.178 | 0.209 | 0.087 | 0.050 | 0.019 | 58% | 22% |
| 1981-1985 | 0.130 | 0.262 | 0.148 | 0.222 | 0.132 | 0.092 | 0.019 | 70% | 14% |
| 1986-1990 | 0.067 | 0.153 | 0.071 | 0.108 | 0.086 | 0.041 | 0.004 | 48% | 5% |
| 1991-1995 | 0.040 | 0.236 | 0.081 | 0.113 | 0.196 | 0.072 | 0.040 | 37% | 20% |
| 1996-2000 | 0.057 | 0.319 | 0.080 | 0.199 | 0.262 | 0.142 | 0.023 | 54% | 9% |
| 2001-2005 | 0.032 | 0.283 | 0.058 | 0.139 | 0.251 | 0.107 | 0.026 | 43% | 10% |
| 2006-2010 | 0.017 | 0.266 | 0.046 | 0.185 | 0.249 | 0.168 | 0.029 | 68% | 12% |
| 2011-2015 | 0.023 | 0.257 | 0.040 | 0.165 | 0.234 | 0.142 | 0.017 | 61% | 7% |
| Times-series average | 0.083 | 0.273 | 0.100 | 0.192 | 0.190 | 0.109 | 0.017 | 57% | 9% |
| **Nondurables:** | | | | | | | | | |
| 1971-1975 | 0.163 | 0.329 | 0.173 | 0.259 | 0.167 | 0.097 | 0.011 | 58% | 7% |
| 1976-1980 | 0.158 | 0.273 | 0.185 | 0.214 | 0.115 | 0.056 | 0.027 | 48% | 23% |
| 1981-1985 | 0.140 | 0.275 | 0.131 | 0.269 | 0.135 | 0.129 | -0.009 | 96% | -6% |
| 1986-1990 | 0.074 | 0.207 | 0.085 | 0.153 | 0.133 | 0.078 | 0.010 | 59% | 8% |
| 1991-1995 | 0.061 | 0.200 | 0.059 | 0.165 | 0.139 | 0.104 | -0.002 | 75% | -1% |
| 1996-2000 | 0.063 | 0.300 | 0.070 | 0.180 | 0.237 | 0.117 | 0.007 | 49% | 3% |
| 2001-2005 | 0.013 | 0.190 | 0.020 | 0.103 | 0.177 | 0.090 | 0.006 | 51% | 4% |
| 2006-2010 | 0.021 | 0.404 | 0.059 | 0.211 | 0.383 | 0.190 | 0.038 | 50% | 10% |
| 2011-2015 | 0.008 | 0.331 | 0.011 | 0.118 | 0.323 | 0.110 | 0.003 | 34% | 1% |
| Times-series average | 0.080 | 0.284 | 0.089 | 0.195 | 0.204 | 0.115 | 0.009 | 57% | 5% |
| **High-tech:** | | | | | | | | | |
| 1971-1975 | 0.109 | 0.297 | 0.110 | 0.262 | 0.188 | 0.153 | 0.001 | 81% | 0% |
| 1976-1980 | 0.209 | 0.271 | 0.222 | 0.246 | 0.063 | 0.037 | 0.013 | 59% | 21% |
| 1981-1985 | 0.111 | 0.193 | 0.133 | 0.128 | 0.082 | 0.016 | 0.022 | 20% | 27% |
| 1986-1990 | 0.080 | 0.183 | 0.093 | 0.119 | 0.103 | 0.038 | 0.013 | 37% | 13% |
| 1991-1995 | 0.036 | 0.251 | 0.057 | 0.172 | 0.215 | 0.136 | 0.021 | 63% | 10% |
| 1996-2000 | 0.027 | 0.237 | 0.041 | 0.129 | 0.209 | 0.102 | 0.013 | 49% | 6% |
| 2001-2005 | 0.000 | 0.255 | 0.008 | 0.130 | 0.256 | 0.130 | 0.008 | 51% | 3% |
| 2006-2010 | 0.000 | 0.252 | 0.010 | 0.041 | 0.252 | 0.041 | 0.011 | 16% | 4% |
| 2011-2015 | 0.001 | 0.114 | 0.009 | 0.044 | 0.113 | 0.043 | 0.008 | 38% | 7% |
| Times-series average | 0.070 | 0.232 | 0.079 | 0.160 | 0.162 | 0.090 | 0.009 | 56% | 5% |

## Appendix A. 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 investment (*Inv*), the change in cash holdings ($\Delta C$), the change in working capital ($\Delta WC$), cash dividends (*Div*), cash flows (*CF*), net debt issued ($\Delta D=DI\text{-}DR$), and net equity issued ($\Delta E=EI\text{-}ER$). PPE denotes property, plant, and equipment. We include in parentheses the Compustat XPF variable names in italics.

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

# Essay Three: The Evolution of Funds Allocation by U.S. Firms


## Abstract

Using a large sample of nonfinancial U.S. firms over the period 1971 to 2015, we study how firms allocate their financial resources to different corporate uses. We find that the funds allocations have changed over time. Specifically, firms have been shifting their allocations of funds away from investment and working capital, and towards cash savings and debt retirement. Moreover, the time trends associated with these allocations are driven not only by changes in sample composition, but also by changes in allocation dynamics. We also find that these time-series changes in funds allocations are related to several macroeconomic factors.



**JEL classification**: G01; G31; G32
**Keywords**: Cash flow allocation; Investment-cash flow sensitivity; Cash holdings

## I. Introduction

According to the neoclassical firm theory, corporate entities exist for the primary purpose of value maximization. To achieve this objective, business managers allocate financial resources to various corporate uses so as to run their businesses, thereby creating value for their firms. In fact, the notion of financial management is closely linked with that of resource deployment. Specifically, financial and resource management contribute to the other functional areas of a firm's operations by directing corporate funds to acquire or deploy the necessary resources needed to generate profits for the firm. The purpose of this paper is to describe the empirical allocation of different sources of funds to various uses by nonfinancial U.S. firms.

In general, there are two broad sources and uses of funds. First, funds could be internally-generated in that cash flows are generated during the course of business, and include earnings from operating activities, proceeds from asset sales, and returns on investment holdings. Second, funds could be externally-generated via equity and debt capital raising activities. These funds are then directed to either investment or non-investment uses. That is, firms can deploy the funds to acquire real assets or investments, build up cash reserve, increase working capital, repurchase equity, retire debt, and pay dividends.

We set forth to review how the pattern of funds allocations has changed over the years 1971 to 2015. We also seek to identify the drivers behind these time trends. We believe that these findings have important economic implications. In particular, the way firms prioritize their funds for investment, cash savings, working capital, security repurchases, and dividends could potentially inform us about the effectiveness of economic policies on investment and savings, and therefore the speed with which the U.S. economy recovers from a recession. For instance, economic policies entailing cuts in taxes and interest rates, aimed at stimulating corporate investment and profitability, may prove futile if firms are mainly using their funds to build cash reserves or rebalance leverage ratios.

To date, there has been numerous studies examining in isolation, the time trends associated with the corporate policies of investment, cash holdings, working capital, and debt. Chen and Chen (2012) find that the cash flow allocation to investment among U.S. manufacturing firms has gradually declined and disappeared over time. Lewellen and Lewellen (2016) attribute this apparent disappearance to a poor measure of cash flow being used to estimate the investment-cash flow sensitivity. Bates et al. (2009), Graham and Leary (2015), and He and Wintoki (2016) all find that U.S. firms have been increasingly allocating their funds to cash holdings. McLean (2011) adds that these savings are driven by high precautionary motives; Firms have been saving a large portion of their equity capital over time. Bates et al. (2009) and Aktas et al. (2015) document a sharp decline in the working capital needs of U.S. firms over time. Custodio, Ferreira and Laureano (2013) show that firms have reduced their reliance on long-term debt and increased their use of short-term debt to finance their businesses.

To examine the way firms simultaneously allocate their financial resources to different uses, we follow Chang et al. (2014) and set up the cash flow identity based on Compustat Statement of Cash Flows (*SCF* hereafter). That is, we define six main uses of funds, namely investment, cash savings, working capital needs, equity and debt repurchases, and dividends, and equate them with all sources of a firm's funds, including internal cash flow, equity issuance proceeds, and debt issuance proceeds. With this identity, we set up an integrated regression framework in which we simultaneously estimate six empirical models, regressing each use of funds on the sources of funds. Coefficients of the different uses of funds on each source of funds therefore indicate the allocation of that source of funds to the said uses. The variables of our interest are the coefficients on all the sources of funds.

Such an integrated framework of regressions has the methodological advantage of offering a complete view of the cash flow activities of a firm as it simultaneously tracks all uses of funds, which are interrelated among one another by virtue of the cash flow identity.

Specifically, it offers the intuitive interpretation that a change in the allocation of say, internal funds to investment must be met by an offsetting change in the allocation of internal funds to other use(s) since all uses of internal funds must sum to the amount of internal funds. Like Frank and Goyal (2003) and Chang et al. (2014), we use the *SCF* data to define all variables in the cash flow identity. Using a common data source has the advantage of achieving an almost balanced cash flow identity for our sample firms.[39]

Our empirical analysis is three-fold. First, we examine the contemporaneous allocation of all sources of funds to the different uses, namely investment, cash savings, working capital needs, equity repurchase, debt retirement and dividends. These cross-sectional results serve as a basis for examining the general differences in the allocation of internal versus external funds, and that of equity versus debt funds. Second, we examine the dynamic funds allocations i.e., the annual changes in the various funds allocations over the sample period 1971-2015. Third, we explore potential factors that could have driven the observed time trends in funds allocations. The focus of our study is therefore not to establish any causal relation between the sources and uses of funds, but to uncover and explain the time trends associated with these allocations.

We find that our sample firms have four main uses of funds namely, investment, cash savings, working capital needs, and debt repurchase, which are funded by two general sources, i.e., internal funds generated by the firms' operating activities and external funds, made up of equity and debt capital. In particular, for every available dollar of internal (external) funds, firms invest 30 (26) cents, save 22 (12.9) cents, allocate 31.9 (12.1) cents to working capital, and retire 12.6 (48.3) cents of debt. These four uses of funds together made up more than 95% of the use of a typical dollar of internal, as well as external funds.

[39] In fact, Gatchev, Pulvino, and Tarhan (2010) adopt a similar cash flow identity but define its components using data from not only the *SCF*, but also the balance sheet, and income statement. As a result, their cashflow identity generally do not hold for their sample.

Importantly, we find that regardless of the sources of funds, the allocations to investment and working capital have declined over time, and that these decreases are met by increasing allocation to debt retirement. Specifically, the per dollar internal (external) funds allocation to investment drops from 39.4 (28.4) cents in 1971 to 33.5 (23.6) cents in 2015, while that to working capital decreases from 32 (32.4) cents to 19 (3.7) cents. In contrast, the rate of debt retirement increases from 7.1 (30.4) cents per dollar of internal (external) funds in 1971 to 20.4 (65.8) cents in 2015. Notably, firms have also altered their funds saving rates over time. In 1971, firms save 14.8 (9.2) cents per dollar of internal (external) funds. This amount then grew to 36.4 (24.7) cents in 2003, before falling to 17.2 (4.9) cents in 2015.

In comparing the allocations of equity versus debt funds to the four main uses, we find that over time, firms in our sample reduce their allocations of equity funds to investment and working capital, while significantly increasing their allocation to cash savings. The allocation of equity funds to debt repurchase is however, trivial with no obvious time trend. Similarly, these firms cut back on their allocations of debt funds to investment and working capital over time. However, unlike the corresponding allocations of equity funds, these diminishing allocations of debt funds are met by increasing allocation to debt repurchase, and not by higher allocation to cash savings. In fact, the sensitivity of cash savings to the availability of debt funds is minimal with no time trend.

To investigate the sharply declining allocation to working capital with respect to all sources of funds, we decompose the change in working capital into five components namely, changes in accounts receivables, inventories, accounts payables, income tax payables and other net receivables, and examine their respective allocations. Specifically, we find that for all sources of funds, the diminishing allocation to working capital is largely contributed by decreasing allocations to accounts receivables, inventories, and accounts payables. The allocations to income tax payables and other net receivables are relatively trivial. In general, we attribute the decline in working capital needs to better receivables management by the firms, more efficient inventory administration, and improved access to finance over time.

Furthermore, we find that the time trends of both internal and external funds allocations are driven not only by changes in sample composition, but also by changes in allocation dynamics. That is, although the type of firms in our sample has changed over time such that different firms are used to estimate the funds allocations for different time periods, the business fundamentals underlying these firms have also changed, leading to changes in the way they allocate internal and external funds to different uses. In fact, regardless of the different schemes used to classify firms into incumbents and entrants, the allocations of both internal and external funds by incumbents generally approximate those by entrant firms.

In addition, we find that these time-series changes in funds allocations are related to several economic and financial factors, such as real GDP growth, inflation, cost of carry, default spread, credit spread and stock market return. That is, the principal component analysis with respect to these six factors reveals that the time trends are closely related to the business cycle, economic growth, and stock market conditions, as captured by three principal components. In particular, the sharply declining time trend associated with the allocation to working capital is consistent with the downward trends of cost of carry and inflation. Specifically, a decline in the cost of carry over time can explain why firms have switched from maintaining working capital to holding cash and marketable securities, as a form of short-term liquidity. Moreover, a decline in the rates of inflation reduces the incentive of firms to stock up their inventories, thereby reducing their working capital needs over time.

Our paper contributes to the literature in several ways. First, we provide important insights into how firms deploy their financial resources, using an integrated regression approach that has the methodological advantage of providing a complete view of how firms allocate different sources of funds to various uses, interrelated among one by the cash flow identity. Our approach simultaneously examines the corporate policies of investment, cash holdings, working capital, equity repurchase, debt retirement, and dividends, thereby gauging their relative importance. While prior research has looked at each of these policies in isolation, to the best of our knowledge, we are the first to provide a comprehensive accounting of the sources and uses of these funds.

Second, we show that distinguishing between funds that are generated internally, and those that are raised externally is important. In fact, we find notable differences in the way firms deploy internal versus external funds, and equity versus debt funds; On average, while both internal and external funds have similar rates of investment, more of a dollar of internal funds are saved (22 cents) and used to meet working capital needs (31.9 cents) than that of a dollar of external funds (12.9 cents and 12.1 cents, respectively). Firms also retire significantly more debt in response to a dollar of available external funds (48.3 cents) than to a dollar of internal cash flow (12.6 cents). Likewise, the allocations of equity and debt funds are vastly different. For every dollar of equity (debt) funds available, firms save 42.2 (4) cents, assign 15.7 (11) cents to working capital, and retire debt with 12.8 (59.1) cents. That said, investment, cash savings, working capital needs, and debt repurchase constitute the four main uses of all these sources of funds.

Third, we evaluate the time trends associated with the collective policy of corporate investment, cash holdings, working capital, equity repurchase, debt retirement, and dividends. Although previous studies have examined the time trend pertaining to each of these uses, they do so without regards to the implications that changes in a specific use of funds would have on the other uses. That is, for a given amount of funds, a dollar deployed for a particular use would mean a dollar reduced for other uses. Our analysis taps on the cash flow identity, which posits that uses of funds must sum to the amount of funds. Therefore, it offers the interpretation that an increase in the funds allocation to one use must be met by a decrease in the allocation to other use(s). In fact, we find that for our sample firms, decreasing allocations to investment and working capital are counteracted by increasing allocations to debt retirement.

Fourth, we build on the empirical literature on the time trends of corporate policies by elaborating on the time series patterns of funds allocations. To be specific, while there is no time trend associated with the allocation of external funds to cash savings, distinguishing between equity and debt funds, and estimating their respective allocations to cash savings reveal otherwise; Consistent with McLean (2012), we find that firms have been increasingly saving their equity capital over the sample period. In addition, while we find that the allocation of external funds to debt repurchase has increased over time, further analysis shows that this increase is mainly due to firms rolling over their debts, rather than changing their leverage policies by retiring debt with equity capital. Last, we attempt to explain the evolution of funds allocation by identifying various economic and financial factors that could potentially influence the resource deployment by the U.S. firms.

The remainder of the paper is organized as follows: Section II reviews the literature related to our scope of research, Section III describes the data and variables used in our analysis, Section IV highlights the empirical methodology, Section V presents the summary statistics of our sample, Section VI describes the empirical results, and Section VII concludes.

## II. Related Literature

Our study is closely related to the literature on the time trends of corporate policies with respect to investment, cash holdings, working capital, and debt repurchase. First, the allocation of internal funds to investment has declined over time. Specifically, Chen and Chen (2012) document that the cash flow allocation to investment among U.S. manufacturing firms has gradually declined and disappeared over time. Lewellen and Lewellen (2016) attribute this apparent disappearance to a poor measure of cash flow being used to estimate the investment-cash flow sensitivity. Specifically, they find that the conventional cash flow measure has become noisy over time because it erroneously incorporates several non-cash expenses, which have become increasingly important in recent years. Consequently, they employ an improved measure of cash flow, and find that the resulting cash flow allocation to investment exhibit a diminishing albeit not disappearing time trend.[40]

To date, there has been numerous studies reporting different magnitude of the investment-cash flow sensitivity of U.S. firms, differing in terms of the definitions of investment and cash flow, as well as the model specification used in their estimation. Traditionally, investment-cash flow sensitivity is estimated by a standalone regression whereby investment is regressed on cash flow and a proxy for investment opportunities. This approach is used by Fazzari, Hubbard, and Petersen (1988) in their pioneering work on investment-cash flow sensitivity and has since been adopted by many researchers in their analyses of the cash flow sensitivity of investment. They include Kaplan and Zingales (1997), Cleary (1999), Baker et al. (2003), Rauh (2006), and Chen and Chen (2012), to name a few. However, despite the abundance of such research, there is still a lack of consensus about what constitute investment and cash flow, and how to estimate investment-cash flow sensitivity. In other words, there is still controversy over how much of a dollar of available cash flow is allocated to investment.

Second, the allocation of funds to cash holdings has increased over time. Bates et al. (2009) document that U.S. firms have been increasingly holding a large amount of cash, so

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[40] We note that the cash flow measure of Lewellen and Lewellen (2016) is akin to our measure of cash flow. Specifically, they define cash flow as the sum of the following items: income before extraordinary items, extraordinary items and discontinued operations, depreciation and amortization, deferred taxes, equity in net loss of unconsolidated subsidiaries, losses from the sale of property, plant and equipment, and funds from other operations. It is noteworthy that although Lewellen and Lewellen (2016) also use the *SCF* data to define cash flow, our measure of cash flow differs from theirs in that we explicitly consider the different format codes that firms follow in reporting their *SCF* data and adjust our cash flow definition accordingly. This enables us to more precisely estimate the cash flow components. Moreover, we supplement missing *SCF* variables with hand-collected data, obtained by looking up the 10-K statements that firms file with the Securities and Exchange Commission. This gives us a more complete set of cash flow data to begin with.

much so that the average cash-to-assets ratio of these firms increases from 10.5% in 1980 to 23.2% in 2006, a more than two-fold increase. Graham and Leary (2015) find that this increase is concentrated in the technology and healthcare sectors and is almost completely driven by new Nasdaq firms. He and Wintoki (2016) show that research and development (R&D) spending contributes significantly to the increase in cash holdings; In response to a dollar of R&D spending, firms hold on average, a mere 4 cents of cash in 1980, but a daunting 60 cents in 2012. In fact, this increase in cash holdings per dollar of R&D spending, and the growing magnitude of R&D investment over time, together explain more than 20% of the increase in mean cash holdings of U.S. firms. McLean (2011) adds that the high cash holdings are also driven by firms increasingly saving their equity capital due to high precautionary motives.

Third, the allocation of funds to working capital has declined sharply as time passes. Bates et al. (2009) find that firms have been holding less working capital, in the form of lower inventories and lesser accounts receivables, than they used to be. Aktas et al. (2015) note that a significant amount of working capital may not always be necessary and find that firms adjust their investment in working capital to achieve the optimal level of working capital policy, which will improve stock and operating performance. In fact, they find that firms have been holding significantly less inventories over time. Such a reduction in inventories is likely to be associated with the adoption of just-in-time inventory management system (JIT hereafter) by U.S. firms. Specifically, Gao (2017) posits that as firms migrate from traditional inventory system to JIT, non-value-added inventories can be reduced, thereby releasing financial resources, which can be reallocated to cash holdings for business expansion.

Fourth, the funds allocation to debt repurchase has also changed over time in that firms have been increasingly retiring their debts with all available sources of funds. In fact, Custodio, Ferreira and Laureano (2013) find that firms have reduced their reliance on long-term debt and increased their use of short-term debt to finance their businesses. The authors posit that the shortening of debt maturity by U.S. firms seem to be related to the increase in corporate cash holdings as documented by Bates et al. (2009). Specifically, the decrease in debt maturity is significant for firms with high cash holdings, but not significant for those with low cash holdings. Furthermore, the time trend of debt maturity is attributed to a change in the sample composition in the 1980s and 1990s, during which risky publicly listed firms enter the sample.

## III. Data and Variables

### A. Data

Our sample consists of firms listed in the Compustat Industrial Annual files between 1971 and 2015. Following Frank and Goyal (2003) and Chang et al. (2014), we use the flow-of-funds (*SCF*) data to define variables that made up the cash flow identity. For firms with missing *SCF* data, we manually collect whenever possible, the data from 10-K statements that firms file with the Securities and Exchange Commission. Data on stock prices are retrieved from the Center for Research on Security Prices (CRSP) files. Dollar values are converted into 2009 constant dollars using the GDP deflator. Following common practice, we exclude 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, changes in working capital, and external financing. To minimize the sampling of financially distressed firms, we follow Almeida, Campello, and Weisbach (2004) and Almeida and Campello (2010) and exclude firm-years for which: (1) the market value of assets (GDP deflator adjusted) is less than $1 million, (2) the asset growth rate exceeds 100%, and (3) annual sales (GDP deflator adjusted) is less than $1 million. Furthermore, to ensure that the cash flow identity holds well in our data, we exclude observations for which the absolute value of the difference between the uses of funds and the sources of funds is greater than 1% of the beginning-of-period total assets. These sample filtering rules leave us with an unbalanced panel that consists of 12,163 firms and 114,573 firm-year observations.

### B. The Cash Flow Identity and Variables

Our empirical analysis hinges upon the following cash flow identity, as defined using Compustat flow-of-funds (*SCF*) data:

$$Inv + \Delta C + \Delta WC + ER + DR + Div + Oth = CF + EF \tag{1}$$

where the right-hand side of equation (1) depicts the two main sources of funds i.e., internally- and externally-generated funds. Specifically, internal funds refer to cash flow (*CF*) generated during the firms' course of business, and include earnings from operating activities, monies from assets sales, and profits from investment holdings. External funds (*EF*) refer to proceeds raised from both equity and debt issuances (*EI* and *DI*, respectively). The left-hand side of equation (1) comprises the uses of funds, namely investment (*Inv*), cash savings as measured by the change in cash holdings ($\Delta C$), working capital needs as given by the change in working capital ($\Delta WC$), equity repurchase (*ER*), debt repurchase (*DR*) and cash dividends (*Div*). *Oth* is a residual term for rounding errors and misreported data that might cause the cash flow identity to be unbalanced.

Defining external funds as the sum of equity and debt issuance proceeds i.e., $EF = EI + DI$, and substituting the definition into equation (1), we have the following augmented cash flow identity.

$$Inv + \Delta C + \Delta WC + ER + DR + Div + Oth = CF + EI + DI \tag{2}$$

According to the Compustat data manual, definitions of the variables in equation (2) vary depending on the format code a firm follows in reporting the *SCF* data. Appendix A details the construction of these variables based on the different format codes. All variables in the cash flow identity are scaled by one-year lagged book value of assets. To control for firm-specific characteristics, we include in our regression analysis, various firm characteristics as control variables. The market-to-book ratio (*MB*) is a proxy for both firm value and growth opportunities and is defined as (total assets + market value of equity - book value of equity) / total assets. *Sales growth* is the growth rate of net sales and serves as an alternative proxy for growth opportunities. The log of book value of assets, *Ln*(*Assets*), is included as a proxy for firm size. *Leverage* is the ratio of total debt to total assets. *Tangibility* is a measure of the tangibility of a firm's assets and is defined as the net property, plant and equipment-to-asset ratio. These control variables, as well as the variables in equation (1), are winsorized annually at the top and bottom 1% of their distributions to mitigate the effect of outliers.

## IV. Empirical Methodology

To examine how firms allocate their financial resources to different uses of funds, we measure the said allocations using the coefficients on such funds within an integrated regression framework. That is, we estimate six empirical models in which we regress each use of funds (i.e., *Inv*, $\Delta C$, $\Delta WC$, *ER*, *DR*, and *Div*) on all sources of funds, firm-specific control variables, and year fixed-effects. Also included as one of the independent variables is the residual term, *Oth*, which captures any rounding errors and misreported data that might cause the cash flow identity to be unbalanced. Variables are demeaned by firm to remove the firm fixed effects. Specifically, to measure the allocations of internal and external funds to different uses, we write our regression equations as follow:

$$Inv_{it} = \beta_0^{Inv} + \beta_1^{Inv} \times CF_{it} + \beta_2^{Inv} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (3)$$

$$\Delta C_{it} = \beta_0^{\Delta C} + \beta_1^{\Delta C} \times CF_{it} + \beta_2^{\Delta C} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (4)$$

$$\Delta WC_{it} = \beta_0^{\Delta WC} + \beta_1^{\Delta WC} \times CF_{it} + \beta_2^{\Delta WC} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (5)$$

$$ER_{it} = \beta_0^{ER} + \beta_1^{ER} \times CF_{it} + \beta_2^{ER} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (6)$$

$$DR_{it} = \beta_0^{DR} + \beta_1^{DR} \times CF_{it} + \beta_2^{DR} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (7)$$

$$Div_{it} = \beta_0^{Div} + \beta_1^{Div} \times CF_{it} + \beta_2^{Div} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (8)$$

$$Oth_{it} = \beta_0^{Oth} + \beta_1^{Oth} \times CF_{it} + \beta_2^{Oth} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (9)$$

where *Y* represents the vector of firm-specific control variables, which include *MB*, *Sales growth*, *Ln*(*Assets*), *Leverage*, and *Tangibility*. The allocation of internal funds to a particular use of funds thus reveals how much of an additional dollar of cash flow is directed to that use. The allocation of internal and external funds across the various uses of funds is therefore captured by $\beta_1^i$, and $\beta_2^i$, respectively.

This integrated framework of regressions has the methodological advantage of offering a complete view of how firms deploy funds for different uses as it simultaneously tracks all uses of funds, which are interrelated among one another by virtue of the cash flow identity. Specifically, it offers the intuitive interpretation that an increase (decrease) in the allocation of funds to a particular use must be met by a corresponding decrease (increase) in the allocation to some other use(s) since all uses of funds must sum to the sources of funds. Following Frank and Goyal (2003) and Chang et al. (2014), we use the *SCF* data to define all variables in the cash flow identity. Using a common data source has the advantage of achieving an almost balanced cash flow identity for our sample firms. In fact, Gatchev, Pulvino, and Tarhan (2010) rely on a similar cash flow identity but define its components using data from not only the *SCF*, but also the balance sheet, and income statement. As a result, their cashflow identity generally do not hold in their sample.

Chang et al. (2014) show that if the cash flow identity in equation (1) and (2) holds in the data, the coefficients on each source of funds should add up to unity across equations (3) to (9), and the coefficients on each control variable in *Y* should sum to zero. That is,

$$\beta_1^{Inv} + \beta_1^{\Delta C} + \beta_1^{\Delta WC} + \beta_1^{ER} + \beta_1^{DR} + \beta_1^{Div} + \beta_1^{Oth} = 1$$

$$\beta_2^{Inv} + \beta_2^{\Delta C} + \beta_2^{\Delta WC} + \beta_2^{ER} + \beta_2^{DR} + \beta_2^{Div} + \beta_2^{Oth} = 1$$

$$\sum_{i=1}^{5} \delta^i = 0.$$

If any source of funds increases by one dollar while holding other sources of funds unchanged, then the change in all uses of that said source of funds must sum to one dollar. However, if the shock stems from an exogenous or predetermined variable that represents neither a source nor a use of funds in the current period, then the total response across different uses of that particular source of funds must sum to zero.[41] In addition, Chang et al. (2014) demonstrate that estimating equations (3) to (9) in isolation is equivalent to estimating them as simultaneous equations, so long as the model specifications incorporate the same set of right-hand-side variables.[42]

## V. Summary Statistics

Figure 1 illustrates the evolution of all sources of funds (GDP deflator adjusted) for our sample firms. We show that internal funds (*CF*) and debt issuance proceeds (*DI*) constitute the firms' major sources of funds, and that these amounts have been gradually increasing over time.

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[41] For instance, suppose the coefficient on *MB* is 0.1 in equation (3), 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(s) must sum to -10% of total assets, holding all sources of funds variables constant.

[42] This result is not surprising in view that the simultaneous equations (3) - (9) qualify as seemingly unrelated regressions (SURs). In fact, Kruskal's (1960) theorem implies 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. This is exactly the case in our equations (3) - (9). See Greene (2008) (page 257-258) for a detailed proof.

In fact, internal cash flow increases from an aggregate amount of only US$0.25 trillion in 1971 to a daunting US$1.15 trillion in 2015. Similarly, the amount of debt funds grew from being only US$0.09 trillion in 1971 to as much as US$1.01 trillion in 2015. In sharp contrast, capital raised from equity issuance (*EI*) does not exhibit a growing time trend, and aggregate to only US$2.18 trillion across all the sample years i.e., a trivial 5% of all sources of funds.

[Insert Figure 1 Here]

Table 1 reports the descriptive statistics of our sample. The mean values of *CF* and *DI* are 0.088 and 0.080, respectively. The average sizes of these funds are therefore greater than that of *EI* (0.026), suggesting that internal cash flow and debt issuance proceeds are the most important sources of funds for a typical firm in our sample. In other words, a firm receives an average funds infusion worth 19.4% (=0.088 + 0.080 + 0.026) of its beginning-of-period assets every year. A majority of these funds are invested (8.4%), used to retire debt (6.6%), and allocated to cash savings (0.6%) and working capital needs (1.7%). The remaining funds are directed to equity repurchase (1.1%) and paid out as dividends (1.0%). The mean value of the residual term, *Oth*, is zero, suggesting that the cash flow identity holds well in our data. In fact, its 25th percentile, median, and 75th percentile values are all zero.

[Insert Table 1 Here]

Panel A and B of Figure 2 depict respectively, the relative proportions of the average uses and sources of funds. Notably, investment constitutes the most important use of a firm's funds, with almost 45% of its financial resources allocated to such use, while debt repurchase represents the next prominent use. Together, these two uses consume more than 75% of a firm's funds, which consist of internal cash flow, as well as equity and debt capital. In line with Myers and Majluf (1984), we find that firms have a tendency to rely on internal funds for their financing needs such that internal cash flow made up as much as 45% of their funds. When external funding is necessary, debt is preferred to equity; 42% of the mean sources of funds are debt proceeds whereas only 13% originates from equity capital.

[Insert Figure 2 Here]

## VI. Empirical Results

### A. The Allocation of Internal and External Funds

We start by examining how firms allocate internal and external funds to different uses. In doing so, we estimate regression equations (3) to (9) and tabulate the results in the odd-numbered columns of Table 2. We find that firms have four main uses of funds, regardless of their sources. That is, given the availability of a dollar of internal (external) funds, firms invest an average 30 (26) cents, holds 22 (12.9) cents as cash, allocate 31.9 (12.1) cents to working capital needs, and retire 12.6 (48.3) cents of debt. In other words, investment, cash savings, working capital needs, and debt repurchase together made up more than 90% of the firms' use of internal as well as external funds. The remaining internal/external funds are trivially allocated to equity repurchase (2.2 cents/0.7 cents) and dividends (1.3 cents/0.1 cents).

[Insert Table 2 Here]

Figure 3 plots the yearly allocations of internal and external funds to the four main uses of funds. These rates of allocation are obtained by running regression equations (3) to (9) on an annual basis. Contrary to Chen and Chen (2012), we find that the investment-cash flow sensitivity of U.S. firms has decreased but not disappeared over time. That is, the allocation to investment has declined over the sample period for both internal and external funds. Moreover, the allocation of internal funds to investment closely tracks that of external funds, suggesting that money is fungible for investment purposes; A dollar of internal cash flow is invested just like a dollar of externally-generated funds.

[Insert Figure 3 Here]

We also find that firms have been concurrently allocating funds to cash savings throughout the sample period. In other words, firms have been not only consistently saving internal cash flow over time, but also allocating equity and debt capital to cash savings. In 1971, firms held 14.8 (9.2) cents as cash for every dollar of internal (external) funds made available to them. The saving rates of internal (external) funds then grew to 28.5 (38.9) cents in 1983, during which the U.S. economy slipped into a recession. As such, the greater tendency of U.S. firms to hold cash during this time is consistent with the precautionary motive of cash savings by Keynes (1936). In fact, McLean (2011) find that firms have been increasingly saving their equity issuance proceeds, so much so that cash savings have become the primary use of equity capital by U.S. firms. That said, the cash-cash flow sensitivity of these firms has neither been increasing nor decreasing over the sample years.

In contrast, the firms' cash flow sensitivity to changes in working capital has decreased sharply in terms of both internal and external funds; On average, 32 (32.4) cents out of every dollar of internal (external) funds are allocated to working capital in 1971, whereas only 19 (3.7) cents are dedicated to such use in 2015. The downward trend in working capital allocation is consistent with the overall decline in working capital needs as documented by Bates et al. (2009). Specifically, the authors find that firms have been holding less working capital in the form of reduced accounts receivables and inventories. In fact, Aktas et al. (2015) note that a significant amount of investment in working capital may not always be necessary and find that firms adjust their working capital investment to achieve the optimal level of working capital policy that will improve stock and operating performance. Taken together, our finding of declining working capital allocation among U.S. firms may well be attributed to the increased efficiency in working capital management by these firms. In the forthcoming section, we further investigate the decreasing trend in working capital allocation with respect to the different components of working capital.

In view that the allocations of internal and external funds to investment and working capital have both declined over time, we examine the corresponding allocations to debt repurchase, and find that the sensitivity of debt repurchase to funds availability has significantly increased over the sample period. In 1971, firms retire an average 7.1 (30.4) cents of debt for every available dollar of internal (external) fund but in 2015, this per-dollar amount grew to 20.4 (65.8) cents. Notably, while the allocation to debt retirement of internal funds tracks that of external funds, the allocation is relatively more pronounced for external funds, mainly because firms have been rolling over existing debts with new debt issuance. As a side note, we find in unreported results that the annual allocations to equity repurchase and dividends are trivial and does not exhibit any obvious trend. In any given year, a maximum amount of only 7.1 (2.9) cents and 6.1 (0.6) cents are respectively allocated to equity repurchase and dividends per dollar of internal (external) funds.

To summarize, during the years 1971 to 2015, U.S. firms have four main uses of funds namely investment, cash savings, working capital needs, and debt repurchase. These uses are funded by two sources, i.e., internal funds generated by the firms' operating activities, and external funds, which are made up of equity and debt capital. For both sources of funds, we find that their allocations to investment and working capital have declined over time. By virtue of the cash flow identity, these diminishing allocations imply that there must be a corresponding increase in the allocation to some other use(s). Examining the allocations to cash savings, security repurchases and dividends, we indeed find that the decreasing allocations to investment and working capital are counteracted by the increasing allocation to debt retirement during the same time period.

## B. The Allocation of Equity and Debt Funds

To compare the allocations of equity versus debt funds to different uses, we substitute *EF* = *EI* + *DI* into equations (3) to (9), and rewrite the regression equations as follow:

$$Inv_{it} = \beta_0^{Inv} + \beta_1^{Inv} \times CF_{it} + \beta_2^{Inv} \times EI_{it} + \beta_3^{Inv} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (10)$$

$$\Delta C_{it} = \beta_0^{\Delta C} + \beta_1^{\Delta C} \times CF_{it} + \beta_2^{\Delta C} \times EI_{it} + \beta_3^{\Delta C} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (11)$$

$$\Delta WC_{it} = \beta_0^{\Delta WC} + \beta_1^{\Delta WC} \times CF_{it} + \beta_2^{\Delta WC} \times EI_{it} + \beta_3^{\Delta WC} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (12)$$

$$ER_{it} = \beta_0^{ER} + \beta_1^{ER} \times CF_{it} + \beta_2^{ER} \times EI_{it} + \beta_3^{ER} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (13)$$

$$DR_{it} = \beta_0^{DR} + \beta_1^{DR} \times CF_{it} + \beta_2^{DR} \times EI_{it} + \beta_3^{DR} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (14)$$

$$Div_{it} = \beta_0^{Div} + \beta_1^{Div} \times CF_{it} + \beta_2^{Div} \times EI_{it} + \beta_3^{Div} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (15)$$

$$Oth_{it} = \beta_0^{Oth} + \beta_1^{Oth} \times CF_{it} + \beta_2^{Oth} \times EI_{it} + \beta_3^{Oth} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (16)$$

The coefficients on *EI* and *DI* (i.e., $\beta_2$ and $\beta_3$, respectively) therefore represent correspondingly, the allocation of equity and debt funds to the different uses. The even-numbered columns of Table 2 depict the results of running regression equations (10) to (16). Figure 4 plots the associated annual coefficients of the four main uses of funds over the period 1971-2015.

[Insert Figure 4 Here]

We find that the allocations of equity and debt funds to investment are similar to that of internal and external funds. Specifically, the sensitivities of investment to the availability of both equity and debt funds have gradually declined over time. Moreover, the two types of external funds generally have similar rates of allocation to investment throughout the sample period. In 1971, firms invest on average, 23.1 (29.6) cents per dollar of equity (debt) capital, and in 2015, the rate of investment was 34.3 (22.5) cents for every dollar of available equity (debt) funds. In other words, resources from external financing are fungible in terms of investment; A dollar of equity capital is invested just like a dollar of debt capital.

Interestingly, although there is no obvious time trend for the allocation of external funds to cash savings, differentiating between the two components of external funds i.e., equity and debt capital, and examining their respective allocations to cash savings reveal otherwise. In particular, the saving rate of equity capital has significantly increased over time; On average, firms saved 14.2 cents from every dollar of equity capital raised in 1971. The recession during the early 1980s saw firms saving as much as 58.3 cents out of a dollar of equity funds in 1983. The average saving rate then dropped slightly to 45.7 cents in 2015. On the other hand, there is no time trend associated with the allocation of debt funds to cash savings. Moreover, the saving rate of debt capital is significantly lower than that of equity capital; For any given year, firms do not save more than 14.3 cents per dollar of debt funds.

The allocations of equity and debt funds to working capital generally track that of overall external funds in that the sensitivities of working capital to the availability of both types of external funds have significantly decreased over time. In terms of the increasing allocation of external funds to debt repurchase, Panel D of Figure 4 confirms that such an upward trend mainly came from firms rolling over existing debt. Specifically, the allocation of debt capital to debt retirement has increased over time, whereas that of equity capital has not. In fact, there is no trend associated with the allocation of equity funds to debt repurchase; The rates of allocation are generally low, with firms retiring less than 16 cents of debt per dollar of equity capital in any given year of the most recent decade.

In a nutshell, firms have decreased their allocations of equity funds to investment and working capital over time. These diminishing allocations are counteracted by the significantly increasing allocation to cash savings. The allocation of equity funds to debt repurchase is however, minimal with no obvious time trend. In terms of debt funds, firms have similarly reduced their allocations to investment and working capital with the passage of time. However, unlike the corresponding allocations of equity funds, the declining allocations of debt funds to investment and working capital are met by the growing allocation to debt repurchase. The sensitivity of cash savings to the availability of debt funds is trivial with no time trend.

**C. The Allocation to Working Capital**

To recapitulate, we find that U.S. firms have significantly reduced their allocation to working capital over the years 1971-2015. This is intriguing because the sharp downward trend in working capital allocation is pertinent not to a single source of funds, but to all sources of funds. That is, the allocation to working capital has decreased over time with respect to both internal cash flow and external funds, consisting of equity and debt issuance proceeds. To shed light on these results, we decompose the change in working capital into five components and examine their respective allocations. That is, we define the change in working capital as:

$$\Delta WC = \Delta AR + \Delta IV + \Delta AP + \Delta TP + \Delta Oth \tag{17}$$

where $\Delta AR$, $\Delta IV$ and $\Delta Oth$ refer respectively to the change in accounts receivables, inventories, and other net receivables, while $\Delta AP$ ($\Delta TP$) is the negative of the change in accounts payables (income tax payables). In other words, the change in working capital is the sum of changes in accounts receivables, inventories, and other net receivables, less the changes in accounts payables and income tax payables.

[Insert Table 3 Here]

To examine the allocation of internal and external funds to the components of working capital, we substitute equation (17) into regression equation (5). That is, we run the following regression equations:

$$\Delta AR_{it} = \beta_0^{\Delta AR} + \beta_1^{\Delta AR} \times CF_{it} + \beta_2^{\Delta AR} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \tag{18}$$

$$\Delta IV_{it} = \beta_0^{\Delta IV} + \beta_1^{\Delta IV} \times CF_{it} + \beta_2^{\Delta IV} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \tag{19}$$

$$\Delta AP_{it} = \beta_0^{\Delta AP} + \beta_1^{\Delta AP} \times CF_{it} + \beta_2^{\Delta AP} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (20)$$

$$\Delta TP_{it} = \beta_0^{\Delta TP} + \beta_1^{\Delta TP} \times CF_{it} + \beta_2^{\Delta TP} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (21)$$

$$\Delta Oth_{it} = \beta_0^{\Delta Oth} + \beta_1^{\Delta Oth} \times CF_{it} + \beta_2^{\Delta Oth} \times EF_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it.} \quad (22)$$

The regression results are tabulated in the odd-numbered columns of Table 3. Specifically, we find that firms mainly allocate their funds to three components of working capital namely, accounts receivables, inventories, and accounts payable. As shown in Table 2, firms increase working capital by 31.9 (12.1) cents per dollar of internal (external) funds. To add on, we show that of this allocation, 17.9 (5.3) cents are allocated to accounts receivables, 13.9 (5.1) cents are used to raise the level of inventory, and 3 (1.3) cents are deployed to reduce accounts payables. In other words, the allocations to these three components of working capital together made up more than 90% (75%) of the allocation of internal (external) funds to working capital.

To examine the allocation of equity and debt funds to the components of working capital, we substitute *EF* = *EI* + *DI* into equation (18) to (22) and write the following regression equations.

$$\Delta AR_{it} = \beta_0^{\Delta AR} + \beta_1^{\Delta AR} \times CF_{it} + \beta_2^{\Delta AR} \times EI_{it} + \beta_3^{\Delta AR} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (23)$$

$$\Delta IV_{it} = \beta_0^{\Delta IV} + \beta_1^{\Delta IV} \times CF_{it} + \beta_2^{\Delta IV} \times EI_{it} + \beta_3^{\Delta IV} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (24)$$

$$\Delta AP_{it} = \beta_0^{\Delta AP} + \beta_1^{\Delta AP} \times CF_{it} + \beta_2^{\Delta AP} \times EI_{it} + \beta_3^{\Delta AP} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (25)$$

$$\Delta TP_{it} = \beta_0^{\Delta TP} + \beta_1^{\Delta TP} \times CF_{it} + \beta_2^{\Delta TP} \times EI_{it} + \beta_3^{\Delta TP} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (26)$$

$$\Delta Oth_{it} = \beta_0^{\Delta Oth} + \beta_1^{\Delta Oth} \times CF_{it} + \beta_2^{\Delta Oth} \times EI_{it} + \beta_3^{\Delta Oth} \times DI_{it} + \delta Y_{it-1} + \theta_{it} + \varepsilon_{it} \quad (27)$$

The corresponding regression results are tabulated in the even-numbered columns of Table 3. We find that the working capital allocations of both equity and debt funds are similarly directed to the three main components of working capital; On average, 15.7 (11) cents are allocated to working capital per dollar of equity (debt) funds raised. Of which, 8.3 (4.4) cents are directed to accounts receivables, 6 (4.8) cents are used to raise inventory level, and 1.7 (1.1) cents are deployed to reduce accounts payables.

[Insert Figure 5 Here]

To investigate the prominent downward trend in working capital allocation, we run regression equations (18) to (27) on an annual basis and plot the coefficients of the three main components of working capital in Figure 5; Panel A (B) depicts the allocation of internal (external) funds, while Panel C (D) illustrates that of equity (debt) funds. Consistent across all the sources of funds, we find that the decreasing allocation of working capital is, to a large extent, driven by the diminishing allocations to accounts receivables and inventories. Given that working capital needs are more heavily funded by internal funds than by external funds, it is therefore not surprising that the sensitivities of changes in accounts receivables and inventories are relatively higher with respect to the availability of internal funds.

The decreasing funds allocations to working capital in general, and to accounts receivables and inventories in particular, are consistent with the findings of both Bates et al. (2009) and Aktas et al. (2015). The former finds that, from the 1980s to the 2000s, the level of net working capital drops by more than 10% of assets, largely contributed by a decrease in accounts receivables and inventory holdings. Specifically, they find that accounts receivables (inventories) average to 20.3% (19.9%) of assets in the 1980s, but only average to 15.3% (12.3%) in the 2000s. Aktas et al. (2015) similarly document that firms have been holding less working capital (particularly inventories) over time.

To understand why U.S. firms have been decreasingly allocating resources to manage their accounts receivables, we note two potential explanations. First, firms could be better managing their receivables over time, thereby necessitating a reduced need for working capital. That is, the firms' liquidity could be strengthened by ensuring customers pay their invoices and preventing overdue payment. Firms could also be engaging in accounts receivable financing (also known as factoring), whereby receivables are sold to third parties such that the firms can quickly receive cash on their receivables, rather than wait till their customers ultimately pay up. Factoring therefore enhances the firms' liquidity, making it easy for them to pay employees and handle customer orders. Second, customers may simply be needing less or no credit terms from the firms. With the widespread availability of credit card finance, along with its associated convenience, perks and benefit of cash advances, customers may possibly be substituting credit card financing for accounts receivables as an alternative mode of payment.

In examining the decreasing time trend associated with the firms' allocation of financial resources to inventories, we attribute the associated decline in inventory level to the adoption of just-in-time inventory management system (JIT hereafter) by U.S. firms. In fact, Gao (2017) posits that as firms migrate from traditional inventory system to JIT, they shift resources from inventories to cash holdings. Specifically, receiving goods just as they are needed in the production process eliminates non-value-added inventory, thereby reducing the associated inventory holding costs. As a result, the funds allocation to inventories can be reduced such that the released resources can be reallocated to cash holdings for business expansion, without the need to tap on costly external financing.

Notably, the coefficients on $\Delta AP$ are negative in almost all the regressions. Given that $\Delta AP$ is defined as the negative of the change in accounts payables, the allocation of financial resources to accounts payables is therefore regarded as a use of funds. Figure 5 shows that the allocation to accounts payables has slightly increased over the sample years for all the sources of funds. Put differently, firms have been changing their working capital policies over time in the form of reduced reliance on accounts payables.

**D. The Time Trend in Funds Allocations**

In this section, we evaluate two possible explanations for the observed time trends in the allocation of internal and external funds to different uses. First, the type of firms in our sample could have changed over time, such that different firms are used to estimate the funds allocations for different time periods.[43] Second, the business fundamentals underlying our sample firms could have changed during the sample period, leading to changes in the way they allocate internal and external funds to different uses. To disentangle the effect of changes in sample composition from that of changes in allocation dynamics, we classify firms into incumbents and entrants, and estimate their respective funds allocations.

If the observed time trends of the various funds allocations are attributed to changes in sample composition, then we would expect the entrants, but not the incumbents, to exhibit those time trends over the sample period. On the contrary, if the time trends are attributed to changes in allocation dynamics, then we would expect only incumbents to exhibit such patterns.[44] We classify firms as incumbents or entrants based on their listing year. Specifically, we adopt three classification methods whereby firms are classified as incumbents if they are listed (1) before 1971, (2) during 1966 to 1980, or (3) during 1976 to 1990. Correspondingly, firms are regarded as entrants if they are listed during the years (1) 1971 to 1985, (2) 1981 to 1995, or (3) 1991 to 2005. We then separately estimate for incumbents and entrants, the allocations of internal and external funds to the four main uses of funds.

[Insert Figure 6, 7 and 8 Here]

[43] In fact, Fama and French (2004) document a dramatic increase in the number of firms newly listed on the major U.S. stock markets in the 1980s and 1990s. Importantly, they find that these firms are significantly different from existing listed firms in that the profitability (growth) of these entrant firms are relatively more left (right) skewed.
[44] In a similar note, Graham and Leary (2015) find that the secular increase in the average cash holdings of U.S. firms is attributed to the entry of cash rich firms, rather than to firms changing their cash policies over time.

Figure 6 plots the regression results based on the first classification scheme, while Figure 7 and 8 depict the respective results based on the second and third classification schemes. Regardless of the different classification schemes used, we find that the allocations of internal and external funds to various uses by incumbents generally approximate those by the entrant firms. In other words, the time trends of these funds allocations to the four main uses of funds are driven by both changes in sample composition, and changes in allocation dynamics.

**E. Sensitivities of Fund Allocations to Macroeconomic Factors**

To understand why firms have changed their allocations of financial resources over time, we identify various economic and financial factors that could potentially influence the resource deployment by U.S. firms. These factors include: (1) *Real GDP Growth*, the percentage increase in real gross domestic product in 2000 dollars, (2) *Inflation*, the annual percentage change in the Consumer Price Index, (3) *Cost of Carry*, the spread between the cost and return of liquid assets, constructed using data from Fed Flow of Funds following Azar et al. (2016), (4) *Default Spread*, the difference between the December yields on Baa and Aaa Moody's rated corporate bonds with maturity of approximately 20-25 years, (5) *Credit Spread*, the difference between the December commercial paper annualized yield and the annualized December 3-month Treasury bill rate, and (6) *Stock Market Return*, the monthly compounded returns on the CRSP value-weighted index of stocks traded on NYSE, NASDAQ, and AMEX.

In view that some of these factors are highly correlated (for example, inflation and cost of carry), and relate to the same underlying economic conditions, we reduce the dimensionality of these factors by way of a principal component analysis (PCA hereafter). In this way, we isolate the common component associated with the multiple factors. Specifically, we obtain three principal components with eigenvalues greater than one. We name these components PC1, PC2, and PC3, respectively. Together, these components explain as much as 84.2% of the variation in the six original factors. The loadings on these components are reported in Panel A of Table 4, whereas the correlations among the components and their underlying factors are reported in Panel B of the same table.

[Insert Table 4 Here]

We find that the first principal component, PC1, is strongly correlated with four of the six factors i.e., it increases with the cost of carry, inflation, default spread, and credit spread. In fact, these four factors tend to vary together. PC1 therefore seems to capture business cycles. Figure 9 depicts the scores of PC1, plotted against the four factors. A visual inspection of the graphs reveals that the component scores are highest during the years 1973 to 1975, and in the early 1980s, during which there was a recession in the U.S., accompanied by high inflation and unemployment. The scores are also high during the economic downturn triggered by the 1987 stock market crash, and the 2008 global financial crisis. On the other hand, the second principal component, PC2, is strongly correlated with real GDP growth, entailing a correlation coefficient as high as 0.832. As such, PC2 can be viewed as a measure of economic growth. In contrast, the third principal component, PC3, seems like an indicator of stock market conditions given that it comoves strongly with stock market returns, with a correlation coefficient of 0.8.

[Insert Table 5 Here]

To understand how these principal components affect funds allocations, we first note that during economic downturns, firms could experience low cash flow stability and/or reduced investment opportunities. Cash savings are likely to be high due to high precautionary motives. The firms' customers may also negotiate for better credit terms such that working capital needs are increased. Moreover, firms could cut back on debt retirement as they need the capital to finance their businesses. On the contrary, during periods of high economic growth, we expect firms to have profitable projects to invest in and allocate more funds to investment. Moreover, the precautionary need for cash could possibly be reduced. As firms experience high business volumes during the high economic growth periods, they are likely to require greater working capital to finance their operations. Last, it is well documented that firms tend to issue equity when their market values are high.[45] During stock market booms, we therefore expect firms to raise significant amounts of equity capital. Since the issuance of equity is likely to be driven by the incentive to exploit the temporary low cost of equity and not by an initiative to raise capital for specific uses, we expect firms to park the proceeds as cash rather than channel the funds to other uses. Hence, the allocation of external funds (particularly equity capital) to cash savings is likely to increase when stock market conditions are favorable.

To test these hypotheses, we include the principal components as key explanatory variables in our regressions. That is, we regress with respect to the four main uses of funds, the yearly allocations of each source of funds on the three principal components, and the respective lagged allocation. In Table 5, Panel A reports the regression results pertaining to the allocations of internal versus external funds, while Panel B reports that of equity versus debt funds. In general, a high score for PC1 indicates the occurrence of a recession, whereas a high score for PC2 signifies the presence of high economic growth. A high score for PC3 designates a state of favorable stock market conditions.

Consistent with our hypotheses, we find that an increase in the score of PC1 is associated with a reduction in the allocation of internal cash flow to investment. There are two possible explanations for this result; First, firms might find themselves with fewer investment opportunities during a recession than an economic boom. As such, they might save rather than invest the cash flow. Consequently, investment might not respond to the availability of cash

[45] See Baker and Wurgler (2002) for a discussion about the market timing theory of capital structure. Specifically, the theory posits that in the event of stock price run-ups, firms have a tendency to issue equity at high prices so as to exploit the temporary fluctuations in the cost of equity.

flow, leading to low investment-cash flow sensitivity. Second, firms might experience low levels of cash flow during a recession such that they are not able to make any investment with the available cash flow. In fact, Allayannis and Mozumdar (2004) find that when firms have weaker financial positions (i.e., negative cash flow), their investment became irresponsive to the availability of cash flow.

During an economic downturn, firms also save more cash flow, possibly due to high precautionary motives; The coefficient of *Cash_CF* on PC1 is positive. In addition, the downturn of an economy is associated with an increase in the allocation to working capital and a decrease in the allocation to debt retirement, both in terms of internal and external funds. Interestingly, we find that in a recession, firms increase their allocation to debt repurchase with respect to equity funds, but not debt funds. That said, for both types of funds, the allocation to investment increases during times of business cycle contraction.

In contrast, when economic growth is high (as indicated by a high score for PC2), firms reduce their allocation to cash savings with respect to both internal and external funds, as well as equity and debt funds. Since the precautionary motive of holding cash is not as pressing when the economy is strong, firms probably have a lesser need to build up their cash reserves than when the economy is weak. In addition, during times of economic expansion, firms significantly increase their allocation to investment for all sources of funds. However, such an increase is generally counteracted by a decrease in their allocation to debt repurchase.

Finally, a high score for PC3 implies that stock market conditions are favorable such that firms are issuing equity and significantly saving the proceeds as cash (coefficient = 1.54; *t*-statistic = 1.2). At the same time, the allocation of equity funds to investment is reduced (coefficient = -2.615; *t*-statistic = -3.2). We also find that firms have been reducing their allocation of debt funds to debt repurchase, possibly because the higher equity values triggered by the stock price run-ups led to lower market leverage, and therefore a reduced need to repurchase debt. In sum, we find that the allocations of all sources of funds to the different uses are indeed closely related to the macroeconomic and financial factors explored in this section.

In particular, the sharply declining time trend associated with the allocation to working capital as documented in Section VI Part C, is consistent with the downward trends of cost of carry and inflation. Specifically, when the cost of carry is high relative to the return on cash assets, firms are likely to be indifferent between attaining short-term liquidity in the form of cash or working capital. However, when the cost of carry is relatively low, cash has an advantage over working capital since holding cash assets entails generating a return on cash. A decline in the cost of carry over time, coupled with the diminishing allocation to working capital, is therefore consistent with firms switching from maintaining working capital to holding cash and marketable securities, as a form of short-term liquidity. Moreover, in view that firms have an incentive to increase their inventories when inflation is high, the level of inventory is likely to vary with that of inflation. As such, with inflation declining over time, it is not surprising that inventories, one of the major components of working capital, are reduced.

## VII. Conclusion

The way U.S. firms allocate financial resources to different uses has changed significantly with the passage of time. Using a large sample of nonfinancial U.S. firms over the period 1971 to 2015, we examine how these firms deploy their funds for specific uses and how the allocations have changed over time. We find that firms have four main uses of funds namely, investment, cash savings, working capital needs, and debt repurchase, which are funded by the firms' internal funds, generated by their operating activities, as well as external funds, made up of equity and debt capital. Specifically, firms have been reducing over time, the allocations of both internal and external funds to investment and working capital, while increasing the allocation to debt retirement.

In addition, firms have been decreasingly allocating equity funds to investment and working capital and increasing their allocation to cash savings. Over the same time, the allocations of debt funds to investment and working capital have also been decreasing. However, these diminishing allocations are met by increasing allocation to debt repurchase and not to cash savings. Notably, the allocation to working capital has declined sharply with respect to all sources of funds. This decline is largely due to the decreasing allocations to accounts receivables, inventories, and accounts payables. In general, we attribute the reduced working capital needs to better receivables management by the firms, more efficient inventory administration, and improved access to finance over time.

To add on, we find that the time trends of the allocations of all funds to the four main uses of funds are driven not only by changes in sample composition, but also by changes in allocation dynamics. Moreover, these time-series changes in funds allocations are related to several macroeconomic factors, such as real GDP growth, inflation, cost of carry, default spread, credit spread and stock market return.

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**Figure 1. Evolution of Funds, 1971-2015**

This figure presents by calendar year, the aggregate amounts of funds available to nonfinancial U.S. firms in Compustat for the years 1971 to 2015. In general, there are two main sources of funds i.e., internally- and externally-generated funds. Internal funds refer to internal cash flow (*CF*), generated during the firms' course of business, and include earnings from operating activities, monies from assets sales, and profits from investment holdings. External funds refer to proceeds raised from both equity and debt issuances (*EI* and *DI*, respectively). Amounts are in billions of 2009 constant U.S. dollars.

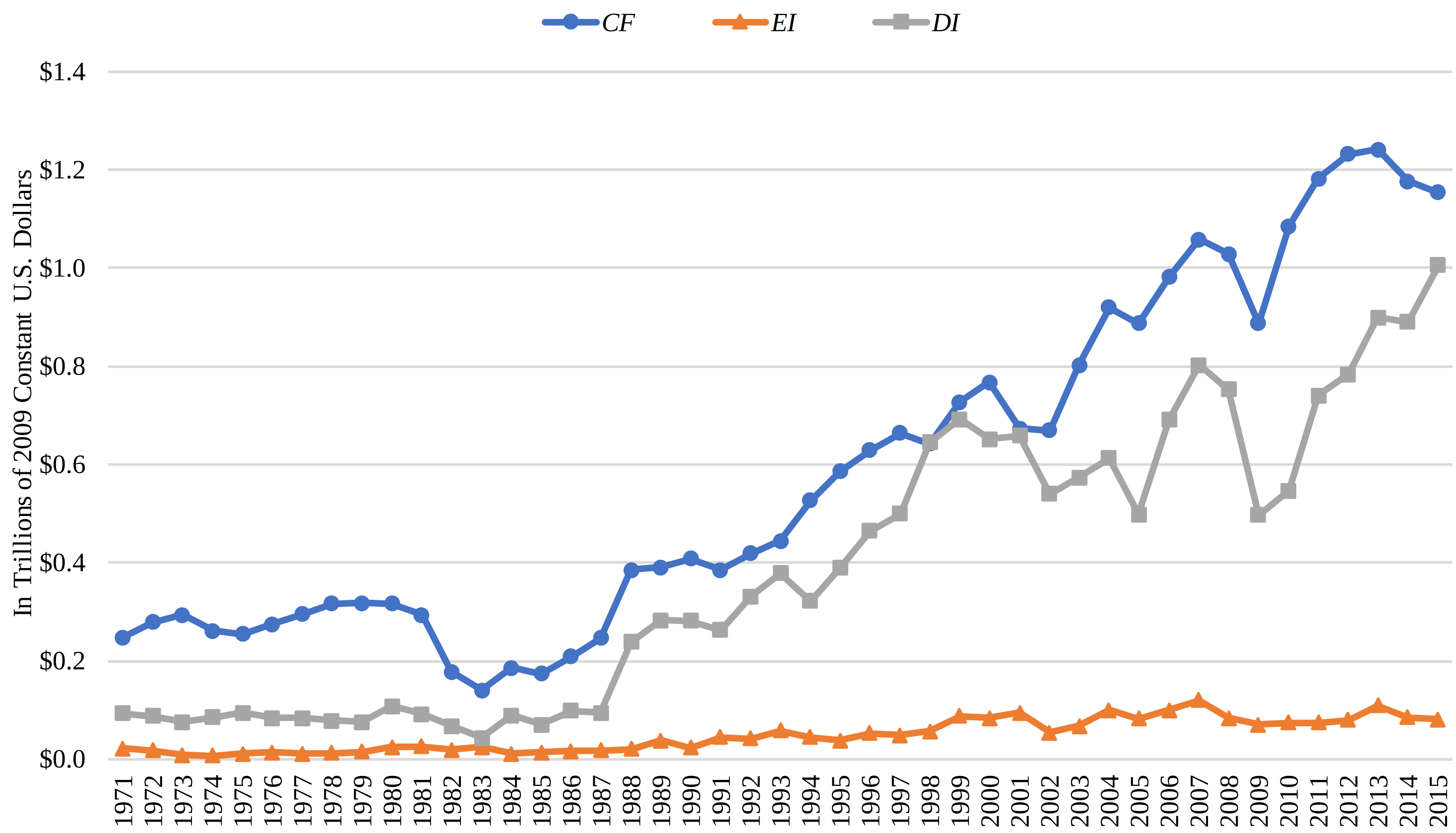
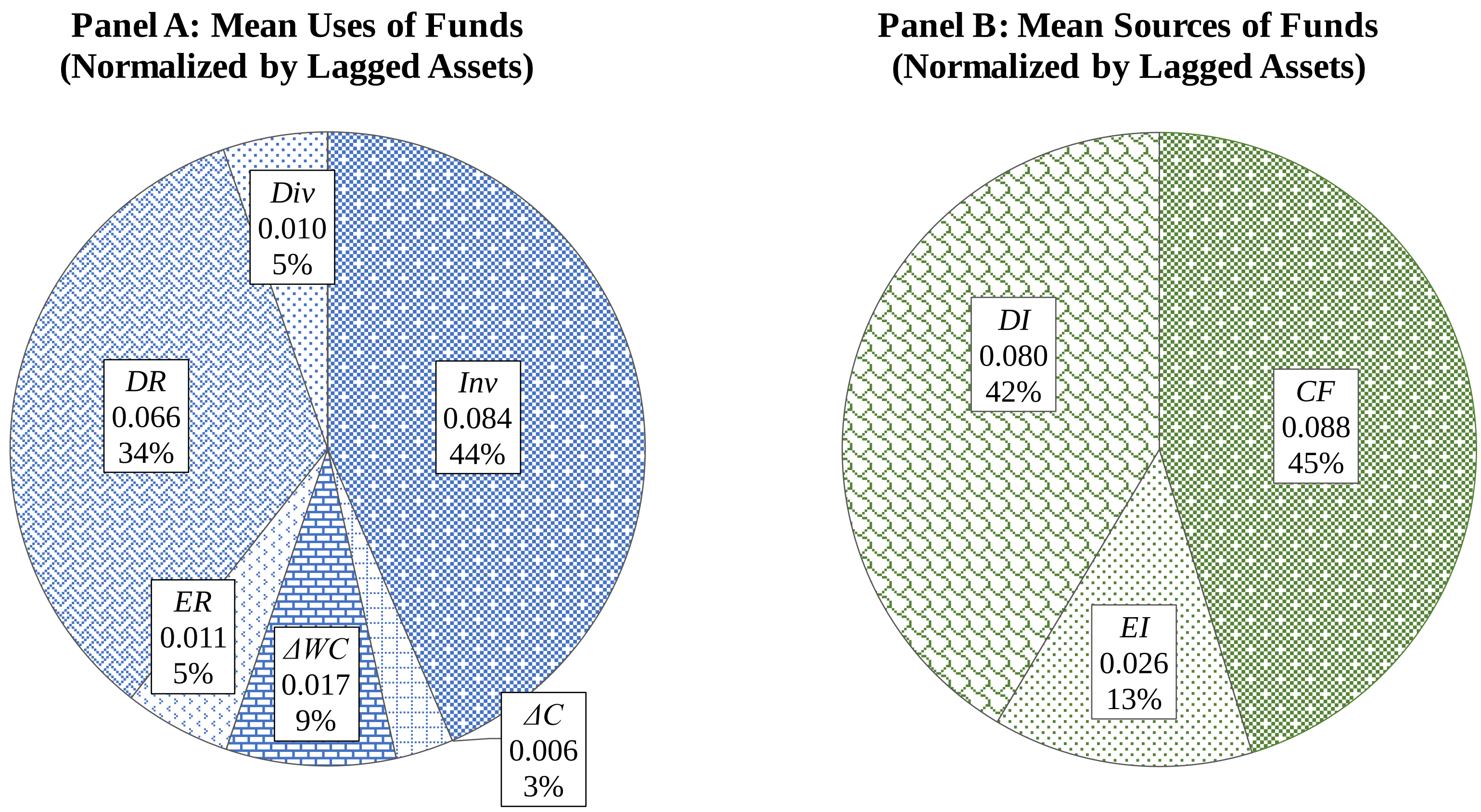


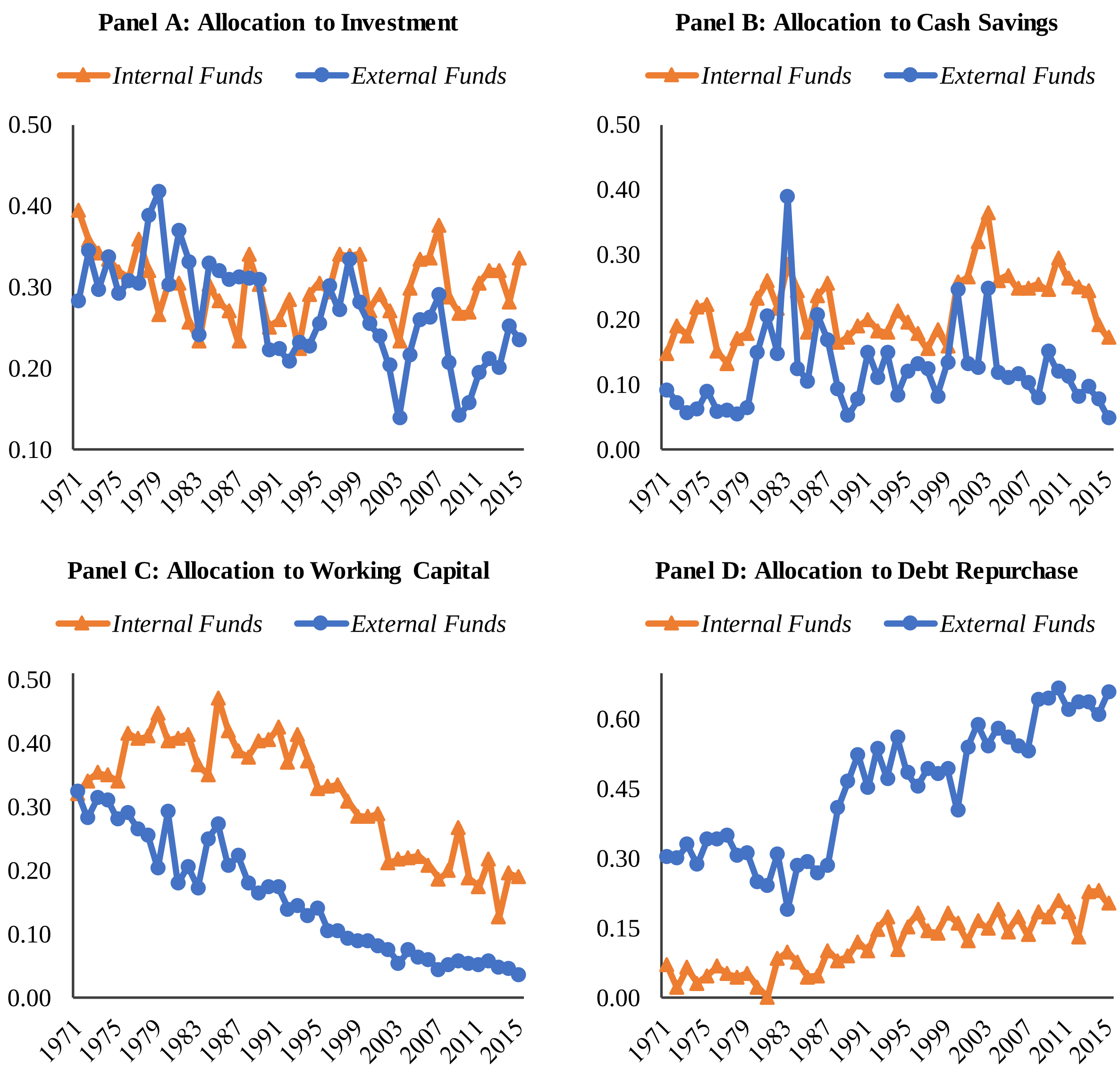
**Figure 2. Mean Uses and Sources of Funds, 1971-2015**

This figure depicts the mean values of uses and sources of funds for nonfinancial U.S. firms in Compustat during the period 1971-2015. Panel A presents the mean ratios of the uses of funds to beginning-of-period total assets. Uses of funds include investment (*Inv*), cash savings ($\Delta C$), working capital needs ($\Delta WC$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* refers to the plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. Panel B depicts the average ratios of the sources of funds to beginning-of-period total assets, whereby sources of funds include internal cash flow (*CF*), as well as debt and equity funds (*DI* and *EI*, respectively). Appendix A depicts the definitions of these variables.



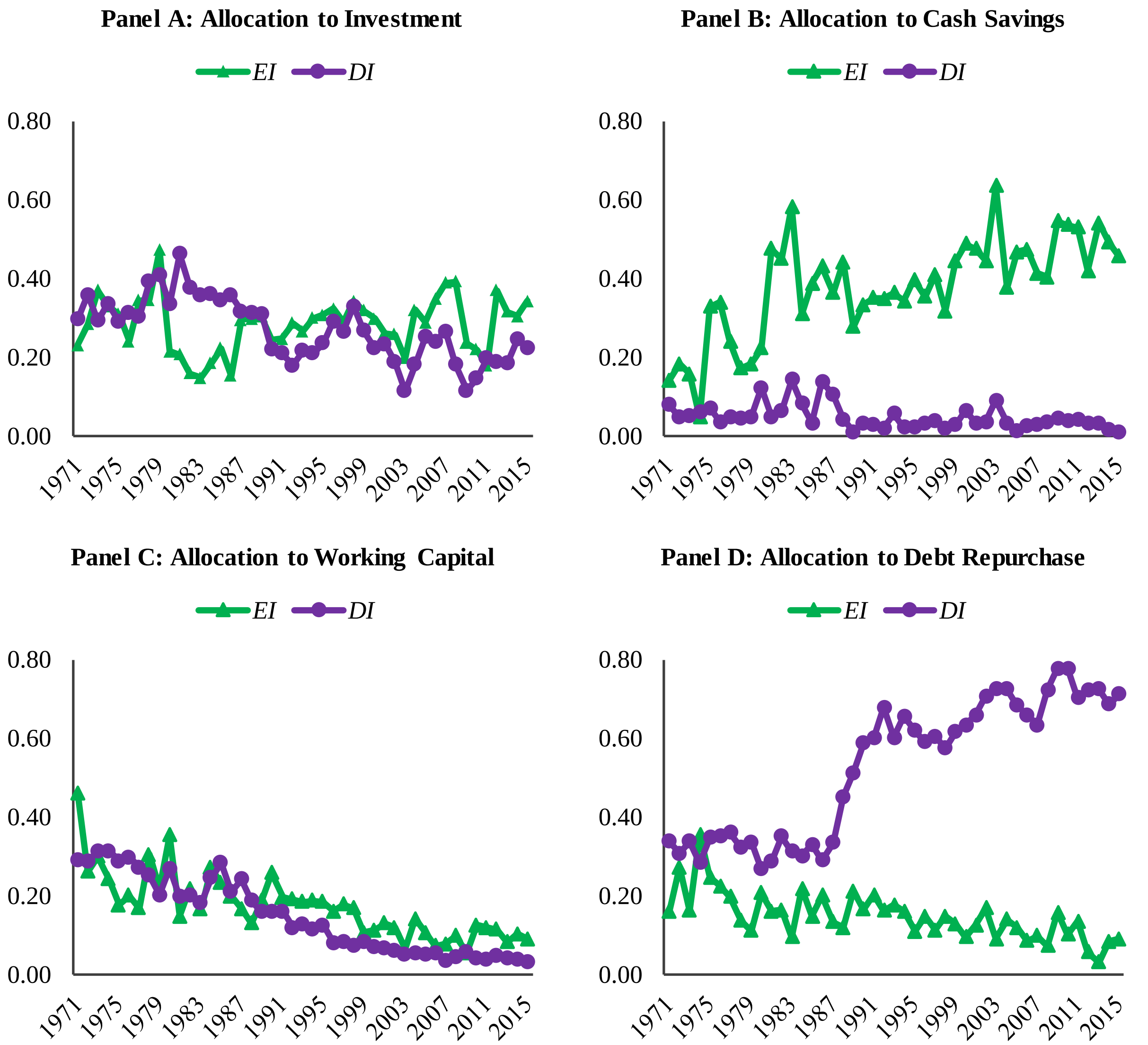
## Figure 3. Allocation of Internal and External Funds

This figure depicts for the period 1971-2015, the yearly rates of both internal and external funds allocations, by nonfinancial U.S firms in Compustat, to four main uses of funds, namely investment, cash savings, working capital needs, and debt repurchase. Specifically, the rates of allocation are estimated under the cash flow identity-based integrated regression framework of Chang et al. (2014), whereby each use of funds is regressed on the two main sources of funds. That is, internal funds refer to internal cash flow (*CF*), generated during the firms' course of business, and include earnings from operating activities, monies from assets sales, and profits from investment holdings. External funds refer to the proceeds raised from both equity and debt issuances (*EI* and *DI*, respectively).



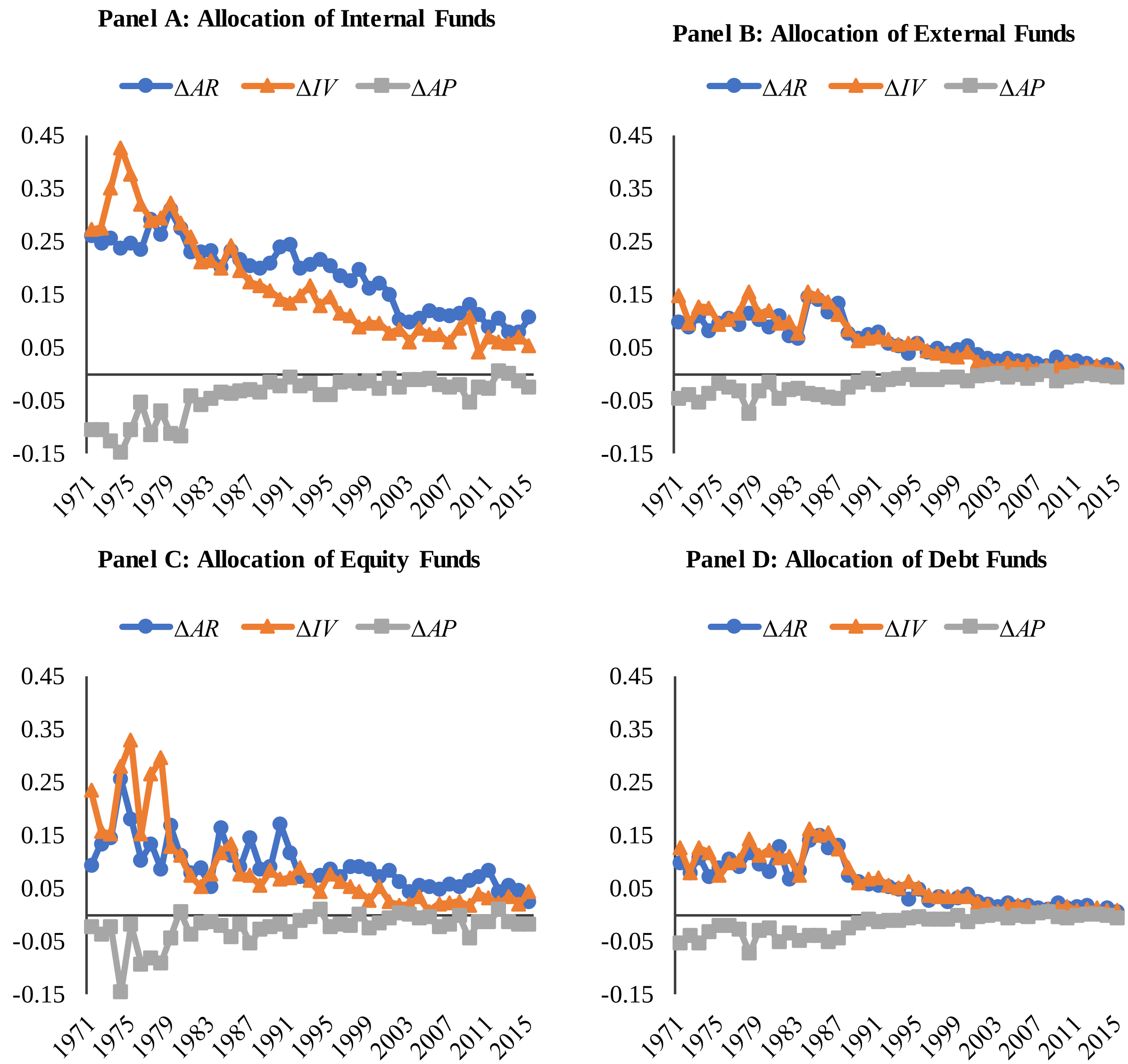
## Figure 4. Allocation of External Funds (Equity versus Debt Funds)

This figure depicts for the period 1971-2015, the yearly allocations of equity and debt funds, by nonfinancial U.S. firms in Compustat, to four main uses of funds namely investment, cash savings, working capital needs, and debt repurchase. Specifically, the rates of allocation are estimated under the cash flow identity-based integrated regression framework of Chang et al. (2014), whereby each use of funds is regressed on internal cash flow (*CF*), as well as the proceeds raised from both equity and debt issuances (*EI* and *DI*, respectively).



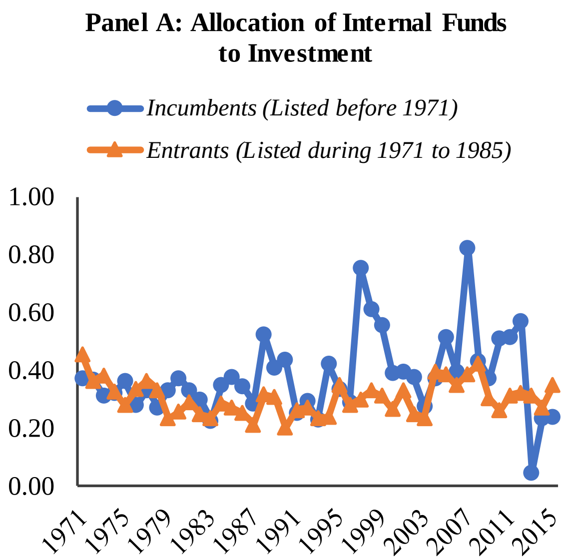
## Figure 5. Funds Allocation to Working Capital

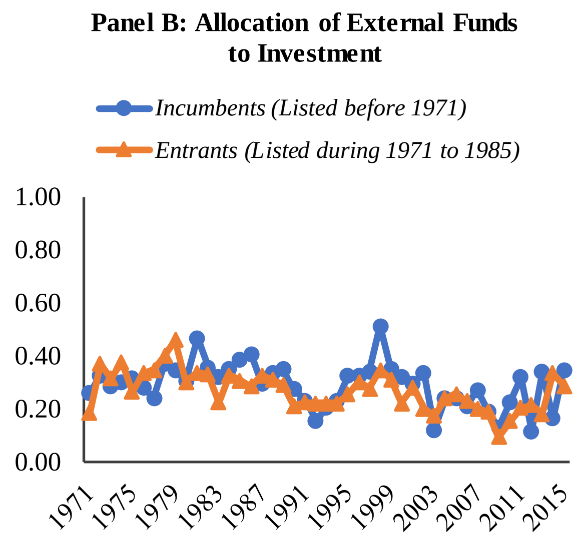
This figure depicts for the period 1971-2015, the yearly allocation of both internal and external funds, by nonfinancial U.S firms in Compustat, to the three main components of changes in working capital ($\Delta WC$) namely, changes in accounts receivables, inventories and accounts payables ($\Delta AR$, $\Delta IV$ and $\Delta AP$, respectively). Specifically, the rates of allocation are estimated under the cash flow identity-based integrated regression framework of Chang et al. (2014), whereby each component of $\Delta WC$ is regressed on the two main sources of funds. That is, internal funds refer to internal cash flow (*CF*), generated during the firms' course of business, and include earnings from operating activities, monies from assets sales, and profits from investment holdings. External funds refer to the proceeds raised from both equity and debt issuances (*EI* and *DI*, respectively).

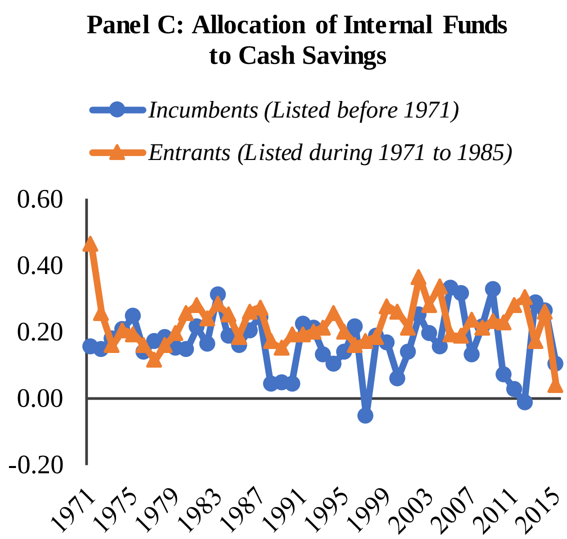


## Figure 6. Funds Allocation by Incumbent and Entrant Firms (First Classification)

This figure depicts for the period 1971-2015, the yearly allocations of internal and external funds to four main uses of funds (i.e., investment, cash savings, working capital needs and debt repurchase) by both incumbent and entrant nonfinancial U.S. firms in Compustat. Internal funds refer to internal cash flow (*CF*), generated during the firms' course of business, and include earnings from operating activities, monies from assets sales, and profits from investment holdings. External funds represent the sum of equity and debt funds (*EI* and *DI*, respectively). Incumbent firms refer to firms listed before 1971, while entrant firms are firms listed between 1971 to 1985.



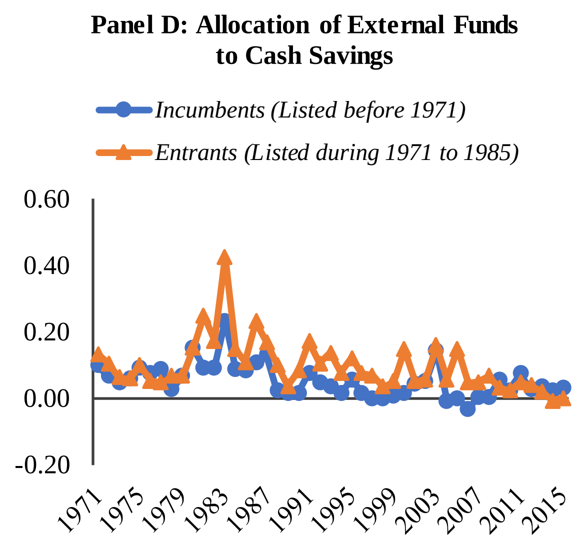
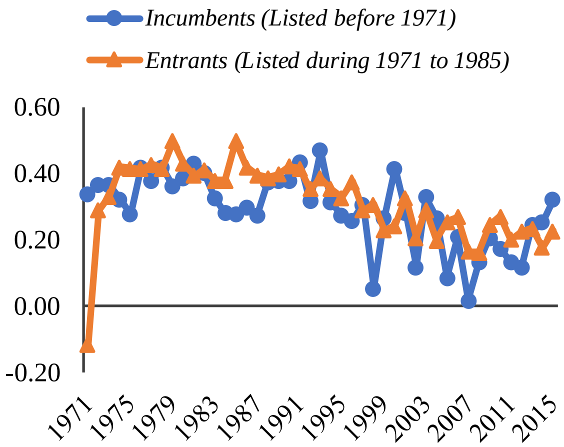
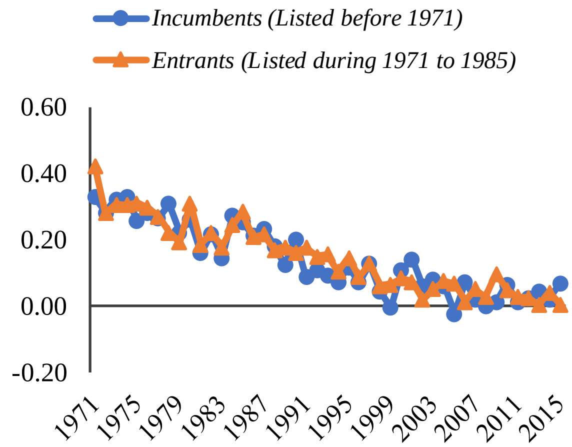



**Figure 6. Funds Allocation by Incumbent and Entrant Firms (First Classification) (continue)**

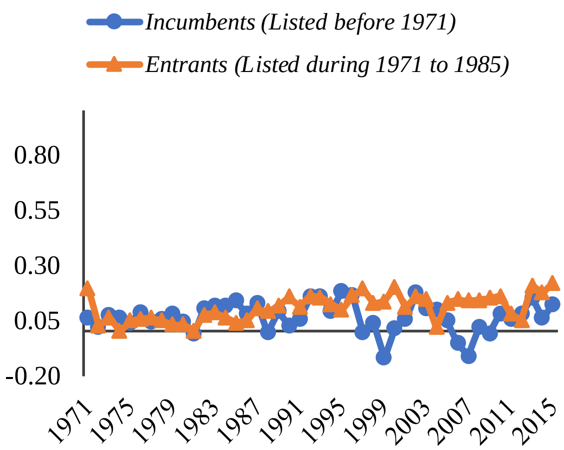
**Panel E: Allocation of Internal Funds to Working Capital**




**Panel F: Allocation of External Funds to Working Capital**




**Panel G: Allocation of Internal Funds to Debt Repurchase**




**Panel H: Allocation of External Funds to Debt Repurchase**

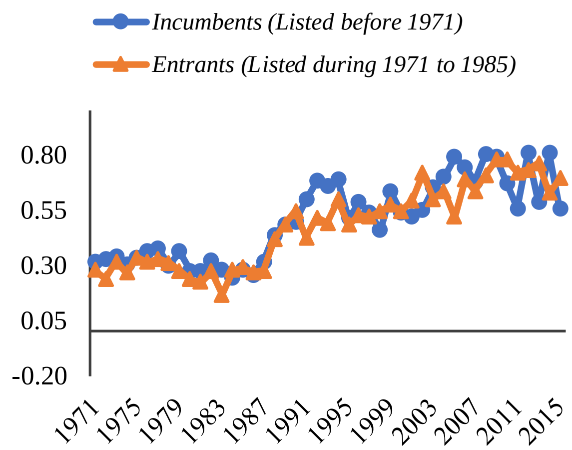


**Figure 7. Funds Allocation by Incumbent and Entrant Firms (Second Classification)**

This figure depicts for the period 1971-2015, the yearly allocations of internal and external funds to four main uses of funds (i.e., investment, cash savings, working capital needs and debt repurchase) by both incumbent and entrant nonfinancial U.S. firms in Compustat. Internal funds refer to internal cash flow (*CF*), generated during the firms' course of business, and include earnings from operating activities, monies from assets sales, and profits from investment holdings. External funds represent the sum of equity and debt issuance proceeds (*EI* and *DI*, respectively). Incumbent firms refer to firms listed between 1966 to 1980, while entrant firms are firms listed between 1981 to 1995.

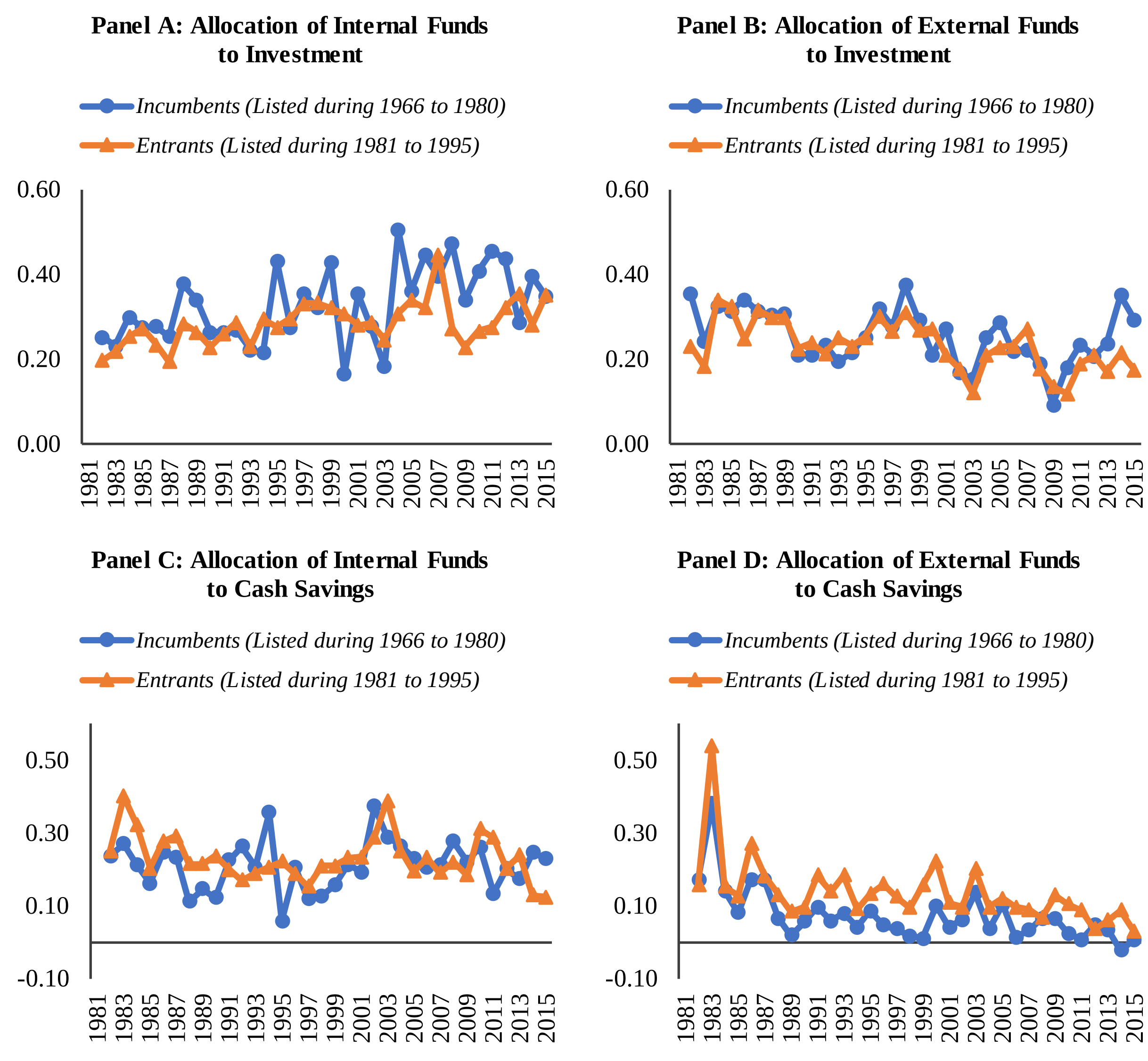
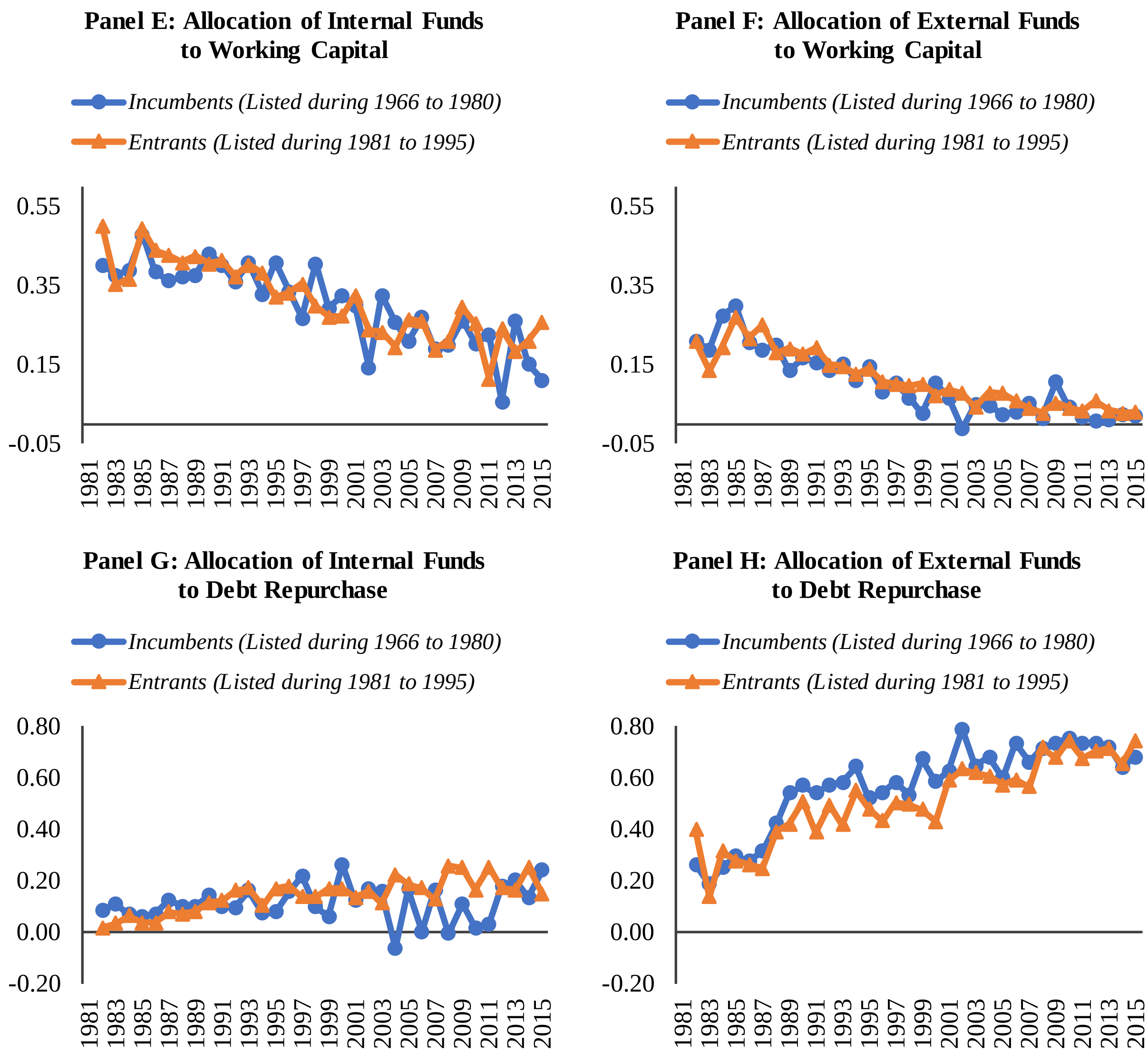


**Figure 7. Funds Allocation by Incumbent and Entrant Firms (Second Classification) (continue)**



## Figure 8. Funds Allocation by Incumbent and Entrant Firms (Third Classification)

This figure depicts for the period 1971-2015, the yearly allocations of internal and external funds to four main uses of funds (i.e., investment, cash savings, working capital needs and debt repurchase) by both incumbent and entrant nonfinancial U.S. firms in Compustat. Internal funds refer to internal cash flow (*CF*), generated during the firms' course of business, and include earnings from operating activities, monies from assets sales, and profits from investment holdings. External funds represent the sum of equity and debt issuance proceeds (*EI* and *DI*, respectively). Incumbent firms refer to firms listed between 1976 to 1990, while entrant firms are firms listed between 1991 to 2015.

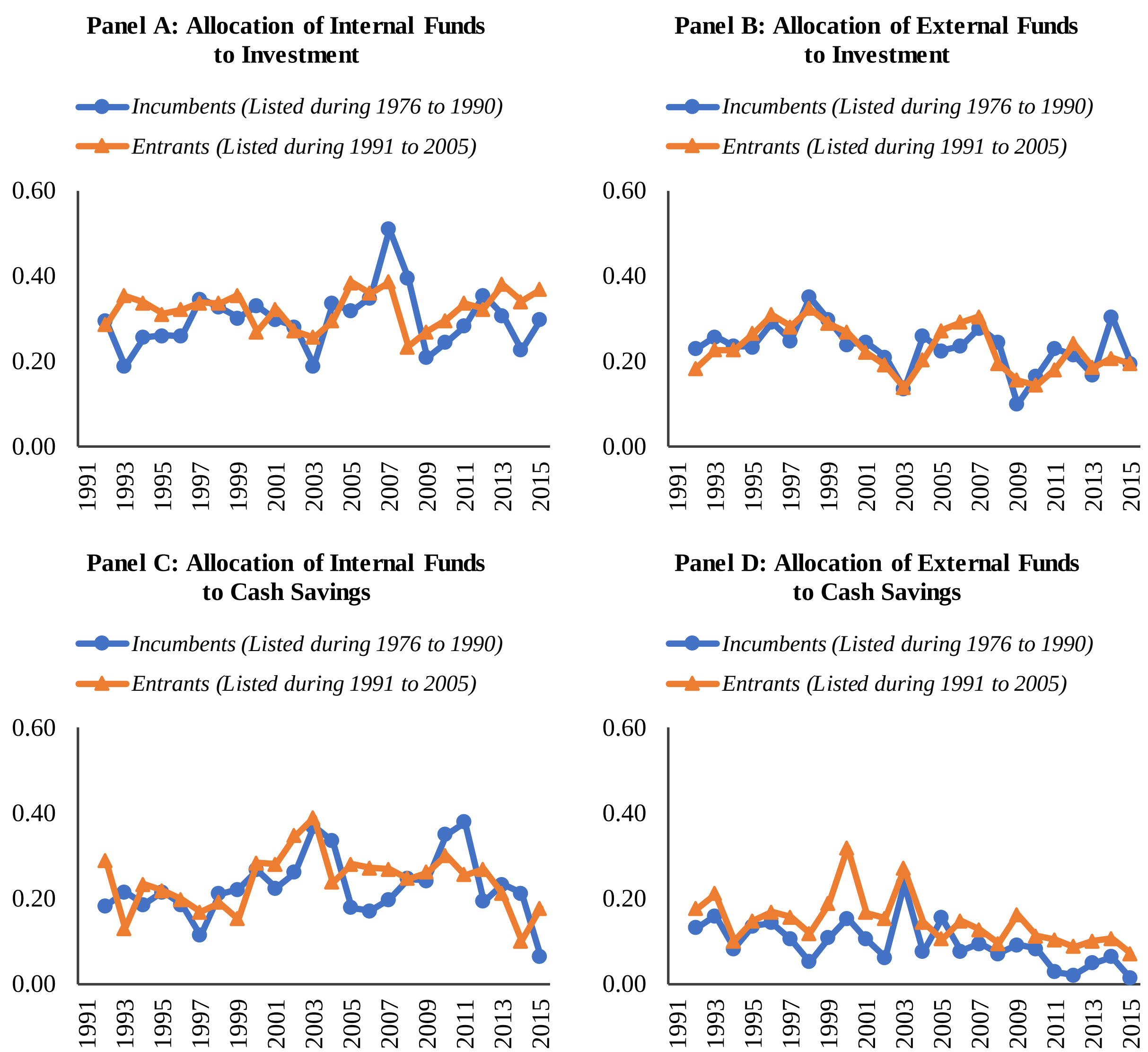
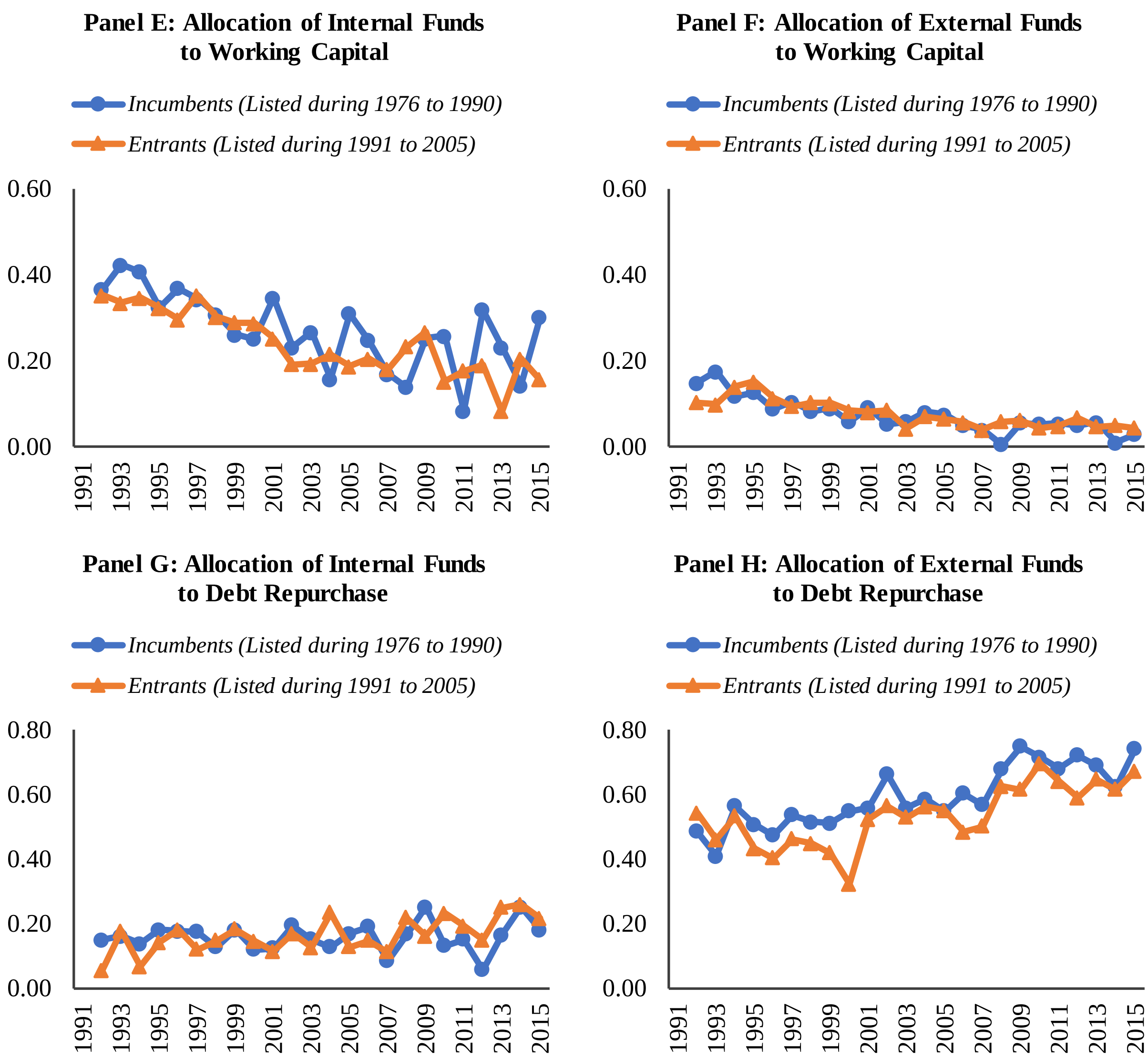
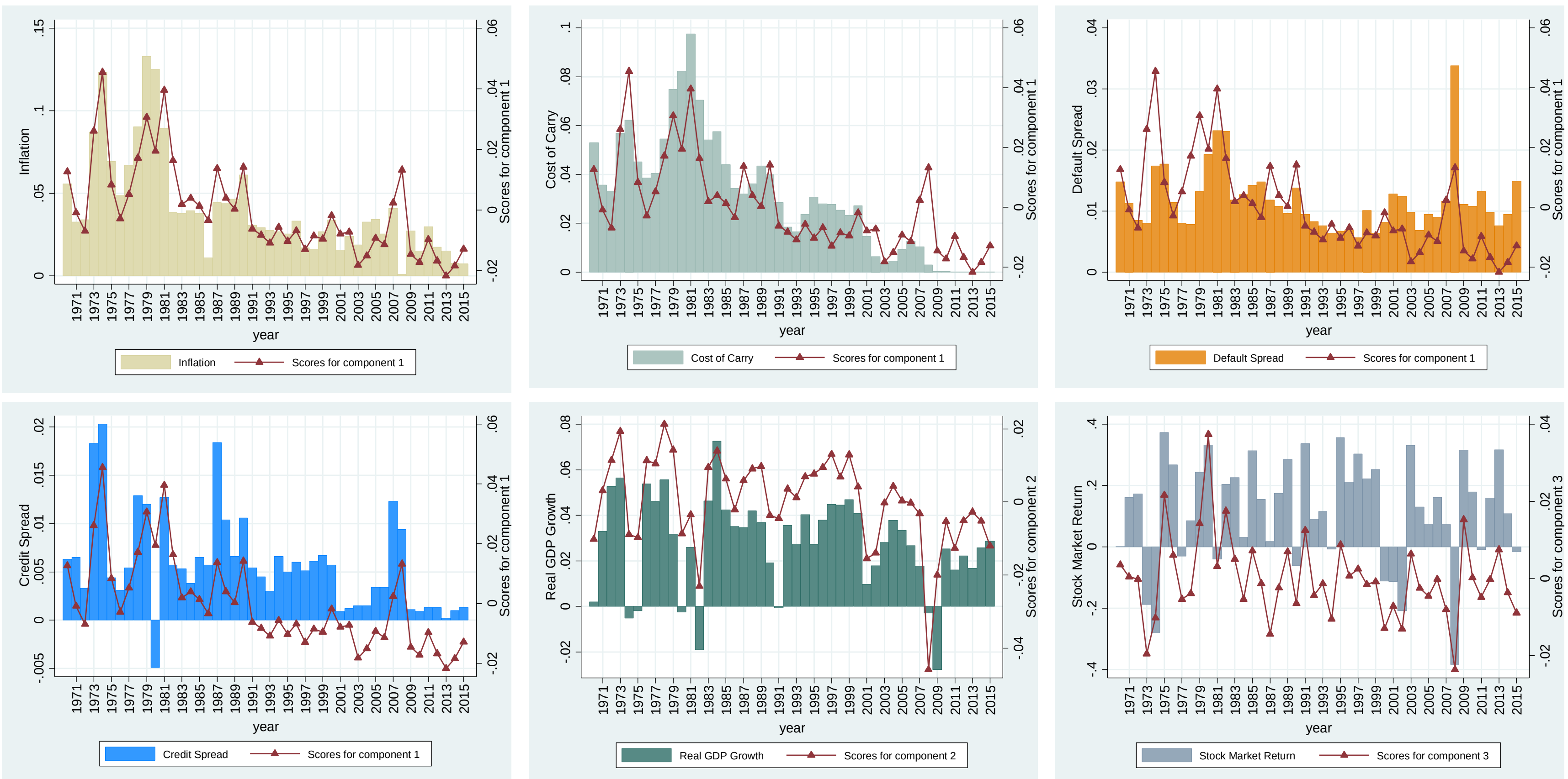


**Figure 8. Funds Allocation by Incumbent and Entrant Firms (Third Classification) (continue)**



## Figure 9. Principal Components and their Underlying Factors

This figure plots the scores for our three principal components (PC1, PC2, and PC3), along with their selected factors. In sum, the associated principal component analysis involves six macroeconomic factors, which include *Real GDP Growth*, *Inflation*, *Cost of Carry*, *Default Spread*, *Credit Spread*, and *Stock Market Return*. That is, *Real GDP Growth* is the percentage increase in real gross domestic product in 2000 dollars. *Inflation* refers to the annual percentage change in the Consumer Price Index. *Cost of Carry* is the spread between the cost and return of liquid assets, constructed using data from Fed Flow of Funds following Azar et al. (2016). *Default Spread* is the difference between the December yields on Baa and Aaa Moody's rated corporate bonds with maturity of approximately 20-25 years. *Credit Spread* is the difference between the December commercial paper annualized yield and the annualized December 3-month Treasury bill rate. *Stock Market Return* is computed by compounding monthly returns on the CRSP value-weighted index of stocks traded on NYSE, NASDAQ, and AMEX.



## Table 1. Summary Statistics, 1971-2015

This table presents for our sample of nonfinancial U.S. firms in Compustat, the descriptive statistics of our main regression variables for the period 1971 to 2015. That is, sources of funds include internal cash flow (*CF*), as well as equity and debt funds (*EI* and *DI*, respectively). Uses of funds include investment (*Inv*), cash savings ($\Delta C$), working capital needs ($\Delta WC$), equity repurchase (*ER*), debt repurchase (*DR*), and dividends (*Div*). *Oth* refers to the plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. All variables that made up the cash flow identity are deflated by the respective firm's beginning-of-period total assets. Appendix A depicts the definitions of these variables. Control variables include the ratio of market assets to book assets (*MB*), annual sales growth rate (*Sales growth*), log of book assets (*Ln*(*Assets*)), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility*).

| **Variable** | **Description** | **Mean** | **S.D.** | **Min.** | **25th** | **Median** | **75th** | **Max.** |
|---|---|---|---|---|---|---|---|---|
| Sources of Funds (Normalized by Lagged Total Assets): | | | | | | | | |
| *CF* | Internal cash flow | 0.088 | 0.126 | -1.287 | 0.048 | 0.101 | 0.154 | 0.956 |
| *EI* | Equity issuance proceeds | 0.026 | 0.090 | 0.000 | 0.000 | 0.002 | 0.011 | 2.376 |
| *DI* | Debt issuance proceeds | 0.080 | 0.161 | -0.230 | 0.000 | 0.013 | 0.098 | 1.875 |
| Uses of Funds (Normalized by Lagged Total Assets): | | | | | | | | |
| *Inv* | Investment | 0.084 | 0.110 | -0.849 | 0.024 | 0.061 | 0.123 | 1.376 |
| $\Delta C$ | Change in cash | 0.006 | 0.085 | -0.440 | -0.020 | 0.001 | 0.028 | 1.139 |
| $\Delta WC$ | Change in net working capital | 0.017 | 0.082 | -0.495 | -0.020 | 0.012 | 0.051 | 0.519 |
| *ER* | Equity repurchase | 0.011 | 0.029 | 0.000 | 0.000 | 0.000 | 0.004 | 0.366 |
| *DR* | Debt retirement | 0.066 | 0.134 | 0.000 | 0.002 | 0.019 | 0.065 | 1.530 |
| *Div* | Dividends | 0.010 | 0.018 | 0.000 | 0.000 | 0.000 | 0.016 | 0.318 |
| *Oth* | Cash flow identity plug | 0.000 | 0.001 | -0.010 | 0.000 | 0.000 | 0.000 | 0.010 |
| Firm characteristics: | | | | | | | | |
| *MB* | Market-to-Book ratio | 1.600 | 1.153 | 0.419 | 0.963 | 1.250 | 1.795 | 17.085 |
| *SaleG* | Sales growth | 0.091 | 0.224 | -0.765 | -0.021 | 0.081 | 0.194 | 0.942 |
| *Ln(Assets)* | Log of book value of assets | 5.316 | 2.041 | 0.426 | 3.849 | 5.201 | 6.687 | 11.387 |
| *Leverage* | Ratio of total debt to total assets | 0.235 | 0.193 | 0.000 | 0.066 | 0.213 | 0.355 | 0.884 |
| *Tangibility* | Ratio of net PPE to total assets | 0.299 | 0.216 | 0.002 | 0.130 | 0.250 | 0.419 | 0.911 |

## Table 2. Allocation of Funds, 1971-2015

This table reports the results of regressing each use of funds on the sources of funds. Uses include investment (*Inv*), cash savings ($\Delta C$), working capital needs ($\Delta WC$), equity repurchase (*ER*), debt repurchase (*DR*), dividends (*Div*), and *Oth*, which is a plug that balances the cash flow identity in the presence of reporting errors and/ or rounding adjustments. For brevity, coefficients of *Oth* are not reported as they are not significantly different from zero. Sources include internal cash flow (*CF*), as well as equity and debt issuance proceeds (*EI* and *DI*, respectively). Externally-generated funds (*EF*) refer to the sum of *EI* and *DI*. Variables are demeaned by firm and scaled by book assets. Control variables include the ratio of market assets to book assets (*MB*), annual sales growth rate (*Sales growth)*, log of book assets (*Ln(Assets)*), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility)*. Regressions are run by ordinary least squares with year fixed effects. *T*-statistics are in parentheses and computed using standard errors robust to both heteroskedasticity and clustering at firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively.

| Dependent Variables | (1) $Inv_t$ | (2) $Inv_t$ | (3) $\Delta C_t$ | (4) $\Delta C_t$ | (5) $\Delta WC_t$ | (6) $\Delta WC_t$ | (7) $ER_t$ | (8) $ER_t$ | (9) $DR_t$ | (10) $DR_t$ | (11) $Div_t$ | (12) $Div_t$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $CF_t$ | 0.300*** | 0.302*** | 0.220*** | 0.249*** | 0.319*** | 0.323*** | 0.022*** | 0.022*** | 0.126*** | 0.091*** | 0.013*** | 0.013*** |
| | (77.3) | | (49.2) | | (85.7) | | (26.3) | | (30.8) | | (32.2) | |
| $EF_t$ | 0.260*** | | 0.129*** | | 0.121*** | | 0.007*** | | 0.483*** | | 0.001*** | |
| | (83.1) | | (42.9) | | (62.0) | | (12.0) | | (108.2) | | (2.6) | |
| $EI_t$ | | 0.282*** | | 0.422*** | | 0.157*** | | 0.008*** | | 0.128*** | | 0.003*** |
| | | (47.2) | | (62.5) | | (35.6) | | (8.2) | | (28.3) | | (9.4) |
| $DI_t$ | | 0.253*** | | 0.040*** | | 0.110*** | | 0.006*** | | 0.591*** | | -0.000 |
| | | (70.5) | | (18.6) | | (51.9) | | (9.6) | | (136.2) | | (-1.0) |
| $MB_{t-1}$ | 0.008*** | 0.008*** | -0.001 | -0.005*** | 0.001*** | 0.001*** | 0.001*** | 0.001*** | -0.011*** | -0.006*** | 0.001*** | 0.001*** |
| | (19.4) | (18.5) | (-1.0) | (-10.7) | (4.4) | (2.7) | (8.3) | (8.1) | (-26.6) | (-18.5) | (15.6) | (14.6) |
| $SalesG_{t-1}$ | 0.012*** | 0.012*** | -0.006*** | -0.007*** | 0.007*** | 0.007*** | -0.003*** | -0.003*** | -0.009*** | -0.008*** | -0.001*** | -0.001*** |
| | (14.0) | (14.0) | (-6.9) | (-7.9) | (9.6) | (9.5) | (-16.4) | (-16.4) | (-11.1) | (-11.8) | (-11.6) | (-11.7) |
| $Ln(Assets)_{t-1}$ | -0.007*** | -0.007*** | -0.005*** | -0.000 | -0.006*** | -0.005*** | 0.006*** | 0.006*** | 0.011*** | 0.006*** | 0.001*** | 0.001*** |
| | (-15.7) | (-15.0) | (-10.4) | (-1.2) | (-15.3) | (-13.9) | (45.6) | (45.6) | (24.5) | (14.6) | (14.7) | (15.3) |
| $Leverage_{t-1}$ | -0.110*** | -0.111*** | 0.019*** | 0.009*** | -0.029*** | -0.030*** | -0.021*** | -0.021*** | 0.157*** | 0.168*** | -0.015*** | -0.015*** |
| | (-45.1) | (-45.4) | (8.2) | (4.2) | (-14.0) | (-14.6) | (-31.2) | (-31.2) | (60.9) | (69.1) | (-48.2) | (-48.4) |
| $Tangibility_{t-1}$ | 0.017*** | 0.017*** | 0.054*** | 0.051*** | -0.027*** | -0.028*** | -0.010*** | -0.010*** | -0.034*** | -0.031*** | 0.001* | 0.001* |
| | (4.8) | (4.7) | (17.1) | (17.1) | (-10.1) | (-10.3) | (-11.2) | (-11.2) | (-10.6) | (-10.5) | (1.7) | (1.7) |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Observations* | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 |
| *R-squared* | 0.31 | 0.31 | 0.12 | 0.21 | 0.21 | 0.21 | 0.07 | 0.07 | 0.52 | 0.60 | 0.07 | 0.07 |

## Table 3. Allocation to Working Capital, 1971-2015

This table reports the results of regressing the five components of the change in working capital on the sources of funds. Specifically, the change in working capital is composed of changes in accounts receivables ($\Delta AR$), inventories ($\Delta IV$), accounts payables ($\Delta AP$), income tax payables ($\Delta TP$), and other receivables and payables ($\Delta Oth$). Sources include internal cash flow (*CF*), as well as equity and debt issuance proceeds (*EI* and *DI*, respectively). Externally-generated funds (*EF*) refer to the sum of *EI* and *DI*. Variables are demeaned by firm and scaled by book assets. Control variables include the ratio of market assets to book assets (*MB*), annual sales growth rate (*Sales growth)*, log of book assets (*Ln(Assets)*), ratio of total debt to book assets (*Leverage*), and ratio of fixed assets to book assets (*Tangibility)*. Regressions are run by ordinary least squares with year fixed effects. *T*-statistics are in parentheses and computed using standard errors robust to both heteroskedasticity and clustering at firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively.

| Dependent Variables | (1) $\Delta AR_t$ | (2) $\Delta AR_t$ | (3) $\Delta IV_t$ | (4) $\Delta IV_t$ | (5) $\Delta AP_t$ | (6) $\Delta AP_t$ | (7) $\Delta TP_t$ | (8) $\Delta TP_t$ | (9) $\Delta Oth_t$ | (10) $\Delta Oth_t$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $CF_t$ | 0.179*** | 0.182*** | 0.139*** | 0.140*** | -0.030*** | -0.030*** | -0.015*** | -0.015*** | 0.045*** | 0.046*** |
| | (65.0) | (66.2) | (58.4) | (58.7) | (-13.4) | (-13.6) | (-31.0) | (-31.3) | (16.0) | (16.0) |
| $EF_t$ | 0.053*** | | 0.051*** | | -0.013*** | | 0.001*** | | 0.028*** | |
| | (40.8) | | (40.5) | | (-13.1) | | (5.8) | | (21.8) | |
| $EI_t$ | | 0.083*** | | 0.060*** | | -0.017*** | | -0.002*** | | 0.033*** |
| | | (27.4) | | (22.4) | | (-6.9) | | (-4.7) | | (10.7) |
| $DI_t$ | | 0.044*** | | 0.048*** | | -0.011*** | | 0.002*** | | 0.027*** |
| | | (31.5) | | (34.3) | | (-10.9) | | (9.7) | | (19.0) |
| $MB_{t-1}$ | 0.002*** | 0.001*** | 0.002*** | 0.001*** | -0.001*** | -0.001*** | 0.000*** | 0.000*** | -0.001*** | -0.001*** |
| | (6.9) | (5.1) | (8.2) | (7.5) | (-6.4) | (-6.0) | (4.9) | (6.0) | (-3.7) | (-3.9) |
| $SalesG_{t-1}$ | 0.002*** | 0.002*** | 0.007*** | 0.007*** | -0.001*** | -0.001*** | 0.001*** | 0.001*** | -0.002*** | -0.002*** |
| | (4.2) | (4.1) | (16.6) | (16.5) | (-2.9) | (-2.9) | (11.0) | (11.1) | (-3.9) | (-3.9) |
| $Ln(Assets)_{t-1}$ | -0.011*** | -0.010*** | -0.009*** | -0.008*** | 0.007*** | 0.007*** | 0.001*** | 0.001*** | 0.005*** | 0.005*** |
| | (-37.0) | (-35.4) | (-31.4) | (-30.7) | (28.8) | (28.4) | (18.9) | (18.1) | (17.6) | (17.7) |
| $Leverage_{t-1}$ | -0.011*** | -0.012*** | -0.033*** | -0.033*** | 0.006*** | 0.006*** | -0.007*** | -0.007*** | 0.017*** | 0.016*** |
| | (-7.4) | (-8.1) | (-23.1) | (-23.3) | (4.9) | (5.0) | (-21.2) | (-20.9) | (9.9) | (9.8) |
| $Tangibility_{t-1}$ | 0.008*** | 0.008*** | -0.007*** | -0.007*** | -0.003* | -0.003* | -0.004*** | -0.004*** | -0.022*** | -0.022*** |
| | (4.0) | (3.9) | (-3.8) | (-3.8) | (-1.8) | (-1.8) | (-8.4) | (-8.3) | (-10.0) | (-10.0) |
| *Year FE* | Included | Included | Included | Included | Included | Included | Included | Included | Included | Included |
| *Observations* | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 | 114,573 |
| *R-squared* | 0.15 | 0.15 | 0.14 | 0.14 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 |

## Table 4. Principal Component Analysis (PCA)

Panel A depicts the results of a principal component analysis on six macroeconomic factors. That is, *Real GDP Growth* is the percentage increase in real gross domestic product in 2000 dollars. *Inflation* refers to the annual percentage change in the Consumer Price Index. *Cost of Carry* is the spread between the cost and return of liquid assets, constructed using data from Fed Flow of Funds following Azar et al. (2016). *Default Spread* is the difference between the December yields on Baa and Aaa Moody's rated corporate bonds with maturity of approximately 20-25 years. *Credit Spread* is the difference between the December commercial paper annualized yield and the annualized December 3-month Treasury bill rate. *Stock Market Return* is computed by compounding monthly returns on the CRSP value-weighted index of stocks traded on NYSE, NASDAQ, and AMEX. Three principal components with eigenvalues greater than one are obtained. We name them PC1, PC2, and PC3, respectively. Panel B presents the correlations among the principal components as well as the six underlying macroeconomic factors. *Sentiment* is based on the first principal component of five (standardized) sentiment proxies of Baker and Wurgler (2006), in that all proxies have been orthogonalized with respect to a set of six macroeconomic indicators. Correlations significant at the 5% level are marked with the symbol * in superscripts.

### Panel A: Principal components (eigenvectors components with eigenvalue >1)

| Variable | PC1 | PC2 | PC3 |
|---|---|---|---|
| Real GDP Growth | -0.079 | 0.674 | -0.325 |
| Inflation | 0.542 | 0.204 | 0.275 |
| Cost of Carry | 0.539 | 0.232 | 0.332 |
| Default Spread | 0.353 | -0.585 | 0.057 |
| Credit Spread | 0.470 | 0.195 | -0.395 |
| Stock Market Return | -0.254 | 0.265 | 0.741 |

### Panel B: Correlation Matrix

| | PC1 | PC2 | PC3 | Real GDP growth | Inflation | Cost of Carry | Default Spread | Credit Spread | Stock Market Return |
|---|---|---|---|---|---|---|---|---|---|
| PC2 | 0.0000 | 1.0000 | | | | | | | |
| PC3 | 0.0000 | 0.0000 | 1.0000 | | | | | | |
| Real GDP growth | -0.1219 | 0.8317* | -0.3509* | 1.0000 | | | | | |
| Inflation | 0.8330* | 0.2516 | 0.2967* | -0.0500 | 1.0000 | | | | |
| Cost of Carry | 0.8286* | 0.2867 | 0.3583* | 0.0818 | 0.7872* | 1.0000 | | | |
| Default Spread | 0.5422* | -0.7226* | 0.0615 | -0.5275* | 0.1952 | 0.3217* | 1.0000 | | |
| Credit Spread | 0.7226* | 0.2404 | -0.4260* | 0.1444 | 0.4733* | 0.4449* | 0.1476 | 1.0000 | |
| Stock Market Return | -0.3906* | 0.3269* | 0.7995* | 0.0275 | -0.0767 | 0.0295 | -0.3569* | -0.4103* | 1.0000 |
| Sentiment | -0.1522 | 0.0166 | -0.0208 | 0.1324 | -0.3168* | 0.0785 | -0.0152 | -0.1810 | 0.0150 |

## Table 5. Sensitivities of Funds Allocation to Macroeconomic Factors

This table reports the results of regressing each funds allocation on its lagged allocation, and three principal components. Specifically, two main sources of funds (i.e., internally- and externally-generated funds), are each allocated to four primary uses. Internal funds refer to internal cash flow (*CF*), while external funds (*EF*) refer to proceeds from equity and debt issuances (*EI* and *DI*, respectively). The four main uses of funds include investment (*Inv*), cash savings ($\Delta C$), working capital needs ($\Delta WC$), and debt retirement (*DR*). *PC1*, *PC2*, and *PC3* are three principal components with eigenvalues greater than one, resulting from the principal component analysis performed on the basis of six macroeconomic factors. That is, *Real GDP Growth* is the percentage increase in real gross domestic product in 2000 dollars. *Inflation* refers to the annual percentage change in the Consumer Price Index. *Cost of Carry* is the spread between the cost and return of liquid assets, constructed using data from Fed Flow of Funds following Azar et al. (2016). *Default Spread* is the difference between the December yields on Baa and Aaa Moody's rated corporate bonds with maturity of approximately 20-25 years. *Credit Spread* is the difference between the December commercial paper annualized yield and the annualized December 3-month Treasury bill rate. *Stock Market Return* is computed by compounding monthly returns on the CRSP value-weighted index of stocks traded on NYSE, NASDAQ, and AMEX. *T*-statistics are in parentheses and computed using standard errors robust to heteroskedasticity and clustering at firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively.

**Panel A: Sensitivities of Internal versus External Funds Allocations**

| Dependent | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Variables: | *Inv_CF* | *Cash_CF* | *WC_CF* | *DR_CF* | *Inv_EF* | *Cash_EF* | *WC_EF* | *DR_EF* |
| *Lag one* | 0.396*** | 0.552*** | 0.762*** | 0.417** | 0.335*** | 0.313** | 0.823*** | 0.704*** |
| | (3.1) | (3.6) | (9.7) | (2.7) | (3.2) | (2.1) | (9.5) | (7.0) |
| *PC1* | -0.176 | 0.084 | 0.917** | -1.657*** | 1.694*** | -0.164 | 0.542 | -1.676** |
| | (-0.5) | (0.3) | (2.6) | (-2.9) | (4.3) | (-0.3) | (0.7) | (-2.1) |
| *PC2* | 0.676** | -0.945* | 0.756* | -0.948** | 1.969*** | -0.211 | 0.279 | -2.045*** |
| | (2.3) | (-2.0) | (1.8) | (-2.5) | (4.8) | (-0.4) | (0.6) | (-4.0) |
| *PC3* | -0.210 | -0.198 | 0.893 | -0.843** | 0.141 | 1.282** | 0.561 | -1.978*** |
| | (-0.4) | (-0.4) | (1.4) | (-2.1) | (0.3) | (2.0) | (0.8) | (-3.4) |
| Observations | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 |
| R-squared | 0.23 | 0.46 | 0.83 | 0.73 | 0.69 | 0.12 | 0.88 | 0.88 |

**Panel B: Sensitivities of Equity versus Debt Funds Allocations**

| Dependent | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Variables: | *Inv_EI* | *Cash_EI* | *WC_EI* | *DR_EI* | *Inv_DI* | *Cash_DI* | *WC_DI* | *DR_DI* |
| *Lag one* | 0.551*** | 0.361** | 0.195 | 0.264* | 0.488*** | 0.266* | 0.896*** | 0.860*** |
| | (3.8) | (2.3) | (1.6) | (1.9) | (4.5) | (2.0) | (9.4) | (10.3) |
| *PC1* | 0.189 | -2.956* | 1.935** | 1.361 | 1.741** | 0.443** | 0.322 | -0.912 |
| | (0.3) | (-1.9) | (2.7) | (1.4) | (2.3) | (2.2) | (0.5) | (-1.0) |
| *PC2* | 1.482** | -2.599*** | 1.641** | 0.121 | 1.882*** | -0.079 | 0.115 | -1.316** |
| | (2.2) | (-3.0) | (2.5) | (0.2) | (4.3) | (-0.4) | (0.3) | (-2.7) |
| *PC3* | -2.615*** | 1.540 | 1.100 | 0.757 | 0.498 | 0.711* | 0.361 | -1.029 |
| | (-3.2) | (1.2) | (1.1) | (1.2) | (0.8) | (1.9) | (0.6) | (-1.5) |
| Observations | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 |
| R-squared | 0.39 | 0.56 | 0.54 | 0.30 | 0.74 | 0.21 | 0.91 | 0.94 |

## Appendix A. 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 investment (*Inv*), the change in cash holdings ($\Delta C$), the change in working capital ($\Delta WC$), cash dividends (*Div*), cash flows (*CF*), net debt issued ($\Delta D=DI-DR$), and net equity issued ($\Delta E=EI-ER$). PPE denotes property, plant, and equipment. We include in parentheses the Compustat XPF variable names in italics.

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