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Changes in cash holdings around the S&P 500 additions

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Abstract

We analyze the changes in cash holding policies of S&P 500 firms from before to after their inclusion in the index. One year after inclusion, their mean industry-adjusted cash holdings decline by nearly 32% from the year before inclusion. Several factors explain this decline. The precautionary motive for cash subsides due to these firms becoming more visible, less uncertain, and less constrained to raise cheap external capital. Corporate governance deteriorates after inclusion due to increased managerial entrenchment, which leads to a reduction in cash as suggested by the free cash flow hypothesis. Most index firms face diminishing investment opportunities and decreasing capital expenditures, which implies a lesser need for cash holdings related to the transaction motive.

JEL classification: G31; G34

Keywords: Cash holdings; Corporate governance; Liquidity policy; S&P 500 Index

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1. Introduction

Does addition to the S&P 500 Index affect corporate policies? The answer to this question has important implications. If index addition changes firm behavior, then this event cannot be considered information free. We shed light on the topic by investigating the changes in the cash holding policy (or the liquidity policy) of the firm. More specifically, we ask “Is addition to the S&P 500 Index a significant event from the standpoint of corporate cash management?” The liquidity policy of a firm involves substantial discretion by the management, and thus it can reflect the major policy shifts occurring within the corporation.

Our paper links the corporate cash holdings literature to the S&P 500 literature. From the former, Opler, et al. (1999) document that firms with higher growth opportunities, higher business risk, higher external constraints, lower leverage, and smaller size tend to have high levels of cash. Kalcheva and Lins (2007) and Harford, et al. (2008) show that cash is lowered by poor corporate governance. Mikkelsen and Partch (2003) find that high cash holdings are accompanied by greater investment, larger R&D spending, and greater growth in assets.

The S&P 500 studies show that several major changes occur after a firm is added to the index. Stock positively reacts to the announcement (Shleifer, 1986; Jain, 1987; Dhillon and Johnson, 1991; Beneish and Whaley, 1996; Lynch and Mendenhall, 1997; and Wurgler and Zhuravskaya, 2002) and bonds trade at a premium (Morck and Yang, 2002). The trading liquidity in the stock improves and the transaction costs decline (Elliott and Warr, 2003; Hegde and McDermott, 2003; Chen, et al., 2004; and Cai, 2007). S&P 500 firms’ securities command higher investor awareness (Chen, et al., 2004) and their stocks exhibit stronger cross-correlation with the stocks of other index firms (Vijh, 1994; and Barberis, et al., 2005). All of these studies claim that there

are visible changes in the firm and its stock after inclusion in the S&P 500 Index. Our study shows that the attitude towards cash also changes.

Specifically, we document that the cash holdings¹ are substantially lower after inclusion (between the year prior to inclusion and the year after inclusion, the cash declines on average by approximately 7%). Furthermore, the drop in the industry-adjusted cash holdings is even more pronounced (on average, around 32% lower in the year after inclusion). Thus, for the first time in the literature, we document that one of the major corporate policies, the cash holding policy of the firm, is affected by inclusion into the S&P 500 Index. This result demonstrates that an index addition event, which on the surface has little to do with a firm's inner functioning and financial management, can alter corporate incentives and behavior in the long-run.

Our conclusions are robust to macroeconomic effects, large-cap firm effects (a la Bates, et al., 2009), financial constraints effects and measurement error issues (a la Riddick and Whited, 2009), or endogeneity effects. Using the Abadie and Imbens (2006) matching estimator, we show that decline in the index firms' cash holdings is significantly greater than the decline for matched firms, where matching procedure uses a large set of control variables. We also find that while the index firms decrease their relative cash, the firms in the top-size-decile of Compustat increase their cash holdings over time.

To explain this shift in the index firms' demand for cash, we develop and test several hypotheses. We propose that the addition to the index serves as a certification to the firm's credibility, which makes it easier for the firm to raise any type of external capital.² Thus, the new

¹ Throughout the paper, we use "cash" or "cash holdings," to refer to *cash and cash equivalents* divided by the contemporaneous *assets*. Similarly, "relative cash" or "adjusted cash" will refer to either the size-adjusted cash, or matching-firms adjusted cash holdings, or the growth rates in cash. That is, cash that is relative to its size or to other similar firms.

² While Standard & Poor's states that "company additions to and deletions from the S&P equity indexes do not in any way reflect an opinion on the investment merits of the company," numerous academic studies have shown that inclusion into the S&P 500 Index has an informative aspect. See, for example, Denis, et al. (2003).

member is able to focus on the cheapest external capital, debt. We find that the total leverage of the firm increases after addition to the index and the net equity issuance is negative, i.e. the index firms repurchase equity (swap equity for debt). Furthermore, borrowing costs (the credit spread on long-term maturity bonds) are lower in the post inclusion years, partially due to improved credit ratings. These results imply that the constraints on raising cheap external capital are lower for these firms, and hence the need for safety cash is reduced. That is, the precautionary motive for holding cash becomes less important. We refer to this explanation as the *Declining Need for Safety Cash Hypothesis* or the *Index's Certification Hypothesis*.

Also, the corporate governance indicators of the newly added index firms deteriorate after their inclusion; the median GIM Index (Gompers, et al., 2003), EIndex (Bebchuk, et al., 2009), and classified board indicator (CBOARD) all increase. As shown by Kalcheva and Lins (2007) and Harford, et al. (2008), firms with weaker corporate governance structures hold less cash to minimize the costs associated with the free cash flow hypothesis. Thus, the post-inclusion decline in cash may happen as a reaction to increasing managerial entrenchment (*The Increasing Agency Conflicts Hypothesis*).

Finally, we also consider the hypothesis that these large cap firms, in general, have declining investment opportunities, which reduces their need for cash related to the transaction motive. We refer to this hypothesis as the *Declining Investment Opportunities Hypothesis*. According to this hypothesis, the newly added index firms are in a maturing stage and exhausting their internal growth opportunities. The addition to the index happens around this time, and the addition itself is not necessarily the main cause of the cash reduction. While the empirical support of this hypothesis is not as strong as the evidence for the other two hypotheses, several results are consistent with such an explanation. Index firms' size-adjusted capital expenditures decline

during the years around the inclusion date, as do their cash flows, net working capital, and sales. We also show that while the market-to-book ratio and the R&D spending of the index firms decline after addition, their acquisition spending increases. Although this last result is statistically inconclusive, it is still in directional accordance with the idea that these firms seek investment opportunities from outside sources in the post-inclusion period.

An analysis of the accounting cash identity related to the cash flow statement provides additional insights. In the post-inclusion period, the S&P 500 firms keep less cash from their cash flows related to operating activities. They have negative cash from financing activities, because after inclusion they spend disproportionately more on dividends and repurchases than they take in from debt and equity proceeds. Also, they spend less cash on capital expenditures, except for acquisition spending, which is higher after inclusion.

Our findings of declining adjusted cash holdings, due to what we henceforth refer to as the *index inclusion effect*, is remarkable because it occurs despite two major trends associated with cash holdings. First, as documented by Bates, et al. (2009), the cash levels of US firms tend to rise over time. We show that for our S&P 500 sample this trend is reversed, most likely due to this index inclusion effect. Second, Dittmar and Duchin (2010) show that a firm's cash holdings do not change easily, i.e., the transition from a high cash-level group to a lower cash-level group, and vice-versa, is rare. So, the cash decline in our sample must be strong enough to overcome both of these two counter-trends.

The remainder of the paper is structured as follows. Section 2 describes studies that analyze the motives for holding cash and elaborates on various factors that might affect cash. Section 3 develops the hypotheses explaining why a firm's liquidity policy can be affected by inclusion into the S&P 500 Index. Section 4 discusses our data. Section 5 documents that the index firms'

disposition towards cash is changing after inclusion. Section 6 tests our hypotheses regarding changes in liquidity policy around inclusion. The last section concludes the paper and provides further venues for research.

2. Review of the motives for holding cash

The cash holdings literature has developed several explanations for why firms hold liquid assets. We summarize them here to guide our hypothesis development.

2.1. Transaction motive

One main reason a firm holds cash is to conduct its day to day operations, pay for goods and services, and finance its net working capital. Furthermore, it reduces the transaction costs of raising external funds by avoiding liquidating assets to make payments. Keynes (1936) refers to this motive as the transaction motive for holding cash. Mulligan (1997) finds evidence supporting the existence of economies of scale with the transaction motive for holding cash.

2.2. Precautionary motive

Another motive originally suggested by Keynes (1936) is the precautionary motive. The firm needs liquid assets to finance its investments and acquisitions in cases when other sources of funding are unavailable or very costly. The external funds may be costly due to agency conflicts (Jensen, 1986), information asymmetry (Myers and Majluf, 1984), or financial distress. Cash, on the other hand, is a relatively safe investment.

Opler, et al. (1999) find several results that are consistent with the precautionary motive. Large firms, firms with strong credit ratings, and highly-levered firms tend to hold less cash. They also find that the transition probabilities out of the high cash group are low, suggesting that managers prefer liquidity as a precaution. Almeida, et al. (2004) claim that financially constrained firms invest in cash generated from cash flow, while financially unconstrained firms do not. Han and

Qui (2007) and Riddick and Whited (2009) further show that the cash holdings increase with a firm's income uncertainty.

2.3. *Speculative motive*

Firms can also hold cash to take advantage of bargain purchases, acquisitions, or other investments. The cost of holding liquid assets includes the lower rate of return of these assets because of a liquidity premium and, possibly, tax disadvantages. According to Harford (1999), firms with high cash reserves are more likely to make diversifying acquisitions that decrease shareholder wealth.

2.4. *Corporate governance and motives related to the free-cash flow hypothesis*

Several papers show how the corporate governance structure of the firm influences its cash holdings. Large cash holdings may weaken market discipline and increase the entrenched CEO autonomy. The imperfectly monitored managers can burn through the cash stockpiles to finance projects that do not enhance firm value. In support of this view, Harford, et al. (2008) document a negative relation between corporate governance and the level of cash holdings in US data. Kalcheva and Lins (2007) confirm this in an international setting.

Entrenched managers may hold more cash. Jensen (1986) finds that agency conflicts provide a plausible explanation as to why entrenched managers in firms with high free cash-flows are reluctant to pay out cash to shareholders. Dittmar, et al. (2003) demonstrate that cash levels are generally higher in countries with poor investor protection, and factors that generally drive the need for cash holdings, such as investment opportunities and asymmetric information, become less important.

Others suggest that agency problems impact the accumulation of cash and show how this excess cash impacts the value of the firm. Pinkowitz, et al. (2006) show that cash is worth less

when agency problems between insiders and outside shareholders are greater. Dittmar and Mahrt-Smith (2007) and Harford, et al. (2008) claim that entrenched managers are more likely to build excess cash balances, but they spend this excess cash quickly.

Some question the impact that corporate governance has on cash holdings. Mikkelsen and Partch (2002) show that proxies for managerial incentive problems, such as ownership and board characteristics, do not explain differences in cash holdings. They also find that high cash holdings are accompanied by greater investment, R&D, and growth in assets. Opler et al. (1999) and Ozkan and Ozkan (2004) find little evidence that managerial entrenchment explains the levels of cash holdings.

2.5. Other factors affecting firm cash holdings

Bates, et al. (2009) document that since the 1980s there is a steady upward trend in the average cash-to-assets ratios of firms that is attributable to the precautionary motive. Boileau and Moyen (2009) suggest that the significant increase in cash holdings since the 1970's is due to the liquidity motive. Dittmar and Duchin (2010) report that the cash holdings are “sticky” and persistent, and that transition probabilities out of high (or low) cash groups are low.

Firm-level uncertainty may be an important determinant of cash holdings. It is well known that idiosyncratic risk increased over recent decades (Campbell, et al., 2001). In a related finding, Bates, et al. (2009) report that the average cash ratio between 1980 and 2006 increases by less than 50% for firms in industries experiencing the smallest increase in risk, but by almost 300% for firms in industries experiencing the greatest increase in risk. Brown and Kapadia (2007) show that idiosyncratic risk is higher for firms in more recent IPO listing cohorts, and that these more recent listing cohorts hold higher levels of cash. Brandt, et al. (2010) note that both idiosyncratic risk and cash holdings have fallen in more recent years.

3. Hypotheses related to changing cash holdings of S&P 500 firms

The hypotheses we develop next provide insights into why a firm's cash hoarding behavior could be affected by inclusion in the S&P 500 Index.

3.1. Index's certification hypothesis (Declining need for safety cash hypothesis)

As the newly added index firm is now better-known (Chen, et al., 2004), stable, prestigious, and reliable, the need for "safety cash" declines (precautionary motive). Such well-known firms can easily obtain external capital through borrowing (and if necessary through equity issuances), so the need to hold excess cash reserves is relatively lower. Holding cash can be expensive. The costs of holding liquid assets include the pre-tax cost of carry (the cost of debt used to fund cash is higher than the return earned on cash) and the negative tax shield on interest income. Holding excess cash can also be costly due to agency conflicts. To avoid these costs, firms reduce their desire for saving cash.

H1: Relative cash holdings after S&P 500 Index inclusion decline because the need for safety cash is less when the firm is part of a prestigious index. Thus:

H1A: The total debt holdings of firms should increase and the relative cost of debt should be lower when the firm becomes part of the index.

According to the pecking-order hypothesis of cash (Kim, et al., 1998; Opler, et al., 1999; Bates, et al., 2009; Faulkender and Wang, 2006), when external constraints are low, firms will choose to raise cheap capital through debt rather than equity. Furthermore, as a firm becomes more predictable, the degree of asymmetric information declines, and the firm can borrow easily and in larger magnitudes. Therefore, the decline in cash holdings after inclusion should be associated with a rise in total debt. Since equity capital is more expensive, the S&P 500 firms should be averse to issuing equity. Thus,

H1B: Because equity capital is costlier than debt, equity issuance should decline after inclusion.

3.2. *Increasing agency conflicts hypothesis*

Kalcheva and Lins (2007) and Harford, et al. (2008) show that large cash holdings can weaken market discipline and enhance the entrenched CEO's wastefulness (free cash flow hypothesis). In such cases, it is optimal for the firm's shareholders to push for a reduction in cash. In our case, if the managerial entrenchment within the new S&P 500 firm increases³ then, parallel to this deterioration in its governance, the firm's attitude towards cash accumulation should be more negative. Thus,

H2: Relative cash holdings around S&P 500 Index inclusions decline because the managerial entrenchment within the added firm is worsening. Thus, corporate governance measures, including institutional holdings, and the GIM Index, EIndex, and CBOARD indicators, should deteriorate after a firm becomes a member of the S&P 500 Index.

3.3. *Declining investment opportunities hypothesis*

Relative cash holdings of index firms could decrease after inclusion because their businesses are at a maturing stage and their investment opportunities are diminishing. Since projected capital spending declines in accordance with declining investments, firms will slowly reduce

³ Explaining why this entrenchment happens is beyond the scope of this paper. It can happen for many reasons. For example, it can be an indirect result of Standard and Poor's Index Committee's preference toward "stable" firms (see Bos and Ruotolo 2000), which might lead to less turnover in these firms' management teams. Alternatively, it could happen due to a substitution effect; increased visibility after inclusion in the S&P 500 Index can lead to a lower need for other forms of monitoring (e.g., shareholders are becoming more diffuse). Since the paper's focus is on cash holdings, and not on corporate governance, we restrict ourselves to just empirically documenting (in section 4.5.2) that the corporate governance measures associated with managerial entrenchment are deteriorating around inclusion, without necessarily explaining why. Then, we rely on the hypotheses developed by Kalcheva and Lins (2007) and Harford, et al. (2008). When corporate governance deteriorates, a firm's desire for cash accumulation declines.

their cash reserves⁴ because of the weaker *transaction motive*. That is, as capital expenditures decline, the need for net working capital declines.⁵

Inclusion in the index is not the primary reason for the cash decline described in this hypothesis, since the investment opportunities of these firms are declining regardless of whether they are part of the index. We include it, however, as an alternative explanation to the other hypotheses. Next, we present two hypotheses related to this explanation.

H3: The S&P 500 firms' adjusted cash holdings decline around inclusion dates because of a diminishing need for transaction cash. If investment opportunities are disappearing, their need for net working capital is declining. Thus, we expect:

H3A: Investment opportunities after inclusion should be lower than before inclusion.

H3B: Capital spending, net working capital, cash flows, R&D, and sales should be lower after inclusion.

A related hypothesis is that if S&P 500 firms realize they are exhausting investment opportunities, they may seek growth through acquisitions. Vijh and Yang (2009) show that S&P 500 firms tend to engage in value increasing acquisitions more frequently than other firms. This suggests that being part of the index provides certain advantages in M&A activities, such as visibility and cheaper external capital.

H4: S&P 500 firms' relative cash holdings are depleted after inclusion because they engage in aggressive acquisition activities to buy growth opportunities from outside. If being part of the

⁴ Riddick and Whited (2009) show that the corporate propensity to save is positively affected by investment opportunities (i.e., Tobin's q) even after controlling for other known economic and econometric factors (such as income uncertainty, the cost of external constraint, and the measurement error in the q).

⁵ This might mean that the Standard & Poor's Index Committee systematically selects firms for index inclusion at or near the peak of their growth cycle (see also Çolak, 2012, for example). Regardless of its causes, however, what matters to us is that the new index firms see diminishing investment opportunities and declining capital expenditures around the inclusion year. We empirically show that such a decline in investment activities indeed occurs, which in turn may lead to a decline in the cash holdings associated with the transaction motive. Providing further explanations on the reasons for the declining investment opportunities and capital spending of these index firms is an enormous task, and thus it is beyond the scope of this study.

index facilitates such activities, then firms' spending on acquisitions should increase after inclusion.

4. Data and variables

Next, we describe the construction of our sample of S&P 500 additions. We also provide details on the variables used in our analysis of the cash holdings of these firms.

4.1. The S&P 500 additions sample

We start with the 775 firms that were added to the S&P 500 Index from 1971 through 2006, obtained from the COMPUSTAT North America Index Constituents database. Figure 1 shows the number of firms added for each year. We then eliminate financial firms, with Standard Industrial Classification (SIC) codes between 6000 and 6999, because their business involves the management of cash inventories and because of their need to meet statutory capital requirements. We also eliminate utility firms (SIC codes between 4900 and 4999) because their cash holdings can be subject to regulatory requirements. We then merge the COMPUSTAT and CRSP data and manually check the CUSIP and PERMNO numbers of each firm for accuracy in matching. When these firm identifiers were missing or erroneous, we manually correct them using the code lookup tool provided by Wharton Research Data Services (WRDS).

We also eliminate five firms that appear to be added twice as a result of the firm undergoing a major change that resulted in the original firm being dropped from the index, and the new firm being added as a replacement.⁶ We keep the first addition and drop the second one. After applying these selection criteria, we have a sample of 558 firms added to the S&P 500 Index.

Using annual COMPUSTAT data, an event-time panel consisting of years -5 to +5 is created, where year 0 represents the calendar year that the firm was added to the S&P 500 Index. Thus,

⁶ These firms are Computervision Corp., Manor Care Inc., Safety-Kleen Corp., Waste Management Inc., and Wellpoint Health Networks Inc.

year +1 indicates the first full year of operations after the firm is added to the index, while year -1 is the last full year of operations before the firm is added to the index. We have full data available for most addition firms beginning in year -2 (541 out of 558) through year +2 (539 out of 558). The reason why some addition firms are not in the sample from year -5 through 0 is because they are spin-offs from another firm that are added to the index shortly after the spin-off, or they are a recent IPO firm.⁷ A main reason why addition firms may drop out of the sample from year 0 through +5 is because of mergers or acquisitions. Table 1 reports the total number of firms remaining in the sample for each year from -5 to +5 (from now on this period will be denoted as [-5,+5]) in our event-time panel.⁸

4.2. *The variables*

All our variables are described in detail in Appendix A. Here we present only their descriptive statistics. For most, we rely on annual accounting data obtained from COMPUSTAT.⁹ Table 1 reports the descriptive statistics of these variables.

4.3. *Corporate bond data*

Using Securities Data Company (SDC) bond issues data, new debt issues for our sample of S&P 500 Index addition firms are obtained for the 5-year period before and the 5-year period after the year a firm was added to the index. This data includes the date of issue, the yield-to-

⁷ See Çolak (2012) for more information on IPOs of firms that end up in the S&P 500 Index.

⁸ As reported in Table 1, the number of firms with available data is changing from year to year throughout the period [-5,+5]. To address the concerns that the results reported in the next section may be driven by the change in the composition of the firms in each year, we conducted a robustness test. We created a “squared” sample of S&P 500 firms that have data for all 11 years in the pre- and post-inclusion periods, [-5,+5]. There are a total of 381 such firms. Using this sub-set of S&P 500 firms we repeated our main tests (i.e., the results presented in Tables 2 and 3). The qualitative conclusion that the relative cash holdings decline after inclusion are unchanged (these robustness results are available through the authors). Thus, changing sample composition across the years is not the primary driver of our main results. Since this “squared” sub-sample of firms is substantially smaller than our original sample of 558 S&P 500 firms, we do not to use it as our primary sample to conduct our analyses on. Whenever necessary (e.g., in Table 8), we conduct robustness tests using similar “squared” sample(s).

⁹ Using quarterly data to calculate our variables is not appropriate in the context of this study. Many firms have highly seasonal cash holdings, which can impair our analysis of changes in cash holdings around index inclusions. We use quarterly data only to calculate cash flow volatility.

maturity (YTM) as of the issue date, and other information regarding the debt issue. We obtain historical treasury security YTM data for 5-year, 10-year, 20-year, and 30-year (when available) issues from the Federal Reserve Statistical Release website.

5. Results on changes in cash holdings around inclusion

5.1. Change in index firms' disposition towards cash

First, we analyze the changes in firms' cash holdings (scaled, non-scaled, industry adjusted, and non-industry adjusted) around the S&P 500 inclusion date. In Table 2, columns 3 and 4, we report the cash/assets for each year in $[-5,+5]$. They are significantly lower in the post-inclusion years. The decline in the average assets-scaled cash from pre- to post-inclusion period is 9.23% (it drops from 0.1462 to 0.1327) and it is significant at the 1% level. Similarly, the average cash/assets for year +1 is lower by about 7.39% on average than it was for year -1. It declines from 0.1434 to 0.1328, and in untabulated tests, we find that this decline is significant at the 5% level. The S&P 500 addition seems to significantly reduce the firms' incentive to save more cash in proportion to their assets.

Second, column (5) of the same table shows the results for the industry-adjusted scaled cash holdings of the new additions, where the 3-digit SIC identifies the industries and the adjustment is done using median industry values. The COMPUSTAT database from 1971-2006 is used to calculate the three-digit SIC code median level of cash holdings for each year. The mean of the industry-adjusted cash holdings of the new S&P 500 members is much lower in the post-addition period than the mean for the same variable in pre-addition period.¹⁰ For instance, the average decline from $[-5,-1]$ period to $[+1,+5]$ period is very large and statistically significant at the 1% level. The decline from year -1 to year +1 is large, from 3.55% to 2.42% of total assets. In

¹⁰ This decline is present regardless if we use current-year assets or prior-year assets as the scalar.

untabulated results, we find that this drop is significant at the 5% level. This represents a statistically significant decrease of nearly 32% in two years! These industry-adjusted results suggest that the member firms are quickly becoming more like the median firm in their industry (i.e., median industry-adjusted cash is getting closer to zero). That is, we observe a rapid mean reversion in their industry-adjusted cash holdings.

Third, since our goal is to investigate how the behavior of index firms is changing after inclusion, we also investigate the changes in the rate of accumulation of raw (non-scaled) cash. Using the results in columns (6), (7), and (8) we derive the following two conclusions. First, the index firms reduce their average growth rate in cash¹¹ after addition, measured as both non-industry-adjusted and industry-adjusted. The growth rate in non-industry-adjusted raw cash is cut nearly in half after inclusion (the mean drops from 100.49% to 53.22%; significant at the 1% level).¹² The average growth rate in industry-adjusted raw cash is cut by a larger proportion. It drops significantly from 105.04% in the pre-inclusion period to 51.34% in the post-inclusion period. This drop happens immediately after the inclusion year. Second, the decline in the asset-scaled cash reported above is not driven purely by the faster growth in the denominator (the assets). Although both cash and asset growth slow after inclusion, it is more dramatic (in percent decline) for assets. Despite this slow-down in asset growth, the ratio of cash-to-assets still drops significantly.

5.2. *Is the decline in cash a common phenomenon among the large cap firms?*

¹¹ First, a cross-sectional average of firms' growth rates is formed for each year, and then these values are averaged across-time for the pre- and post-inclusion periods. We do similar procedure for cross-sectional median growth rates.

¹² Columns (7) and (8) contain year-over-year changes in raw cash. Raw cash can change substantially in some firms due to one-time large amounts of borrowing, or due to a one-time large amount of cash disbursement (e.g., during a large takeover). This jump can be particularly pronounced for firms with cash holdings near zero. Therefore, in some years for some firms we will see very large y-o-y percentage changes, which can substantially affect the mean annual growth rates in raw cash. To minimize the distortions due to such extreme percentage changes, we applied winsorization at 1% and 99% level for the means and the medians in columns (7) and (8). The results without winsorization are available through the authors.

Next, we address an important question: “Could this decline in cash holdings be a common phenomenon among large-cap firms?” To address this issue, we use two methods. First, we use an advanced matching estimator originally developed by Abadie and Imbens (2006) and first applied in finance by Çolak and Whited (2007).¹³ This estimator calculates the “average treatment effects” by implementing a bias-corrected matching on multiple matching variables. Its advantages over the standard matching techniques include: 1) it corrects for bias due to imprecise matching, 2) it allows for more than one match to be used in the estimation of treatment effects, 3) it allows for control firms to be used for a match more than once, and 4) it puts no parametric assumptions on the distributions of the control variables.

In Appendix B we provide a brief description of the Abadie-Imbens matching estimator. Here, we present our results. Our measure of the treatment effect is the raw cash holdings of the index firm at year t (where $t \in [-5, +5]$) minus the average raw cash holdings of two¹⁴ matching firms for that year.¹⁵ In picking the best matching firms, we use numerous matching (or control) variables. These variables should capture i) one or more inclusion criteria used for choosing S&P 500 Index members, and/or ii) should be an important determinant of firm cash holdings (as documented by prior studies). So, our list of control variables due to the first criterion include the firm’s *3-digit SIC* (as a measure of its industry), *observation year*, *market capitalization*, *market share in its 3-digit industry* (as a measure of its “prominence”), and *cash flow volatility* (as a

¹³ The Abadie and Imbens (2006) matching estimator is also an excellent method to eliminate any endogeneity issues that might be present in the analysis (see Çolak and Whited, 2007).

¹⁴ Using one or three matching firms makes little difference in our results. Results are available upon request.

¹⁵ We report results for the raw cash variable since the main goal of this robustness test is to determine whether the raw cash of S&P 500 firms (cash holdings that are unaffected by any scaling variable) is actually declining in relative terms to the matched firms that are similar in size, industry, profitability, leverage, and other dimensions. Alternatively, we use scaled cash holdings (cash/assets) as the treatment variable in the Abadie-Imbens estimator (the control variables’ list and all the other specifications of the estimator are the same). We find that the treatment effect (the change in scaled cash holdings from the year before inclusion to the year after inclusion) is significantly negative at the 5% level. The same conclusion holds when the treatment variable is the change in the industry-adjusted cash/assets. Results are available upon request.

measure of the “stability” of the firm). When selecting these variables, we use the guidelines for inclusion into the S&P 500 described in the official website of Standard & Poor’s.¹⁶ The variables related to the second criterion are the firm’s *cash flows*, *size*, *acquisitions*, *expenditures*, *net working capital*, *market-to-book*, *lagged raw cash*,¹⁷ and *leverage*. The construction of these control variables is described in Appendix A. We require exact matching on the industry (3-digit SIC code) and year. The rest of the variables are adjusted for bias by the estimator in case of imperfect matching (see Appendix B for further details on bias adjustment).

Our control sample is constituted of “non-treated” firms with similar characteristics to the S&P 500 firms. In forming this sample, we start with all the firms with available data in COMPUSTAT from 1971 to 2006. We form the pool of control firm candidates by deleting any firm-year observation with missing accounting data for at least one of our control variables. We also eliminate firms that are not in the same three-digit industry as any of our index firms. Thus, the total observations in our treated and control samples are 198,551 firm-years.

Column (9) in Table 2 displays the matching-firms-adjusted raw cash (i.e., relative cash) for our index firms in each year t .¹⁸ After inclusion into the index, the relative cash holdings decline. In the period $[-5,-1]$ the index firms hold, on average, \$0.21 million more cash than their matches, and in $[+1,+5]$ period their holdings are \$22.36 million dollars less than their matches. The p -value for the significance in the two means is 0.0142. In short, almost immediately after

¹⁶ In selecting the index members, the Standard and Poor’s Index Committee does not follow strict rules, but rather it relies on general guidelines that are related to the market capitalization of the candidate firm, its industry sector, firm’s prominence in its industry, and the “stability” of its stock and of its financial performance. See Bos and Ruotolo (2000) for further discussions of these criteria.

¹⁷ *Lagged raw cash* is included to assure that the index firm is as similar as possible to its control firms prior to the inclusion year. Our results are qualitatively the same if we do not include this variable as one of the control variables.

¹⁸ A negative mean for the relative cash value indicates that, on average, the cash holdings for the treated firms decline more than the cash holdings of the matching firms.

inclusion the S&P 500 firms change their attitude towards cash, and move to significantly reduce their relative cash levels.

In our second robustness test of this subsection, we check whether other large-cap firms also decrease their scaled cash. We use a methodology similar to Lemmon, et al. (2008) and Dittmar and Duchin (2010) to calculate the mean cash holdings over the next 10 years for the top size (assets) decile of COMPUSTAT firms sorted at the beginning of the 10-year period. Briefly, this methodology calculates the average size-adjusted cash holdings for each year between period 0 through period +10. For year-5 and for each of the subsequent 10 years,¹⁹ we calculate the average size-adjusted cash holdings of the firms in the top-decile portfolio by holding the sample in the portfolio fixed. We repeat this process of re-forming the top-decile portfolios in each subsequent calendar year, and doing the same calculations for the 10 years that follow it. After performing this sorting and averaging the scaled-cash for each year between 1971 and 2006,²⁰ we obtain the results in column (10) of Table 2. The mean size-adjusted cash holdings of these large-cap firms is steadily increasing over time,²¹ yet in column (3) the mean is decreasing for our index firms.

In conclusion, if the scalar (i.e., the assets) was the only driver of our main results (presented in column (3) of Table 2), then the large capitalization firms would behave similarly to our S&P 500 firms. Instead, we find that while the top size decile firms increase their size-adjusted cash holdings, our S&P 500 firms decrease theirs. Thus, the decline in size-adjusted cash holdings of S&P 500 firms is not driven only by the denominator effect. There must be other causes of the

¹⁹ There are 11 years in our time span from year -5 to year +5. This is done to be consistent with the 11 years that are used in Table 2. It facilitates the comparison across the change in $Cash/Assets_t$ of our S&P 500 firms.

²⁰ That is, we have a moving window of 11 years starting at the calendar year when the sorting was performed.

²¹ A result that is consistent with Bates, et al. (2009)'s finding that over the years US firms, on average, have increased their size-adjusted cash holdings.

post-inclusion decline in the relative cash than just the mechanical effect associated with growing firm size.

5.3. *Multivariate analysis: The determinants of S&P 500 firms' cash holdings*

Next, we estimate a model incorporating the variables affecting the new S&P 500 firms' cash holdings around the year of inclusion. The goal is to establish if the scaled cash holdings decline post-inclusion after controlling for other relevant factors. We create a panel data set that covers the time around the inclusion date. We estimate the following model for years $t=-5, \dots, -1, +1, \dots, +5$,²² using a pooled cross-sectional analysis of all the firms in our sample, $i=1, \dots, N$:

$$Cash_{it} = \beta_{0i} + \beta_{1i}After_{it} + \beta_{2i}\mathbf{X}_{it} + \sum_t \gamma_t Year_{it} + \sum_j \lambda_j Ind_j + \varepsilon_{it} \quad (1)$$

The dependent variable, $Cash_{it}$, is the annual cash holdings scaled by contemporaneous assets. The variable of primary interest is $After$, a dummy variable which equals 1 if the firm-year observation is for one of the years following inclusion, and equals 0 during the pre-inclusion period. The controls, indicated by $\mathbf{X}_{it}$, are variables previously documented to affect cash holdings; namely, $\mathbf{X}_{it}$ includes *cash flows*, *size*, *acquisitions*, *expenditures*, *NWC*, *R&D*, *M/B*, *leverage*, *cash flow volatility*, and *distributions*. These variables are defined in Appendix A. $Year_{it}$ is a dummy variable indicating the calendar years from 1971 to 2006, and Ind_j is a dummy variable indicating the firm's 3-digit industry code. We control both for firm fixed effects and heteroskedasticity. There are 558 firms and 5,126 firm-years in the final sample. Some firms have missing observations for some of these variables, so in certain regressions the number of observations can be smaller.

Table 3 describes the results from several versions of the regression specified in Equation 1. In column (1) we include the control variables widely used in the literature (see, for instance, Opler,

²² Year 0 is excluded from these regressions since it is difficult to assess which period, before or after, it belongs to. Gertner, et al. (2002) use a similar procedure, and make the same choice.

et al., 1999; and Harford, et al. 2008), but not the year and industry control dummies. *After*'s coefficient is negative and significant at the 5% level, indicating a substantial decrease in the scaled cash holding of the S&P 500 firms in the post-inclusion period. All the other independent variables affect cash holdings in a way consistent with prior studies (see for example, Harford, et al., 2008). The same outcome occurs in column (2) where we control for yearly and industry fixed effects. The R^2 in column (2) is around 60%, which is comparable to the R^2 s of other corporate liquidity studies.

Since cash shows substantial variation across industries, we run the same regressions with industry-adjusted versions of the dependent and independent variables. The results are shown under columns (5) and (6). Again, the coefficients on *After* are negative and significant.

5.3.1. Macroeconomic factors

We next examine if the cash holdings of firms are affected by aggregate macroeconomic conditions.²³ If they affect the cash holdings of firms, they might also affect the coefficient of *After*. In regressions (3) and (7) in Table 3, we add control variables capturing the impact of macroeconomic shocks on the cash policy of the S&P 500 firms. They are Industrial Production Index (*INDPRO*), short-term interest rates as measured by the *3-Month T-Bill rate* (which is where the saved cash is likely to be “parked”), the S&P 500 Index's level as a measure of investors' confidence (*Stock Market*), and the *M2 Money stock* (adjusted for inflation) as a measure of changes in the Fed's monetary policy. For more details on these variables' definitions see *Appendix A*.

From the results in Column (3) of Table 3, the macroeconomic conditions do affect the S&P 500 firms' liquidity policy. As the industrial production activity declines, the macroeconomic

²³ While we are not aware of any paper that directly addresses the issue of how macroeconomic factors (business cycle, monetary policy, etc.) affect the corporate cash holdings levels, studies by Duchin, et al. (2010) and Bliss, et al. (2012) show that the recent financial crisis has affected the corporate liquidity policy of firms.

uncertainty is rising and firms are more likely to save cash. Similarly, *ceteris paribus*, the higher the short-term interest rates, the better the returns from “parked” cash, and so the costs of holding cash is lower (see Section 2 for details on the costs and benefits of holding liquid assets). M2 Money Supply has a significantly positive effect on the cash levels held by the corporations. This effect is understandable given that when the Fed increases the money supply, there is more cash circulating in the economy and some of it finds its place in the corporations’ balance sheets. Investors’ confidence, as measured by the stock market index, does not seem to carry explanatory power above and beyond industrial production, short-term interest rates, and the money supply.

For the industry-adjusted regressions presented in column (7), the macroeconomic variables’ coefficients are insignificant, except for the M2 money supply. The lack of significance in the macroeconomic regression likely occurs because we remove industry-wide effects in the cash levels and control variables. By removing industry-wide effects we also indirectly remove the aggregate macroeconomic effects on the cash holdings (all the firms in the industry are exposed to the same macroeconomic shocks). Consequently, in the industry-adjusted regressions macroeconomic variables become insignificant. Importantly, however, in both columns (3) and (7), the sign and significance of the estimated coefficient on *After* is unaffected by the macroeconomic variable controls.

5.3.2. *Controlling for measurement error in Tobin’s q*

Previously, we use OLS estimation, and do not control for measurement errors that may exist in our proxy for Tobin’s q , M/B . So, next we check whether a more robust estimation method, Generalized Method of Moments (GMM), and controlling for the measurement error in q , as in Erickson and Whited (2002), alters our conclusions. In the cash holdings literature this method is

used by Riddick and Whited (2009) to show that the measurement error in the proxy variables for q affect the estimation of the other variables' coefficients. We are concerned whether measurement issues in Tobin's q affect the coefficient estimates of *After*.

Our dependent variable (y_i) is *Cash Holdings* of the firm i ($i=1, \dots, n$); the mismeasured regressor (χ_i) is the true q and its proxy (x_i) is M/B ; and the perfectly measured variables' set, z_i , includes all the remaining control variables shown in column (3) of Table 3.

Following Erickson and Whited (2002), the model can be described with the equations:

$$y_i = \alpha_0 + \beta\chi_i + \alpha_1 z_i + u_i \quad i = 1, \dots, n \quad (2)$$

$$x_i = \gamma_0 + \chi_i + \varepsilon_i \quad i = 1, \dots, n \quad (3)$$

where ε_i is a mean-zero error independent of (u_i, z_i, χ_i) , and u_i is independent of (χ_i, z_i) . γ_0 is included to allow for nonzero means of some sources of measurement error. The assumptions of the model are i) $(\varepsilon_i, u_i, z_i, \chi_i)$ are *i.i.d.*; ii) the residual from the projection of χ_i on u_i has a skewed distribution, and iii) $\beta \neq 0$. The last two assumptions are necessary for model identification and they are testable (Identification Test). The EW estimators are based on GMM estimation and, therefore, a further testing of the model assumptions can be done through overidentifying restrictions test (or J -test). For further technical details on how the model produces a consistent estimator, see Erickson and Whited (2000, 2002) and Riddick and Whited (2009). The optimum finite sample performance is obtained using fourth or fifth order moments (GMM4 and GMM5), so in our estimations we chose GMM5.

The results from this estimation are presented under columns (4) and (8) of Table 3.²⁴ Importantly, the sign and significance of *After* is not affected substantially in either regression specification. This suggests that the significant negative coefficient of *After* is not affected by the

²⁴ The firm and industry fixed effects are not included in the estimation equations because EW estimators are not identified with fixed effects.

estimation methodology (GMM vs. OLS) or the measurement error in q . Therefore, we conclude that other factors are driving the decline in the cash holdings of the new S&P 500 firms in the post-inclusion period.

5.3.3. Various other robustness tests related to the multivariate analyses

We perform various other robustness tests on our regression in Equation 1.²⁵ In our first test, we check whether our results are affected by scaling with *sales* instead of *assets*. Cash holdings scaled by sales show a significant decline, at the 1% level, in the post-inclusion period. We also run the regression described in Equation 1 (again, controlling for firm and year fixed effects), but the cash holdings and the control variables (*cash flows*, *acquisitions*, *expenditures*, *NWC*, *R&D*, and *leverage*) are scaled by *sales*. In a separate estimation, we run the regression when these variables are scaled by *assets* lagged one year. The results in both instances are qualitatively the same; the coefficient of *After* is significantly negative at the 5% level. Thus, the decline in cash holdings is robust to using alternative scalars.

Second, we add the *idiosyncratic volatility* from the Fama-French-Carhart four-factor model as a control variable. Prior literature shows that after addition to the S&P 500 Index, the firm's stock price exhibits significant changes with regards to its trading-related characteristics due to better recognition by investors, better liquidity, and lower transaction costs. We conjecture that the idiosyncratic volatility of the stock should be positively related to the cash holdings of the firm; less firm-specific risk means less need for safety cash. After running the modified Equation 1, we find that *After* keeps its sign and significance, as do most of the other control variables. Idiosyncratic risk has a significantly (at the 1% level) positive coefficient.

Finally, we consider the possible effects of corporate governance. Unfortunately, most corporate governance measures are not available before 1990, so their inclusion in the regression

²⁵ Detailed results from these robustness checks are available from the authors.

eliminates a large number of observations. To avoid such distortions, we chose not to include them in our main results presented in Table 3. However, corporate governance may affect the post-inclusion cash decline. So, as a robustness check, we run our regressions with one of four separate corporate governance measures included as an additional control variable. They are the *GIM Index*, *EIndex*, *CBOARD*, and Institutional Ownership. *After*'s coefficient is negative in all cases and is significant at the 10% level or better for *GIM Index*, *EIndex*, and *CBOARD*. The coefficient for *Institutional Ownership* is insignificant.

5.4. Does inclusion in the S&P 500 represents a “regime change” in cash policy?

We perform a “Regime Change” (or discontinuity) analysis to assess whether there are meaningful changes in the cash policy of the firm from before inclusion to after. The cash policy of a firm is not easily discernible from other policies such as capital spending, acquisitions and capital structure. Hence, we look if there is a change in the structural relation between the cash measure and its determinants specified in Equation 1. We again use a pooled cross-section for all the index firms, for the years $t=-5, \dots, -1, +1, \dots, +5$, and estimate:

$$Cash_{it} = \beta_{0i} + \beta_{1i}After + \beta_{2i}X_{it} + \beta_{3i}(After * X_{it}) + \sum_t \gamma_t Year_t + \sum_j \lambda_j Ind_j + \varepsilon_{it} \quad (4)$$

The new term in this equation is $After * X_{it}$, representing the interaction of the *After* dummy with the set of controls.

We run the above regression and perform a Chow test. The null hypothesis is that $\beta_{1i} = 0$ and $\beta_{3i} = 0$ (11 coefficients are tested for simultaneously being equal to zero). There are 2,251 observations. The F-statistics is $F(11, 2534) = 5.16$ and the p -value ≤ 0.0001 . Thus, we reject the hypothesis that there is no change in the relation between cash and its determinants after inclusion in the S&P 500 Index. This shift is consistent with our claim that size-adjusted cash holdings of the member firms are depleted upon inclusion in the S&P 500 Index.

5.5. *The impact of financial constraints*

Several studies (Almeida, et al., 2004; and Riddick and Whited, 2009) suggest that financial constraints have to be considered in studying firms' cash holdings. Therefore, we analyze the impact of financial constraints on this paper's main claim; that the cash holdings of S&P 500 firms are declining after inclusion in the index. The decline in cash holdings may be driven by a subset of firms that are more (or less) financially constrained than the others?

We divide our sample of new S&P 500 firms into financially constrained and less constrained sub-samples. There are numerous indicators of financial constraints used by the literature, such as size, dividend yield, bond ratings, the Kaplan and Zingales (1997) Index (KZ Index), and the Whited and Wu (2006) Index (WW Index). The literature is unclear on which one is the best. Using single-variable indicators of financial constraint seems problematic in our context (e.g., size as constraints indicators can be a problem in our case, because the majority of our S&P 500 firms are "Large Cap," and thus can be considered unconstrained). Therefore, we perform our financial constraints analysis on "richer" indicators of constraints, namely using the WW Index and as a robustness using the KZ Index. These indices are "richer," because they incorporate information from numerous accounting and financial variables that can indicate financial constraints.

We use the WW Index to classify firms as financially constrained or not.²⁶ For each firm i and year t , we calculate the financial constraint index value as:

$$WW\ Index = -0.091CF_{it} - 0.062DIVPOS_{it} + 0.021TLTD_{it} - 0.044LNTA_{it} + 0.102ISG_{it} - 0.035SG_{it} \quad (5)$$

where CF is the ratio of cash flow to total assets; DIVPOS is an indicator that takes the value of one if the firm pays cash dividends; TLTD is the ratio of long-term debt to total assets; LNTA is

²⁶ We report only the results using the WW Index. Using the KZ Index leads to very similar conclusions. These results are available upon request.

the natural log of total assets; ISG is the firm's industry's sales growth (using 3-digit SIC); and SG is firm sales growth.

Following Almeida, et al. (2004), we sort the firms into deciles according to their WW Index values in each year $t \in [-5, +5]$. Then, we divide our sample of S&P 500 additions into two parts: relatively more financially constrained²⁷ and relatively less financially constrained.²⁸ Firm-years that are in the top (bottom) five deciles are included in the constrained (unconstrained) subsamples.²⁹

We run the regressions from Table 3 for each subsample with the same specifications as before. The results are reported in Table 4. Most of the coefficient estimates have similar signs and significance as in Table 3. For all the specifications, the coefficient on *After* preserves its sign and significance, indicating that both the relatively-more constrained and the unconstrained firms are reducing their cash holdings after the addition to the index. The inclusion to the S&P 500 Index has positive effects on the ability of firms to raise external capital regardless of whether they are more or less constrained. The S&P 500 firms are all “superstars,” which means that it is unlikely any of them are truly constrained. So, they do not see any harm in reducing their cash holdings after inclusion into a prestigious index, which can partially substitute for “safety cash.”

²⁷ The term “financially constrained” is used loosely here and is in relative terms. The firms added to the S&P 500 are usually “superstars” and it is unlikely that any of them are truly financially constrained compared to the other firms in COMPUSTAT. Our goal is to understand the effects of financial constraints on the cash holdings of the S&P 500 firms around inclusion. Hence, we compare the S&P 500 firms that are likely to be slightly more financially constrained to the firms that are not that constrained, and compare the changes in cash for each subsample.

²⁸ When creating the WW Index and KZ Index we rely on the original coefficient estimates presented in Whited and Wu (2006) and Kaplan and Zingales (1997) papers, respectively. For each firm and year, we constructed the accounting variables constituting the index as described in those papers. We apply these variables to the coefficient estimates from the above two papers. Thus, using these variables for our S&P 500 sample and the original coefficient estimates from Whited and Wu (2006), we form the WW index for each firm-year.

²⁹ We do not use the top-third-bottom-third method because our focus is to analyze the liquidity policy of *all the firms* added to the index, not just the top or bottom thirds. However, we note that defining the constrained (unconstrained) sample as top (bottom) third does not affect our qualitative conclusions. Results are available through the authors.

The magnitude of *After*'s coefficient is larger for the constrained sub-sample, regardless of the specification of the regression. This suggests that these relatively-more-constrained firms are benefiting the most from the certification role of the S&P 500 Index. Inclusion in the index relieves their constraints more than for unconstrained firms. Thus, they put a larger amount of their “safety cash” to better use. Unconstrained firms need such certification to a lesser extent, and so the magnitude of the change in cash is less pronounced.

6. *Testing our hypotheses: What explains the decline in cash holdings?*

This section presents the evidence regarding our explanatory hypotheses from Section 3. Table 5, Panel A, presents results for various factors shown to affect firms' cash holdings including *size, sales, cash flows, cash flow volatility, acquisitions, expenditures, NWC, inventory, R&D, M/B, total debt, short-term debt, net equity issue, and total dividends*. The panel shows means across time and firms for [-5,-1] and [+1,+5] periods. Results are provided both with and without industry adjustment. Means for each year t can also be found in Table 1.

We divide our sample into more- and less- financially constrained subsamples following the same procedure as in Section 5.5. Then, for each variable, both unadjusted and industry adjusted, we average across [-5,-1] and [+1,+5] periods. We report results for the financially constrained firms in Table 5, Panel B, and for unconstrained firms in Table 5, Panel C.³⁰

6.1. *Evidence related to the index's certification hypothesis*

As per hypothesis H1A, we expect that total debt/assets will increase following inclusion in the index. Table 5, Panel A, shows this ratio increases by 5.15% after addition, and this difference is significant at the 5% level. The percentage increase in the industry-adjusted version of the

³⁰ We conduct these same tests using other measures of financial constraints, such as the KZ Index, payout ratio, firm size, if the firm has a long-term bond rating, and if the firm has a short-term bond rating. All results are consistent with our finding using the WW Index.

variable is larger and significant at 5%. Similarly, the short-term debt ratio (industry-adjusted) significantly increases after inclusion. The net equity issuance of these firms, on the other hand, declines sharply from 3% of assets to -1% of assets. The decline is highly significant for both non-adjusted and industry-adjusted versions of the variable. On net, firms start repurchasing their shares after inclusion. This finding is consistent with hypothesis H1B.

Increasing the debt level, while at the same time decreasing equity issuances, is consistent with the “pecking order” of a firm whose external constraints to raise cheap capital, usually through debt, are minimal.³¹ With S&P 500 additions, these financial constraints are likely alleviated because of the implicit certification associated with being a member of a prestigious index. Since the external constraints to borrow decrease, the need for safety cash is reduced. The more constrained firms benefit the most from index inclusion since they were more restricted prior to inclusion and were not able to borrow as much as desired. The index inclusion allows them to borrow more. This point is better seen when comparing the magnitude of the increase in *total debt/assets* for constrained and unconstrained subsamples (see Table 5, Panels C and D). While for constrained firms this variable increases significantly by 11.31% (173.33% when industry-adjusted), for unconstrained subsample it does not.

We also examine changes in firms’ borrowing costs after index inclusion.³² We obtain bond issue dates and yields-to-maturity (YTM) from SDC for the S&P 500 addition firms, and calculate the change in credit spreads around the S&P 500 addition year. Specifically, we compute the credit spread above current Treasury securities with similar maturity dates for each

³¹ The pecking order hypothesis also implies that firms should invest some of the cheap external capital they raise. As we demonstrate later on, the new S&P 500 firms use this cheaper capital to accumulate more assets through acquisitions. Furthermore, they invest in their own equity through stock buybacks. However, they do not direct this new capital towards capital expenditures (the average capital expenditures/assets actually declines after inclusion).

³² Chen, et al. (2004) show that in the first few quarters after inclusion in the S&P 500 index, the cost of equity capital decreases, which should make holding cash for the precautionary motive less important. We demonstrate that the cost of debt also decreases. Since the costs of both equity and debt decrease, the cost of total capital should be lower after inclusion, reducing the need for safety cash.

of these debt issues, and calculate the mean credit spread for before and after addition periods. We then compute the differences in these firm-level mean credit spreads between the before and after periods.³³ Since there are insufficient observations in each yearly maturity, we organize the bond offerings into four groups: those with maturities of 1 to 5 years, from 6 to 10 years, from 11 to 20 years, and from 21 to 30 years. We examine the periods [-5, -1] and [+1, +5].

The results are presented in Table 6. Panel A shows the change in mean and median credit spreads for the same firm, averaged across firms. There are 62 firms that issue similar-term bonds during both the before and the after inclusion period.³⁴ There is a substantial credit spread decline of 1.58% for 1-5 year maturity bonds after inclusion compared to the before period. This is a direct support for the “Index Certification Hypothesis” (H1A) that predicts the relative cost of debt should be lower after a firm becomes part of the index.³⁵ These results are also consistent with the findings of Dhillon and Johnson (1991) and Morck and Yang (2002) regarding borrowing habits of firms added to an index. Similar patterns are found for the next two maturity groups. The only exception is for 21-30 year maturity bonds, where the credit spreads increase after addition.

Panel B of Table 6 shows the change in mean and median credit spreads before and after inclusion for the debt issuances conducted by all firms in our sample. The difference in this panel is that we include all the issuance observations regardless of whether the same firm has issuance in the after (before) period. We also report the associated *t*-statistics and *p*-values. For maturities

³³ This method allows us to control for the: 1) aggregate market fluctuations in the bond yields over time (by subtracting the T-bond yields), 2) maturity effects (by using similar maturity corporate bonds and T-bonds), and 3) firm effects (by comparing the similar maturity spreads of the same firm for the before and after periods).

³⁴ Since the number of firms with available bond ratings is small, we cannot analyze constrained vs. unconstrained firms.

³⁵ Since the average credit spread changes substantially in the post-inclusion period, we consider including this variable as a control variable in Equation 1. However, there are very few index firms that have this variable observable for the similar maturities bonds for both the before and the after inclusion periods. Also, again because of a lack of observations, we cannot calculate this variable for most of our panel years between years -5 and +5. These difficulties make any regression analysis impossible to conduct in a reliable fashion.

less than 10 years, the average credit spread between S&P 500 addition firm bond issues and similar maturity treasury securities decline after firms are added to the index. For example, for the 1-5 year maturity bonds, there is a statistically significant credit spread decline of -0.60%. For longer term bonds the spreads tend to increase.

Further evidence that firms can borrow more easily and at a cheaper cost after inclusion in the index is that there are more bond issues after firms are added to the S&P 500. There are a total of 388 bond issue observations after addition compared to 348 before addition, representing an increase of 11.5%. This suggests that addition firms increase their frequency of borrowing after inclusion to the index, and supports the “Index Certification Hypothesis” (H1A). These firms also decrease the maturities of their borrowing as can be seen with the percentage of bonds with maturities of 5 years or less increasing from 17.5% (61/348) to 28.4% (110/388) after inclusion.

In a final test of this hypothesis, we analyze changes in credit ratings of the S&P 500 addition firms around the inclusion date. From COMPUSTAT we obtain the credit ratings information of these firms for the periods [-5,-1] and [+1,+5]. Results are in Table 7. Not all sample firms have credit ratings in COMPUSTAT. Before inclusion there are 160 firms with available credit ratings, while after inclusion there are 309. Only 147 firms have this data for both periods. Almost twice as many firms apply for and receive credit after they are included in the index. Combined with the Opler, et al. (1999) finding that a credit-rated firm is more likely to hold lower cash reserves, this helps explain the downward shift in the cash holdings of the S&P 500 firms.

We report several additional results. As shown in Panel A, the mean credit rating improves from BBB- to BBB upon addition to the index. To quantify rating changes with specific numeric values, we assign a number to each credit rating. The highest value, 20, is given to the AAA

rating; the next lower rating gets 19; and so on. The lowest rating, D, gets a value of 1. Using these indexed values, the mean credit rating increases from 12.46 to 13.23, which corresponds to a 6 percent jump. Furthermore, as shown in Panel B, there are substantially more firms whose credit ratings improve rather than worsen.

Table 7 demonstrates a visible improvement in the credit ratings of the new index firms in the post-inclusion period.³⁶ For these firms this improvement facilitates the raising of cheaper external capital through debt and, thus, their need for safety cash decreases. This outcome is predicted by hypothesis H1.

We check, also, whether there is a decline in adjusted cash for the sub-sample of firms for which we have credit ratings data to see if the sample of firms with credit ratings data is representative of the overall sample of index firms. In untabulated results we find that the mean industry-adjusted cash/assets is significantly lower (at the 1% level) in the post-inclusion period for this sub-set of firms. The details on all the related results are available from the authors. Thus, the sub-set of index firms with credit ratings improvement after inclusion also see their adjusted cash decline significantly.

6.2. *Evidence related to the increasing agency conflicts hypothesis*

To test this hypothesis we plot in Figure 2 the annual mean values (averaged across member firms for each year) of the four corporate governance measures around the year of the sample firms' inclusion in the index. Figure 2A, for example, shows the percentage of shares held by institutional investors. Table 8 provides the numbers for each year. *Institutional Holdings* peak

³⁶ For some firms it may be that the credit improvement was already underway, and the inclusion decision was partially due to this improvement. However, according to Bos and Ruotolo (2000), as long as the credit rating of the firm is above a certain level, the increase or decrease in the credit rating of a firm plays a relatively small role in being chosen by the S&P Index Committee. We checked how many of our 74 firms with a post-inclusion rating increase (see Table 7) have a similar rise in credit rating during the period prior to inclusion. Only 38 of these firms have an increase in credit ratings in the period [-5,-1].

the year the firm is included in the index and then steadily drops. This is surprising since there are numerous mutual funds that track the index and yet, on average, the overall percentage of institutional holdings declines post-inclusion.³⁷ Since high levels of institutional holdings indicate better shareholder rights due to large-shareholder activism and monitoring, a drop in this governance measure suggests a worsening of these rights post-inclusion, consistent with our *increasing agency conflict hypothesis*.

Similarly, the other three corporate governance measures, *CBOARD*, *GIM Index*, and *EIndex*, indicate a steady deterioration³⁸ in corporate governance both before and after the index inclusion (see Figure 2 and Table 8). The deteriorations of the *GIM Index* and *EIndex* accelerate after inclusion,³⁹ indicating growth of bureaucratic frictions and managerial entrenchments inside the maturing index firms.⁴⁰ The results for industry-adjusted governance indicators are presented in Panel B of Table 8 (the plots of these variables around the inclusion year are available upon request), and they lead to same conclusions.⁴¹

These results suggest increasing agency conflicts inside firms after their inclusion into the S&P 500 Index. Elevated agency conflicts can increase the costs of holding cash (Jensen, 1986 and

³⁷ Chen, et al. (2004) show that one quarter after inclusion the percentage of shares held by institutional investors increases. We show that it actually peaks during the year of inclusion (i.e., first few quarters after inclusion). In the years that follow, the percentage of institutional holdings steadily declines indicating less monitoring by large investors. Explaining why this decline occurs is beyond the scope of this study.

³⁸ A rise in these variables indicates increasing managerial powers and entrenchment within the corporation.

³⁹ In an untabulated result, we find that the decline in the means of *GIM Index* and *EIndex* between $t=-1$ to $t=+1$ are significant at the 5% level.

⁴⁰ In another untabulated result, we find that for 46 firms (13 firms) the *GIM Index* increased (decreased) in year +1 compared to year -1. For the rest of the firms the data was missing. Similarly, for *EIndex* these numbers are 20 and 5 firms, correspondingly.

⁴¹ In Table 8 the sample size is changing throughout the years because of variation in the number of missing observations for the corporate governance variables in each year. To assure that the changing sample sizes across the years is not the main driver of the above results, we conducted a robustness test. We kept in the sample only the index firms that have all 11 years of the particular variable analyzed. This assures that we follow the same set of firms from $t=-5$ to $t=+5$. The sample size shrinks substantially. For *Inst. Holdings* (*CBORAD*, *GIM Index*, and *EIndex*) the sample size shrinks to 153 (51, 48, and 48) firms. Then, we recalculated the means in Table 8 using these constant samples for each variable. The pattern of deteriorating corporate governance indicators is still observable. The results are available through the authors.

Stulz, 1990). Harford et al. (2008) and Kalcheva and Lins (2007) show that there is a negative relation between poor corporate governance and cash holdings for US firms. Thus, our increasing agency conflicts hypothesis (hypothesis H2) provides a reliable answer for why the S&P 500 firms have declining cash holdings around their addition to the index.

To the best of our knowledge, we are the first to report such a decline in corporate governance indicators of the index firms after their inclusion into the S&P 500 Index. This result is interesting in its own right, because corporate governance has been shown to not change much within firms. As stated in Section 3.2, explaining why managerial entrenchment increases after addition to the index is beyond the scope of this study. What matters to us is that this deterioration in agency conflicts can provide a credible explanation (as per the hypotheses developed in Harford et al., 2008 and Kalcheva and Lins, 2007) of the post-inclusion drop in the firms' relative cash holdings.⁴²

6.3. *Evidence related to the declining investment opportunities hypothesis*

Referring again to Tables 1 and 5, several patterns related to this hypothesis emerge. First, on average these firms are in rapidly maturing businesses with declining *cash flows*, *expenditures*, *sales*, *inventories*, and *NWC*. The patterns of these variables clearly reveal that in the period around the inclusion date, the index firms are showing signs of diminishing investment opportunities. Declining investments could lead to declining sales and cash flows, which could reduce the need for net working capital, inventories, and transaction-related cash holdings.⁴³

These findings support hypothesis H3B.

⁴² As an ex-post verification of this explanation, we find a decline in adjusted cash for the sub-sample of index firms that have corporate governance data. This is an indirect verification that the increasing agency conflicts hypothesis has some explanatory value for the declining relative cash phenomenon described above. The results are available upon request.

⁴³ The results from Panels B and C of Table 5 also support this notion. The above conclusions are valid for both constrained and unconstrained subsamples.

Looking at *M/B* means before and after index addition, we observe an insignificant decline in investment opportunities after inclusion. This implies a weak support for hypothesis H3A. There is limited support for hypothesis H4, also. Although not statistically significant, all the associated variables show a change as predicted by this hypothesis. *M/B*, *R&D*, and *expenditures* are all declining, and *acquisitions* are increasing. These directional changes are consistent with the idea that these firms seek investment opportunities from outside sources.

Thus, we find some evidence consistent with the *Declining Investment Opportunities Hypothesis*. Some of the post-inclusion drop can be explained by a coinciding decline in the investment alternatives of the index firms. However, as the evidence from the tests of the other hypotheses shows, the index inclusion effect on cash holdings is quite strong, and economically and statistically significant. The coefficient on *After* in Equation 1 is significant even after we control for variables associated with the declining investment opportunities hypothesis, such as *cash flows*, *expenditures*, *M/B*, *R&D*, *acquisitions*, and *NWC*. Therefore, both the index inclusion effect and the effect of declining investment opportunities combine to produce a significant drop in cash holdings after inclusion.

To summarize the results from Section 6, we find strong evidence in support of the *Index's Certification* and *Increasing Agency Conflicts Hypotheses*. There is also some weak evidence in favor of the *Declining Investment Opportunities Hypothesis*.

7. Analysis on the deletions' sample

Here we focus on firms that are dropped from the S&P 500 Index. These firms are likely to experience a reciprocal effect to the index inclusion effect(s) analyzed above. As such, they can provide corroborating evidence for the main claims of the paper. We expect these firms to

increase their cash holdings after deletion and the other related variables to show similar reciprocal effects.

We form a sample of deleted firms (The Deletions Sample) that includes all firms that were dropped from the S&P 500 index during our sampling period for any reason other than M&A activity. We identify 125 such firms that are independent one year after deletion. There is likely a major sample selection bias with this deletion sample: the most inefficient ones (thus the ones on whom the index deletion likely would have had the most impact on) were actually acquired by other firms and so are unobservable. Thus, our results from this analysis should be approached with caution.

In unreported findings, we perform similar analyses on the deletions as we did for the additions. We find evidence of a rise in cash holdings after deletion. The average cash holdings in the before-inclusion period increase from 11.79% to 13.35% of assets, significant at the 10% level. With the Abadie-Imbens matching estimator the increase in cash holdings after deletion is significant at the 1% level.

We also find that the corporate governance variables are either slightly improving or are not deteriorating after deletion, thus providing support to hypothesis H2. The results for the other variables are either not obtainable due to an extremely small sample size or provide mixed results. Thus, the Deletions Sample provides some evidence consistent with the results for the additions.

8. Where does the cash go?

We have established that, after controlling for the known determinants of financial liquidity, size-adjusted cash holdings decline after inclusion. We also considered several hypotheses suggesting various factors that directly or indirectly (through changing the incentives) might

affect corporate liquidity. To further understand the dynamics of cash holdings around the inclusion date, we analyze the cash flow statements of these firms around the addition year.

8.1. *Analysis of the accounting identity for cash*

From an accounting perspective, it is possible to identify exactly where the declining cash/assets is going. We use basic accounting identities to pinpoint the causes of decline in the cash holdings of the S&P 500 firms. We start with the identity:

$$\Delta \text{Cash Holdings}_t \equiv CFF_t + CFI_t + CFO_t \quad (6)$$

which shows that the changes in cash holdings can occur only through changes in *cash flows from financing (CFF)*, *cash flows from investments (CFI)*, and *cash flows from operations (CFO)*. We observe a decline in scaled cash holdings, so we should notice changes in scaled *CFF*, *CFI*, and *CFO* if we use the same scalar on both sides of the identity.

We retrieve *CFF*, *CFI*, and *CFO* from COMPUSTAT (FINCF, IVNCF, and OANCF, respectively). We analyze each of these items for each year from -5 through +5 to determine changes around the addition year. Table 9, Panel A, presents their scaled annual means and medians. Panel B gives the means and medians (averaged across time and firms) for the before and after periods, as well as the *p*-values from cross-sectional tests for significant differences between these means and medians.

From *CFF*, there is a substantial reduction in the scaled cash that was made by the index firms from financing activities. The difference in *CFF* between before and after periods is statistically significant at the 1% level. In the pre-inclusion period these firms have positive cash flows from the financing activities. After year +1, *CFF* turns negative. This implies that after inclusion, these firms pay out more cash as dividends and through repurchases relative to the debt and equity proceeds they take in. As shown in Table 5, the total leverage of these firms is higher

post-inclusion, implying that they have more debt proceeds after inclusion. However, their use of these proceeds is rising even faster. The index firms engage in more buybacks and they pay more dividends after addition (see Table 5).

Around the inclusion date, *CFI* is negative, but it declines in magnitude after inclusion (the difference is statistically significant at the 1% level). That is, the S&P 500 firms continue to spend more on investments than they receive from the sale of long-life assets or financial assets of other companies. However, the magnitude of net investments is declining, implying decreasing total spending on capital expenditures, acquisitions, and other firms' financial assets. This decline in total investment spending is primarily driven by the major decline in items related to investment activities such as *expenditures*, *NWC*, and *inventories* (see Table 5). Also, Table 5 shows that *acquisitions* are higher after inclusion. Thus, *CFI*'s magnitude is declining despite the rise in acquisition spending; *acquisitions*' rise is offset by the substantial drop in other capital spending.

The values of *CFO* are positive for the entire period, but their magnitudes decline after the inclusion year (the difference is significant at the 5% level).⁴⁴ So, in the post-inclusion period these firms have less cash available to set aside as savings because their scaled cash flow from operations is decreasing. This is another reason for cash depletion in the index firms.

In short, the analysis of the accounting identity for cash suggests that the cash is being used for several purposes (for acquisitions, dividends, and repurchases), and it is not being replaced fast enough by the operating cash flows and the net new borrowing.

⁴⁴ Denis, et al. (2003) show that in the first few months after inclusion, the realized earnings of the S&P 500 firms are significantly better than what the analysts had forecasted in the month just before inclusion. Their focus is more short-term than ours; they analyze the operating performance during the first few months or the first year after inclusion. We concentrate on longer-term (up to 5 years after inclusion) effects on cash flows. Also, differences in the sampling period and in operating performance measures (earnings-per-share vs. scaled cash flows from operations) could lead to such discrepancies.

8.2. Analyzing the sub-samples of index firms ranked according to cash holdings

To further analyze the causes of the decline in the cash holdings around the S&P 500 inclusion date, we do a before-and-after analysis on terciles formed by ranking the firms according to the change in their relative cash holdings. The top tercile includes firms that increase their adjusted cash holdings substantially more than the firms in the bottom tercile. Table 10 shows the difference-in-difference (d-i-d) of the means between the top and the bottom terciles.⁴⁵ The d-i-d of both non-industry adjusted and industry adjusted variables are shown. One difference between the cash terciles is that M/B (a proxy for investment opportunities) decreases more after inclusion for firms in the bottom tercile (however, the decrease is statistically significant only for the non-industry adjusted variable).

Parallel to this decline in investment opportunities, the firms in the bottom tercile have a larger increase in acquisition activities and R&D spending than the firms in the top tercile. The acquisition activities of the bottom tercile firms increase after inclusion, while for the top tercile firms they decrease. So, another reason for depletion in the scaled cash holdings of the bottom-tercile firms could be their more intensive search for investment opportunities through acquisitions or through research and development. However, since the results for the industry-adjusted variables are not statistically significant for the *acquisition* variable, we consider this evidence to be weak.

Another reason why relative cash holdings of the bottom tercile firms decrease so much more after inclusion into the S&P 500 Index is that the firms in the bottom tercile increase their borrowing (and thus, their interest spending) more than the ones in the top tercile; the change in the *total debt* for the bottom tercile firms is 4.95% of the assets vs. 0.68% of the assets for the

⁴⁵ The *difference-in-difference (d-i-d)* values are calculated by first finding the mean change of the top tercile (i.e., $\text{mean change} = \text{mean after} - \text{mean before}$ for the firms in the top tercile), and then subtracting the mean change of the bottom tercile.

top tercile firms. There is a similar relation for *short-term debt*. Again, the evidence from industry-adjusted variables is statistically weak.

9. Conclusion

We examine changes in the corporate cash holding policies of firms that are added to the Standard and Poor's 500 Index from 1971 through 2006. We concentrate on the cash holding policy of these firms because the decision to hold large amounts of cash involves substantial discretion by the manager, and it can be affected by changes in the firm's exposure to outsiders through events such as index membership.

Our findings indicate that the adjusted cash holdings of these firms decline around the time of addition to the index, which implies a shift in their liquidity policy. This result could have consequences regarding the debate on whether or not addition to the S&P 500 Index is an information-free event. It implies that the S&P 500 addition may not be irrelevant to the firm's inner functioning. It might affect a firm's corporate governance, managerial behavior, investment decisions, and the firm's interactions with the external world (facilitates raising external capital, providing outside visibility that might affect firm's acquisition behavior).

Since a firm's cash policy is closely intertwined with investment, dividend, acquisition, and capital structure policies, future research could analyze whether there is a similar shift in these other corporate policies upon addition to any S&P index. We believe such analyses will shed further light on the relation between index membership, and corporate behavior and policy.

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Appendix A. Variable construction

This appendix shows the construction of the variables used in our analyses. The definition of each variable is as follows (the data codes for each measure as shown in the Annual COMPUSTAT datafiles are in parenthesis):

Acquisitions: the total level of *Acquisitions* (AQC) made by the firm for each fiscal year, scaled by *assets* (AT).

After: a dummy variable that equals 1 starting the year that the firm is added to the S&P 500 Index through year +5. This dummy variable equals 0 for the years -5 through -1 prior to the year the firm is added to the S&P 500 Index.

Assets: the total level of *assets* (AT) for the firm.

Cash Flows (CF): the cash flow of each firm, defined as the *Income Before Extraordinary Items (IB)* + *Depreciation and Amortization (DP)* – *Preferred Dividends (DVP)* – *Common Dividends (DVC)*, scaled by total assets (AT).

Cash Flow (CF) Volatility: for each firm we compute the standard deviation of the distribution of quarterly cash flows over a three-year moving window centered on each year included in the panel data. For example, the *Cash Flow Volatility* for firm *i* for year *t* is defined as the standard deviation of the distribution of quarterly *Operating Income Before Depreciation* for firm *i* over years *t*-1, *t*, and *t* +1. The three-year window moves one year at a time and the

window consists of 12 quarterly *cash flow* observations that are used to compute the standard deviation of the distribution of *cash flows*.

Cash Holdings: cash and cash equivalents (CHE) of the firm for each fiscal year, scaled by *assets*. Following Harford et al. (2008), we also used an alternative definition of cash holdings: CHE over sales. Our results are robust to this alternative definition.

CBOARD: indicates whether or not the firm's board is classified or not (originally developed by Bebchuck et al., 2009). It is an antitakeover provision that has substantial impact on firm value. We use it as a complementary indicator to the *EIndex* and *GIM Index*. It is available for the period after 1990.

Distributions: a dummy variable indicating whether the firm made any cash distributions during the year. It takes a value of 1 if the firm paid a dividend or if the firm had a net equity repurchase (i.e., *Net Equity Issue* < 0). Otherwise it is 0.

Dividends: a variable measuring the total dividend amount (*DIVT*) the firm paid in that year.

EIndex: an alternative antitakeover index to *GIM Index*, developed by Bebchuck, et al. (2009). It is based on variables such as preferred stock, classified board, limits to amend charter, limits to amend bylaws, supermajority, and poison pills. Higher values indicate poorer corporate governance. This variable is not available before 1990.

Expenditures: The total level of *Capital Expenditures* (CAPX) made by the firm for each fiscal year, scaled by *assets*.

GIM Index: an index developed by Gompers, et al. (2003). It takes values from 1 to 24. For each antitakeover provision (total possible=24) associated with five governance rules (delay, protection, voting, state, and other), the firm's index value is increased by one. The higher this index, the more shareholder rights are restricted. It cannot be calculated before 1990.

INDPRO: Industrial production index (index=100 for 2007); seasonally adjusted. It is obtained from Federal Reserve Bank of St. Louis' website.

Institutional Ownership: percentage of the company's shares outstanding held by institutions. The data for this variable is unavailable before 1978.

Inventory: the total level of *Inventories* (INVT) for each firm, scaled by *assets*.

Leverage: it is calculated as *Short Term Debt (DLC)* + *Long Term Debt (DLTT)* divided by *assets*.

M2 Money: Measures the M2 money stock less small time deposits (adjusted for CPI in 1982 dollars); in billions of dollars; seasonally adjusted. It is retrieved from Federal Reserve Bank of St. Louis' website.

Market-to-Book (M/B): The *Market-to-Book* ratio is measured as the market value of equity (CSHO x PRCC_F) divided by the book value of equity (CEQ).

Market Share: Calculated as the percentage of the firm's sales of the total sales made in its industry (3-digit SIC). It measures the firm's prominence in its industry.

Net Equity Issue: measured as *Total Equity Issue (SSTK)* – *Total Equity Purchase (PRSTKC)* scaled by *assets*. It represents the net new equity issuance for each fiscal year.

Net Working Capital (NWC): measured as *Total Receivables (RECT)* + *Total Inventories (INVT)* – *Accounts Payable (AP)*, divided by *assets*.

Research and Development (R&D): The total level of *Research and Development (XRD)* reported by the firm for each fiscal year, scaled by *assets*. If the observation for the *XRD* is missing, we assume it is 0.

Size: The Size is the *assets* (AT) of the firm.

Stock Market: measured by the S&P 500 Stock Price Index as reported at the Federal Reserve Bank of St. Louis' website.

T-Bill_3Mo: represents the 3-month Treasury bill rate (in %); it is the secondary market rate obtained from Federal Reserve Bank of St. Louis' website.

Appendix B. The Abadie-Imbens matching estimator

We provide a simplified version of the estimator. For more details, see Abadie and Imbens (2006) and Çolak and Whited (2007). The goal of this technique is to estimate the unobservable differences between the treated firms and the comparable non-treated firms. It is unobservable since the cash-effect due to index inclusion is not measurable for the non-treated control firms.

Let N_T and N_L be the number of firms in the treated and the matching sample, respectively. A binary variable W indicates whether ($W=1$) or not ($W=0$) the firm is included in the index. $C_i(W=1)$ denotes the percentage change in cash holdings of index firm i from the year before inclusion (i.e., year $t-1$) to the year after inclusion (year $t+1$). Similarly, $C_i(W=0)$ would denote the same measure for the control firms (i.e., matching firms that were not included in the index).

Our goal is to calculate the average cash effect on the treated firms' sample,

$\tau|_{W=1} \equiv E[C_i(1) - C_i(0)|W=1]$, which is usually estimated by the simple matching estimator

$\hat{\tau}|_{W=1} = \frac{1}{N_T} \sum_{i=1}^{N_T} [C_i(1) - \hat{C}_i(0)]$. As stated above, in such an estimation the treatment effect of the

treated firms' sample, $C_i(1)$, is observable; but the treatment effect of the control sample, $\hat{C}_i(0)$, is not. It is imputed during the estimation.

Abadie and Imbens (2006) show that this estimation technique leads to a substantial bias when the matching between the control variables is not perfect. So, instead, they propose a new

technique for removing the bias term that remains after the matching. The bias-corrected matching estimator adjusts the difference within the matched firms for the matching discrepancies between the control variables. The magnitude of the adjustment for the treated sample ($W=1$) is calculated using a regression on the control sample of the form:

$$\hat{\mu}_{W=0}(x) = \hat{\beta}_{0,W=0} + \hat{\beta}'_{1,W=0}x, \text{ where } (\hat{\beta}_{0,W=0}, \hat{\beta}_{1,W=0}) = \underset{\beta}{\operatorname{argmin}} \sum_{i=1}^{N_L} [K_M(i) \cdot (C_i - \beta_{0,W=0} - \beta_{1,W=0})^2],$$

where x is the matrix containing the matching variables and $K_M(i)$ is the number of times firm i is used as a match given that M matches per unit are used divided by the total number of matches (note that $\sum_i K_M(i) = N_L$ is equal to the number of treated units.)

Using the above estimated regression, one can impute the missing potential outcomes for the control sample as:

$$\tilde{C}_i(0) = \begin{cases} C_i & \text{if } W_i = 0 \\ \frac{1}{\#S_M(i)} \sum_{h \in S_M(i)} [C_h + \hat{\mu}_0(x_i) - \hat{\mu}_0(x_h)] & \text{if } W_i = 1 \end{cases}$$

where $S_M(i)$ denotes the set of indices for the matches for unit i that are at least as close as the M^{th} match, and $\#S_M(i)$ denotes the number of elements in $S_M(i)$. Thus, the bias-adjusted matching estimator for average treatment effect on treated group is calculated as:

$$\hat{\tau}_M^1 = \frac{1}{N_T} \sum_{i=1}^{N_T} [C_i(1) - \tilde{C}_i(0)]$$

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Figure 1. S&P 500 index additions per year

The figure shows the number of S&P 500 Stock Index additions in each year from 1971 to 2006.

Figure 2. Corporate Governance Measures

The graphs show the mean corporate governance indicators for our new additions sample from 5 years before to 5 years after the inclusion into the S&P 500 Index. We use 558 newly added firms to plot this graph. The corporate governance indicators are *Inst. Holdings* (percentage of shares outstanding held by institutional investors), *CBOARD* (classified board indicator), *EIndex* (the Bebchuk, et al., 2009 entrenchment index), and *GIM Index* (the Gompers, et al., 2003 anti-takeover index).

Table 1. Descriptive statistics

This table provides descriptive statistics for key variables across each event time panel year from $t=-5$ to $t=+5$, where year 0 represents the calendar year that a firm was added to the S&P 500 Index. Thus, year +1 indicates the first full year of operations after a firm was added to the index, while year -1 is the last full year of operations before a firm was added to the index. *Assets* are the reported total assets for each year. *Cash Flow* is net income plus depreciation and amortization, less preferred and common dividends. *Cash* is the cash holdings of the firm. *Net working capital*, *NWC*, is total receivables plus inventories, and minus accounts payable. The *Market-to-Book (M/B)* is the market value of equity divided by the total book value of equity. *Total debt* is total long-term debt plus total current short-term debt. *Cash Flow Volatility* is the volatility of a firm's quarterly operating income before depreciation over a 3-year period centered on each event time year. *Net equity issue* is the total dollar amount obtained through the sale of common and preferred stocks less the total dollar amount used to purchase common and preferred stocks. *Acquisitions*, *expenditures*, *total dividends*, *inventory*, and *research and development (R&D)* are reported annually. *N* is the number of non-missing observations in the sample for each variable, for each event year. The number of missing observations is also provided.

Variables	Statistic	t = -5	t = -4	t = -3	t = -2	t = -1	t = 0	t = 1	t = 2	t = 3	t = 4	t = 5
<u>Cash Holdings</u> <u>Assets</u>	N/Missing Obs.	469/17	488/16	509/13	534/7	552/2	558/0	549/1	537/2	495/1	478/1	455/0
	Mean	0.1439	0.1539	0.1479	0.1421	0.1434	0.1350	0.1328	0.1282	0.1322	0.1374	0.1330
	75 th Percentile	0.1923	0.2098	0.1979	0.1899	0.1878	0.1757	0.1735	0.1616	0.1784	0.1821	0.1841
	Median	0.0819	0.0840	0.0790	0.0780	0.0785	0.0777	0.0722	0.0720	0.0718	0.0715	0.0755
	25 th Percentile	0.0341	0.0340	0.0281	0.0272	0.0259	0.0263	0.0237	0.0220	0.0256	0.0247	0.0260
<u>Cash Flow</u> <u>Assets</u>	N/Missing Obs.	464/22	483/21	505/17	527/14	537/17	554/7	542/8	532/7	492/4	473/6	452/3
	Mean	0.0893	0.0990	0.1003	0.1038	0.1086	0.0989	0.0789	0.0705	0.0790	0.1143	0.0727
	75 th Percentile	0.1351	0.1386	0.1400	0.1430	0.1435	0.1448	0.1337	0.1247	0.1239	0.1270	0.1245
	Median	0.0958	0.0982	0.1016	0.1032	0.1066	0.1024	0.0940	0.0902	0.0928	0.0934	0.0893
	25 th Percentile	0.0630	0.0669	0.0657	0.0718	0.0708	0.0673	0.0635	0.0561	0.0594	0.0616	0.0522
<u>Acquisitions</u> <u>Assets</u>	N/Missing Obs.	383/103	417/87	444/78	462/79	494/60	518/43	499/51	490/49	460/36	442/37	422/33
	Mean	0.0203	0.0182	0.0225	0.0232	0.0239	0.0258	0.0258	0.0228	0.0253	0.0167	0.0214
	75 th Percentile	0.0098	0.0169	0.0131	0.0144	0.0150	0.0205	0.0199	0.0138	0.0111	0.0123	0.0128
	Median	0	0	0	0	0	0	0	0	0	0	0
	25 th Percentile	0	0	0	0	0	0	0	0	0	0	0
<u>Expenditures</u> <u>Assets</u>	N/Missing Obs.	464/22	480/24	506/16	526/15	547/7	557/4	542/8	528/11	489/7	474/5	453/2
	Mean	0.0994	0.0927	0.0951	0.0918	0.0873	0.0872	0.0823	0.0804	0.0735	0.0701	0.0685
	75 th Percentile	0.1219	0.1178	0.1232	0.1199	0.1122	0.1158	0.1084	0.1070	0.0957	0.0929	0.0917
	Median	0.0761	0.0727	0.0738	0.0744	0.0711	0.0698	0.0690	0.0637	0.0603	0.0570	0.0561
	25 th Percentile	0.0467	0.0431	0.0421	0.0421	0.0418	0.0393	0.0391	0.0364	0.0324	0.0311	0.0314
<u>NWC</u> <u>Assets</u>	N/Missing Obs.	440/46	466/38	494/28	524/17	542/12	550/11	540/10	527/12	487/9	468/11	445/10
	Mean	0.2579	0.2529	0.2510	0.2413	0.2349	0.2266	0.2174	0.2162	0.2141	0.2070	0.2057
	75 th Percentile	0.3892	0.3856	0.3891	0.3707	0.3641	0.3489	0.3353	0.3435	0.3240	0.3143	0.3110
	Median	0.2381	0.2303	0.2288	0.2078	0.2117	0.2007	0.1823	0.1757	0.1818	0.1773	0.1809
	25 th Percentile	0.1053	0.1028	0.1017	0.1001	0.0875	0.0798	0.0730	0.0702	0.0778	0.0768	0.0797
<u>Market</u> <u>Book</u>	N/Missing Obs.	436/50	457/47	482/40	499/42	512/42	556/5	546/4	531/8	486/10	466/13	445/10
	Mean	2.2560	1.1034	3.9049	4.0805	4.4459	3.5100	3.5400	3.1842	2.2534	3.7028	2.6578
	75 th Percentile	4.2702	4.6071	4.6143	4.9123	5.0773	4.8179	4.2126	3.6959	3.6553	3.6837	3.4527
	Median	2.4906	2.5836	2.6556	2.8014	2.9464	2.7965	2.4689	2.1512	2.1647	2.3160	2.1620
	25 th Percentile	1.3677	1.5558	1.6245	1.6634	1.7832	1.6849	1.4563	1.3631	1.3054	1.3569	1.3162

<u>Total Debt</u> <u>Assets</u>	N/Missing Obs.	464/22	484/20	504/18	529/12	548/6	556/5	545/5	535/4	493/3	476/3	453/2
	Mean	0.2302	0.2155	0.2148	0.2064	0.2035	0.2086	0.2211	0.2255	0.2248	0.2254	0.2268
	75 th Percentile	0.3312	0.3193	0.3076	0.2968	0.3039	0.2998	0.3134	0.3200	0.3121	0.3150	0.3087
	Median	0.2011	0.1925	0.2064	0.1948	0.1859	0.1819	0.1947	0.2011	0.2012	0.2006	0.2081
	25 th Percentile	0.0822	0.0751	0.0744	0.0669	0.0632	0.0819	0.0841	0.0885	0.0745	0.0859	0.0812
<u>Cash Flow Volatility</u>	N/Missing Obs.	242/244	251/253	268/254	294/247	314/240	350/208	375/175	351/188	338/158	320/159	315/140
	Mean	15.9769	17.2246	20.8484	27.323	37.9465	45.9769	56.6278	53.1142	50.4597	44.9375	47.8833
	75 th Percentile	17.1603	19.8253	23.2081	30.2756	39.5400	47.0853	53.3446	54.4367	53.9126	49.195	50.5609
	Median	8.1199	10.2111	11.9277	14.7087	17.9485	22.2777	23.4000	24.316	22.6307	20.2632	20.2781
	25 th Percentile	3.7569	4.7217	5.9853	7.0015	7.7136	9.2939	10.7730	9.5724	9.9592	9.8272	9.3927
<u>Net Equity Issue</u> <u>Assets</u>	N/Missing Obs.	376/110	402/102	427/95	463/78	489/65	501/60	498/52	496/43	457/39	441/38	419/36
	Mean	0.0369	0.0429	0.0256	0.0179	0.0185	0.0112	-0.0034	-0.0108	-0.0058	-0.0135	-0.0142
	75 th Percentile	0.0238	0.0272	0.0215	0.0199	0.0141	0.0155	0.0099	0.0069	0.0073	0.0055	0.0051
	Median	0.0025	0.0040	0.0033	0.0032	0.0022	0.0027	0.0010	0.0006	0.0004	0	0
	25 th Percentile	0	0	0	0	0	0	-0.0060	-0.0082	-0.0075	-0.0136	-0.0147
<u>Total Dividends</u> <u>Assets</u>	N/Missing Obs.	465/21	484/20	507/15	530/11	543/11	557/4	545/5	535/4	494/2	475/4	454/1
	Mean	0.0155	0.0142	0.0143	0.0143	0.0168	0.0168	0.0172	0.0147	0.0190	0.0160	0.0163
	75 th Percentile	0.0236	0.0230	0.0223	0.0229	0.0225	0.0234	0.0241	0.0234	0.0242	0.0246	0.0244
	Median	0.0102	0.0090	0.0091	0.0079	0.0084	0.0089	0.0090	0.0092	0.0108	0.0108	0.0109
	25 th Percentile	0	0	0	0	0	0	0	0	0	0	0
<u>Inventory</u> <u>Assets</u>	N/Missing Obs.	462/24	480/24	501/21	529/12	548/6	555/6	546/4	532/7	491/5	473/6	450/5
	Mean	0.1836	0.1750	0.1711	0.1634	0.1592	0.1537	0.1493	0.1478	0.1437	0.1409	0.1399
	75 th Percentile	0.2872	0.2723	0.2661	0.2625	0.2566	0.2409	0.2370	0.2301	0.2262	0.2227	0.2234
	Median	0.1549	0.1390	0.1386	0.1251	0.1185	0.1175	0.1149	0.1053	0.1068	0.1040	0.1022
	25 th Percentile	0.0381	0.0321	0.0287	0.0297	0.0276	0.0267	0.0264	0.0268	0.0271	0.0289	0.0277
<u>R&D</u> <u>Assets</u>	N/Missing Obs.	257/229	278/226	302/220	315/226	333/221	332/229	318/232	315/224	292/204	285/194	271/184
	Mean	0.0714	0.0630	0.0632	0.0627	0.0535	0.0514	0.0595	0.0600	0.0554	0.0540	0.0544
	75 th Percentile	0.1034	0.0946	0.0877	0.0898	0.0826	0.0813	0.0904	0.0914	0.0906	0.0876	0.0914
	Median	0.0380	0.0408	0.0333	0.0350	0.0333	0.0326	0.0337	0.0330	0.0332	0.0359	0.0342
	25 th Percentile	0.0062	0.0070	0.0069	0.0072	0.0058	0.0083	0.0080	0.0064	0.0057	0.0068	0.0059
<u>Assets</u>	N/Missing Obs.	469/17	488/16	509/13	534/7	552/2	560/1	549/1	537/2	495/1	478/1	455/
	Mean	1007.28	1146.29	1413.78	1740.01	2167.47	3029.93	3480.26	4330.44	4195.20	4496.39	4329.03
	75 th Percentile	864.66	1020.83	1287.76	1693.41	2232.10	2994.20	3736.00	4048.10	4093.00	4115.40	4271.90
	Median	365.64	433.01	550.57	712.37	946.11	1214.00	1451.00	1626.50	1681.80	1901.05	2004.10
	25 th Percentile	135.41	167.85	214.39	293.67	388.70	512.43	560.80	636.26	704.01	806.25	862.36

Table 2. Changes in relative cash holdings of S&P 500 firms

The table shows the scaled cash holdings (scaled by assets or lagged assets); the industry-adjusted scaled cash; the year-over-year growth rates of raw cash, raw assets, and industry-adjusted raw cash; and matching-firms adjusted raw cash of the S&P 500 addition firms for each year in [-5,+5]. In column 10 the average assets-scaled cash holdings of the top-size-decile Compustat firms are also presented (see the text for further detail on the techniques used for this purpose). Whenever possible the cross-sectional means (top panel) and cross-sectional medians (bottom panel) for each year are presented. The matching uses the Abadie and Imbens (2006) matching estimator (further details on the matching technique are presented in the text). The industry adjustment uses the industry medians (using 3-digit SICs). The sample is 558 S&P 500 addition firms that joined the index during the period 1971-2006. The growth rates in columns (7) and (8) are winsorized at the 1% and 99% levels to avoid extreme observations associated with y-o-y percentage changes. The rows in the bottom of each panel show the averages (averaged across time) during the before ([-5,-1]) and after ([+1,+5]) periods. The *p*-values from the tests for significant difference between the means and medians of before and after periods are also presented.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
T	Number of Firms	Cash/Assets _(t)	Cash/Assets _(t-1)	Ind-Adj Cash/Assets _(t) (using the median for 3-digit SIC)	Growth in Raw Assets (y-o-y)	Growth in Raw Cash (y-o-y)	Growth in Ind-Adj Raw Cash (y-o-y)	Abadie-Imbens Matching Estimator; Raw Cash _(i,t) - Avg. Raw Cash of Matching Firms _(i,t) ; in million \$s	Avg. Cash/Assets _(t) for the top size decile in COMPUSTAT
Cross-Sectional Means (for the new S&P 500 firms)									
-5	486	0.1439	0.2241	0.0458				-\$11.17	0.1412
-4	504	0.1539	0.3151	0.0483	42.83%	107.07%	115.22%	\$5.21	0.1444
-3	522	0.1479	0.2759	0.0419	39.09%	85.99%	75.48%	-\$3.99	0.1470
-2	541	0.1421	0.2290	0.0351	33.62%	92.53%	97.71%	\$9.29	0.1502
-1	554	0.1434	0.2589	0.0355	42.93%	116.37%	131.76%	\$1.70	0.1537
0	558	0.1350	0.1990	0.0274	37.92%	88.72%	86.16%	\$4.48	0.1555
1	550	0.1328	0.1630	0.0242	20.18%	52.22%	64.04%	-\$36.59	0.1572
2	539	0.1282	0.1441	0.0186	19.48%	58.20%	49.91%	-\$20.05	0.1591
3	496	0.1322	0.1505	0.0181	13.93%	57.83%	52.39%	-\$4.86	0.1612
4	479	0.1374	0.1555	0.0213	11.71%	56.56%	44.95%	-\$16.44	0.1634
5	455	0.1330	0.1477	0.0185	9.76%	41.27%	45.39%	-\$33.84	0.1655
Average Befor(-5,-1) =		0.1462	0.2606	0.0413	39.61%	100.49%	105.04%	\$0.21	0.1473
Average After(+1,+5) =		0.1327	0.1522	0.0201	15.01%	53.22%	51.34%	-\$22.36	0.1613
t-test (p-values)		5.20 (0.0008)	6.40 (0.0002)	7.33 (<0.0001)	8.09 (<0.0001)	6.72 (0.0003)	4.28 (0.0171)	4.15 (0.0142)	8.41 (0.0011)
Cross-Sectional Medians (for the new S&P 500 firms)									
-5	486	0.0819	0.0957	0.0102				--	--
-4	504	0.0840	0.0995	0.0108	17.58%	20.87%	14.79%	--	--
-3	522	0.0790	0.1012	0.0049	18.89%	16.18%	9.79%	--	--
-2	541	0.0780	0.0969	0.0037	19.47%	21.99%	18.49%	--	--
-1	554	0.0785	0.1057	0.0030	19.14%	22.52%	22.48%	--	--
0	558	0.0777	0.0962	0.0000	17.11%	21.28%	14.39%	--	--
1	550	0.0722	0.0813	-0.0007	12.84%	6.61%	6.71%	--	--
2	539	0.0720	0.0827	0.0000	9.99%	11.18%	2.29%	--	--
3	496	0.0718	0.0797	-0.0004	9.61%	8.62%	4.36%	--	--
4	479	0.0715	0.0785	0.0000	8.32%	11.02%	5.01%	--	--
5	455	0.0755	0.0783	0.0001	7.17%	6.01%	2.22%	--	--
Average Befor(-5,-1) =		0.0803	0.0998	0.0065	18.77%	20.39%	16.39%	--	--
Average After(+1,+5) =		0.0726	0.0801	-0.0002	9.59%	8.69%	4.12%	--	--
t-test (p-values)		2.51 (0.0122)	2.51 (0.0122)	2.51 (0.0119)	2.33 (0.0200)	2.33 (0.0200)	2.33 (0.0200)	--	--

Table 3. Determinants of the new S&P 500 firms' cash holdings

The table describes the determinants of the new S&P 500 firms' cash holdings around the period of their inclusion, [-5,+5]. The sample size is 5,126 firm-years within the period of 1971-2006. The dependent variable is cash divided by contemporaneous assets. *After* is a dummy variable set to 1 for panel data years that include the years following the index addition year, and set to zero for the panel data years before addition. The remaining control variables are as defined in *Appendix A*. The regressions are run for non-industry adjusted (columns (1) through (4)) and industry-adjusted (columns (5) through (8)) versions of these variables. The industry adjustment uses median industry values. The results in columns (3) and (7) include variables to control for the shocks in the macroeconomic conditions. The year fixed effects are removed for these two regressions to better capture the year-over-year variation in the macroeconomic variables. The results in under columns (4) and (8) are obtained by using Erickson and Whited's (2002) GMM-based estimator (see the text for more details on this model's specifications). The numbers in parentheses below the coefficients are the *t*-stats calculated using standard errors that are robust to both clustering at the firm level and heteroskedasticity (in case of GMM, they are the unadjusted *z*-stats). At the bottom, we report the total number of observations used in that regression and the regression's R^2 . Only the coefficients that are NOT significant at 10% level are indicated with "#".

Independent Variables	Not Adjusted for Industry Effects				Industry Adjusted			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.3740 (24.18)	0.3171 (9.69)	0.3375 (7.89)	0.3663 (9.88)	0.0857 (12.67)	0.1019 (3.26)	0.1340 (3.54)	0.0912 (2.74)
After	-0.0153 (-3.05)	-0.0229 (-4.74)	-0.0247 (-5.29)	-0.0206 (-4.21)	-0.0135 (-2.83)	-0.0194 (-3.97)	-0.0163 (-3.49)	-0.0161 (-3.50)
Cash Flows	0.0178# (0.84)	0.0107# (0.78)	0.0098# (0.78)	0.0171# (0.77)	-0.0043# (-0.62)	0.0016# (0.16)	0.0015# (0.16)	-0.0042# (-0.65)
Size	-0.0001 (-8.04)	-0.0001 (-6.77)	-0.0001 (-6.81)	-0.0001 (-8.01)	-0.0001 (-6.62)	-0.0001 (-7.21)	-0.0001 (-7.21)	-0.0001 (-6.64)
Acquisitions	-0.2939 (-7.02)	-0.3005 (-8.62)	-0.2990 (-8.78)	-0.3072 (-7.40)	-0.3240 (-7.73)	-0.3332 (-9.08)	-0.3343 (-9.22)	-0.3284 (-7.71)
Expenditures	-0.6392 (-14.77)	-0.5056 (-11.25)	-0.4926 (-11.02)	-0.5778 (-13.21)	-0.4461 (-9.44)	-0.4074 (-8.72)	-0.4003 (-8.63)	-0.4324 (-9.34)
NWC	-0.3420 (-18.87)	-0.4570 (-14.28)	-0.4533 (-14.47)	-0.3282 (-17.65)	-0.4209 (-13.91)	-0.3866 (-10.66)	-0.3839 (-10.62)	-0.4239 (-14.10)
R&D	0.6729 (4.84)	0.3176 (2.87)	0.3147 (2.88)	0.6644 (4.71)	0.3126 (2.56)	0.2079 (2.33)	0.2108 (2.38)	0.3168 (2.49)
M/B	0.0003 (1.75)	0.0002# (1.54)	0.0002 (1.68)	0.0001 (17.08)	0.0002 (1.70)	0.0001 (1.57)	0.0001# (1.27)	-0.0001 (-10.23)
Leverage	-0.2643 (-12.27)	-0.1640 (-8.43)	-0.1625 (-8.59)	-0.2627 (-12.33)	-0.1637 (-9.73)	-0.1207 (-6.10)	-0.1252 (-6.39)	-0.1636 (-9.80)
CF Volatility	0.0001 (2.73)	0.0002 (2.56)	0.0002 (2.58)	0.0001 (2.42)	0.0001 (2.64)	0.0002 (2.62)	0.0001 (2.60)	0.0001 (2.55)
Distributions	-0.0682 (-8.21)	-0.0280 (-3.74)	-0.0282 (-3.80)	-0.0653 (-8.03)	-0.0443 (-7.11)	-0.0326 (-4.22)	-0.0345 (-4.50)	-0.0424 (-6.60)
INDPRO			-0.0028 (-3.32)	-0.0023 (-2.61)			-0.1227# (-1.45)	-0.0005# (-0.64)
T-Bill_3Mo			0.0027 (2.22)	0.0022 (1.75)			0.0001# (0.04)	-0.0010# (-0.79)
Stock Market			0.00003# (1.37)	0.00004# (1.42)			-0.0001# (-0.03)	-0.0001# (-0.22)
M2 Money			0.0066 (3.86)	0.0071 (3.97)			0.0036 (2.08)	0.0023# (1.31)
R^2	0.4445	0.6094	0.6064	--	0.2364	0.4135	0.4068	--
<i>J</i> -stat (<i>p</i> -value)	--	--	--	0.1 (0.9)	--	--	--	0.1 (0.9)
Obs. Used	2,721	2,721	2,721	2,721	2,721	2,721	2,721	2,721
Year Fix. Effects	No	Yes	No	No	No	Yes	No	No
Firm Fix. Effects	No	Yes	Yes	No	No	Yes	Yes	No

Table 4. Determinants of the new S&P 500 firms' cash holdings; Constrained vs. unconstrained sub-samples

The table describes the determinants of the new S&P 500 firms' cash holdings around the period of their inclusion for the constrained and unconstrained subsamples (using Whited and Wu, 2006 index). The dependent and independent variables are as in Table 3. The regressions are run for non-industry adjusted (columns (1) through (6)) and industry-adjusted (columns (7) through (12)) versions of these variables. The results for the constrained sub-sample are under columns (1), (2), (3), (7), (8), and (9). The rest of the regressions are for unconstrained sub-sample. Like in Table 3, some columns show the results including controls for the macroeconomic conditions (e.g., (2), (5), (8), (11)) and the regressions results obtained by using Erickson-Whited (2002) estimation method (e.g., (3), (6), (9), (12)). The rest of the specifications are like in Table 3. The coefficients that are NOT significant at 10% level are indicated with “#”.

	Not Adjusted for Industry Effects						Industry Adjusted					
	Constrained			Unconstrained			Constrained			Unconstrained		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept	0.3922 (14.35)	0.2623 (4.00)	0.3784 (6.09)	0.1765 (5.83)	0.2435 (5.87)	0.1003# (1.08)	0.0411 (1.71)	0.0806# (1.29)	0.0912 (1.57)	0.0297# (1.20)	0.1118 (2.94)	0.7494# (-0.72)
After	-0.0272 (-2.85)	-0.0260 (-2.83)	-0.0326 (-3.79)	-0.0139 (-2.68)	-0.0164 (-3.35)	-0.0125 (-1.70)	-0.0256 (-2.57)	-0.0188 (-1.98)	-0.0276 (-3.26)	-0.0098 (-1.88)	-0.0074 (-1.69)	-0.0067 (-1.67)
Cash Flows	0.1017 (2.34)	0.0879 (2.18)	0.1022 (2.40)	0.0025# (0.77)	0.0038# (1.20)	0.0001# (0.02)	0.0600# (1.44)	0.0552# (1.37)	-0.0031# (-0.09)	0.0039# (1.56)	0.0026# (1.11)	-0.0502# (-0.46)
Size	-0.0001 (-2.58)	-0.0001 (-2.66)	-0.0001 (-3.36)	-0.0001 (-5.39)	-0.0001 (-5.44)	-0.0001# (-0.87)	-0.0001 (-2.80)	-0.0001 (-2.84)	-0.0001 (-2.94)	-0.0001 (-5.60)	-0.0001 (-5.66)	0.0001# (0.64)
Acquisitions	-0.4913 (-7.26)	-0.4963 (-7.52)	-0.5040 (-7.35)	-0.1787 (-4.81)	-0.1747 (-4.55)	-0.2735 (-3.88)	-0.5101 (-7.51)	-0.5292 (-8.34)	-0.4713 (-6.46)	-0.1838 (-4.98)	-0.1849 (-4.92)	-0.8091 (-1.70)
Expenditures	-0.6082 (-8.22)	-0.5869 (-7.94)	-0.8545 (-12.06)	-0.3426 (-6.27)	-0.3437 (-6.28)	-0.3693 (-6.02)	-0.5311 (-6.47)	-0.5169 (-6.38)	-0.6202 (-8.08)	-0.2437 (-4.26)	-0.2478 (-4.33)	-1.9548 (-1.91)
NWC	-0.6410 (-10.75)	-0.6400 (-11.26)	-0.4254 (-14.82)	-0.2677 (-9.01)	-0.2633 (-9.14)	-0.1539 (-4.52)	-0.5859 (-8.70)	-0.5864 (-8.85)	-0.6594 (-13.01)	-0.2369 (-7.33)	-0.2283 (-7.19)	-0.0557# (-0.22)
R&D	0.3480 (3.02)	0.3398 (2.95)	0.6024 (4.49)	0.2760 (1.89)	0.2967 (2.05)	0.4114 (2.03)	0.2429 (2.33)	0.2509 (2.43)	0.3030 (2.12)	-0.1416# (-0.84)	-0.0945# (-0.52)	1.5519 (1.70)
M/B	0.0001# (1.44)	0.0001# (1.45)	0.0001 (16.13)	0.0022 (2.96)	0.0020 (2.79)	0.0299 (2.87)	0.0001# (1.01)	0.0001# (1.07)	-0.0001 (-6.73)	0.0026 (3.32)	0.0026 (3.38)	0.19008# (0.81)
Leverage	-0.1379 (-3.44)	-0.1375 (-3.67)	-0.2255 (-7.78)	-0.1463 (-7.51)	-0.1508 (-7.97)	-0.1809 (-4.26)	-0.1038 (-2.62)	-0.1150 (-3.04)	-0.1631 (-6.21)	-0.1336 (-6.66)	-0.1347 (-6.76)	-0.1849 (-1.68)
CF Volatility	0.0002 (2.51)	0.0002 (2.66)	0.0001 (2.26)	0.0002 (3.35)	0.0002 (3.48)	0.0001 (1.76)	0.0002 (2.98)	0.0002 (2.82)	0.0001 (2.62)	0.0002 (3.26)	0.0002 (3.16)	0.0005 (2.60)
Distributions	-0.0306 (-2.89)	-0.0310 (-3.01)	-0.0545 (-5.74)	-0.0235 (-2.12)	-0.0220 (-2.00)	-0.0276# (-1.50)	-0.0311 (-2.84)	-0.0346 (-3.19)	-0.03355 (-3.81)	-0.0319 (-2.87)	-0.0326 (-3.00)	-0.0333 (2.29)
INDPRO		-0.0005# (-0.32)	-0.0009# (-0.65)		-0.0043 (-5.21)	-0.0032 (-2.21)		0.0006# (0.33)	0.0006# (0.41)		-0.0031 (-3.69)	0.0014# (0.19)
T-Bill_3Mo		0.0009# (0.38)	-0.0006# (-0.26)		0.0054 (4.19)	0.0093 (3.36)		-0.0036# (-1.48)	-0.0032# (-1.42)		0.0032 (2.55)	0.0335# (0.81)
Stock Market		-0.00002# (-0.44)	-0.00002# (-0.06)		0.00005 (2.38)	-0.00004# (-0.63)		-0.00006# (-1.26)	-0.00001# (-1.18)		0.00005 (2.00)	-0.0006# (-0.75)
M2 Money		0.0034# (1.12)	0.0067 (2.33)		0.0094 (5.44)	0.0122 (3.63)		0.0017# (0.55)	0.0014# (0.48)		0.0060 (3.37)	0.0295# (0.75)
R ²	0.6067	0.6026	--	0.6188	0.6091	--	0.4831	0.4690	--	0.4661	0.4546	--
Obs. Used	1,232	1,232	1,232	1,488	1,488	1,488	1,232	1,232	1,232	1,488	1,488	1,488
Year Fix. Eff.	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No
Firm Fix. Eff.	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No

Table 5. Means from before and after addition date

The table presents a univariate comparison of the means of various firm characteristics from the 5 years before addition ([-5, -1]) to the 5 years after addition ([+1, +5]). The event year that the firm was added to the S&P 500 Index is not included. *Size* is measured by the total assets of the firm. *Cash Flow* is defined as net income plus depreciation and amortization, less both preferred and common dividends. *Cash flow volatility* is a measure of volatility of a firm's quarterly operating income before depreciation over a 3 year period centered on each event time year. *Expenditures* measure the capital expenditures (i.e., investments) of the firm per year. *Net working capital, NWC*, is calculated as total receivables plus inventories less accounts payable. The *market-to-book ratio (M/B)* is measured as the market value of equity divided by the total book value of equity. *Total debt* is calculated as total long-term debt plus total current short-term debt. *Short-term debt* is the debt with maturity less than a year. *Net equity issue* is defined as the total dollar amount obtained through the sale of common and preferred stocks less the total dollar amount used to purchase common and preferred stocks. The rest of the variables, *Assets*, *Sales*, *Cash Holdings*, *Acquisitions*, *Inventory*, *Research and Development (R&D) spending*, and *Total Dividends* are as reported by COMPUSTAT. As is standard in the literature, when reporting some firm characteristics, the variables are scaled by the total assets of the firm to achieve uniformity across firms with various sizes. We report the firm-year means for both before- and after-addition year periods for the unadjusted (first four columns in each panel) and for the industry-adjusted versions of these variables (last four columns), where the industry adjustment is done by subtracting 3-digit SIC code industry medians. We also divide the sample into two-subsamples, financially constrained (Panel B) and financially unconstrained (Panel C), and report the results for the unadjusted and the industry-adjusted versions of the variables for each sub-sample. Firms having their Whited and Wu (2006) index values in the top (bottom) five deciles are considered financially constrained (unconstrained). The reported *t*-stats are from the test of the difference between the two period means being equal to zero.

Panel A: Mean Unadjusted and Industry-Adjusted Characteristics for Full Sample								
Characteristics	Mean Unadjusted Characteristics				Mean Industry-Adjusted Characteristics			
	5 years Before	5 years After	% Change	Difference t-stat	5 years Before	5 years After	%Change	Difference t-stat
Size	6.3367	7.4382	17.38%	28.57	2.2168	2.8316	27.73%	15.62
Sales/Assets	1.3360	1.2005	-10.14%	-5.49	0.0752	0.0240	-68.09%	-3.47
Cash Holdings/Assets	0.1461	0.1326	-9.24%	-2.92	0.0410	0.0202	-50.73%	-5.42
Cash Flow/Assets	0.1005	0.0827	-17.71%	-3.00	0.0479	0.0402	-16.08%	-1.29
Cash Flow Volatility	24.635	50.852	106.42%	9.24	19.827	44.382	123.85%	9.13
Acquisitions/Assets	0.0218	0.0225	3.21%	0.41	0.0211	0.0213	0.95%	0.11
Expenditure/Assets	0.0931	0.0753	-19.12%	-9.32	0.0262	0.0159	-39.31%	-6.69
NWC/Assets	0.2470	0.2124	-14.01%	-7.03	-0.0050	-0.0080	-60.00%	-0.92
Inventory/Assets	0.1699	0.1446	-14.89%	-6.08	-0.0001	-0.0070	-6900.00%	-2.79
R&D/Assets	0.0623	0.0568	-8.83%	-1.86	0.0035	-0.0020	-157.14%	-2.28
M/B	3.2200	3.0800	-4.25%	-0.21	1.3300	1.3000	-2.65%	-0.06
Total Debt/Assets	0.2136	0.2246	5.15%	2.16	-0.0120	0.0002	101.67%	2.68
Short Term Debt /Assets	0.0326	0.0369	13.19%	2.46	-0.0040	0.0059	247.50%	5.96
Net Equity Issue/Assets	0.0275	-0.0090	-132.73%	-14.35	0.0208	-0.0140	-167.31%	-13.45
Total Dividends/Assets	0.0150	0.0166	10.67%	1.46	0.0094	0.0117	24.47%	2.17

Panel B: Mean Unadjusted and Industry-Adjusted Characteristics for Financially Constrained Firms Based on the Whited & Wu Index

Characteristics	<u>Mean Unadjusted Characteristics</u>				<u>Mean Industry-Adjusted Characteristics</u>			
	5 years Before	5 years After	% Change	Difference t-stat	5 years Before	5 years After	%Change	Difference t-stat
Size	5.7089	6.8346	19.72%	21.40	2.1289	2.8656	34.60%	13.28
Sales/Assets	1.2527	1.1408	-8.93%	-3.61	0.0809	0.0256	-68.36%	-2.73
Cash Holdings/Assets	0.1980	0.1719	-13.18%	-3.43	0.0601	0.0238	-60.40%	-5.53
Cash Flow/Assets	0.1096	0.0662	-39.60%	-5.87	0.0682	0.0407	-40.32%	-3.62
Cash Flow Volatility	19.115	39.245	105.31%	4.66	16.410	36.329	121.38%	1.64
Acquisitions/Assets	0.0204	0.0196	-3.92%	-0.32	0.0198	0.0191	-3.54%	-0.30
Expenditure/Assets	0.0988	0.0731	-26.01%	-8.88	0.0307	0.0161	-47.56%	-6.26
NWC/Assets	0.2525	0.2314	-8.36%	-2.81	0.0018	0.0047	161.11%	0.62
Inventory/Assets	0.1550	0.1431	-7.68%	-1.94	0.0015	-0.0020	-233.33%	-1.02
R&D/Assets	0.0880	0.0776	-11.82%	-2.11	0.0066	-0.0040	-160.61%	-2.31
M/B	3.4000	3.3200	-2.35%	-0.06	1.2200	1.4700	20.49%	0.20
Total Debt/Assets	0.1838	0.2046	11.32%	2.69	-0.0150	0.0110	173.33%	3.56
Short Term Debt /Assets	0.0316	0.0401	26.90%	2.89	-0.0040	0.0099	347.50%	5.17
Net Equity Issue/Assets	0.0371	-0.0070	-118.87%	-10.23	0.0273	-0.0140	-151.28%	-9.55
Total Dividends/Assets	0.0123	0.0153	24.39%	1.51	0.0087	0.0119	36.78%	1.58

Panel C: Mean Unadjusted and Industry-Adjusted Characteristics for Financially Unconstrained Firms Based on the Whited & Wu Index

Characteristics	<u>Mean Unadjusted Characteristics</u>				<u>Mean Industry-Adjusted Characteristics</u>			
	5 years Before	5 years After	% Change	Difference t-stat	5 years Before	5 years After	%Change	Difference t-stat
Size	6.9690	8.0262	15.17%	24.38	2.3423	2.8001	19.54%	8.15
Sales/Assets	1.4319	1.2687	-11.40%	-4.13	0.0479	0.0237	-50.52%	-1.12
Cash Holdings/Assets	0.0930	0.0913	-1.83%	-0.37	0.0241	0.0145	-39.83%	-2.43
Cash Flow/Assets	0.0931	0.0985	5.80%	0.59	0.0271	0.0393	45.02%	1.32
Cash Flow Volatility	28.321	60.612	114.02%	8.74	21.740	51.034	134.75%	8.79
Acquisitions/Assets	0.0231	0.0259	12.12%	0.99	0.0224	0.0240	7.14%	0.56
Expenditure/Assets	0.0893	0.0783	-12.32%	-4.31	0.0229	0.0166	-27.51%	-3.11
NWC/Assets	0.2462	0.1968	-20.06%	-7.43	-0.0140	-0.0200	-42.86%	-1.29
Inventory/Assets	0.1911	0.1480	-22.55%	-7.27	-0.0020	-0.0100	-400.00%	-2.39
R&D/Assets	0.0288	0.0324	12.50%	1.61	0.0004	0.0006	50.00%	0.07
M/B	2.9700	2.8000	-5.72%	-0.52	1.3900	1.0800	-22.30%	-0.93
Total Debt/Assets	0.2452	0.2406	-1.88%	-0.69	-0.0090	-0.0130	-44.44%	-0.83
Short Term Debt /Assets	0.0326	0.0338	3.68%	0.60	-0.0050	0.0018	136.00%	3.78
Net Equity Issue/Assets	0.0163	-0.0100	-161.35%	-9.65	0.0126	-0.0120	-195.24%	-8.87
Total Dividends/Assets	0.0185	0.0178	-3.78%	-0.77	0.0105	0.0113	7.62%	1.09

Table 6. Evidence from pre- and post-inclusion corporate bond spreads.

The table shows evidence of a decline in corporate credit spreads following addition into the S&P 500 index. For each bond issue, the credit spread is calculated by subtracting the current yield-to-maturity (YTM) of a similar term treasury security from the YTM of the firm's new bond issue. Panel A shows the change in the credit spreads for the same firm before and after inclusion (change in spread = spread after – spread before). There are a total of 62 index firms that issued similar term bonds during both the 5 year period before and the 5 year period after the year of inclusion. The mean/median credit spread for each of these firms is calculated for both the 5 year period before and the 5 year period after the addition, and then the difference between the two periods' mean/median credit spreads is displayed. The table shows the spreads for various bond maturities (1-5, 6-10, 11-20, and 21-30 year terms) and the number of firms that issued bonds of that particular maturity. Panel B shows the change in average and median credit spreads for the before and after inclusion periods, where averaging is done across all observations of debt issuance within the period. The mean and median credit spread for each bond term in both the 5 year period before and the 5 year period after the addition year is calculated, and the differences reported. The *t*-stat and *p*-value associated with the statistical significance of the difference in means and medians are also shown. The number of firms issuing a particular bond term is reported next to the mean/median credit spread of that bond term.

Panel A: Change in Credit Spreads for the Same Firm

<u>Bond Term</u>	<u>Number of Firms Issuing</u>	<u>Mean Spread Difference</u>	<u>Median Spread Difference</u>
1 to 5 Years	10	-1.58%	-1.58%
6 to 10 Years	36	-1.29%	-0.26%
11 to 20 Years	5	-1.11%	-0.32%
21 to 30 Years	11	+1.50%	+0.25%

Panel B: Change in Credit Spreads for All Bond Issues

<u>Bond Term</u>	<u>Mean Spread Before / Number of Issues</u>	<u>Mean Spread After / Number of Issues</u>	<u>Difference</u>	<u>t-stat</u>	<u>p-value</u>
1 to 5 Years	+0.86% / 61	+0.26% / 110	-0.60%	-2.48	0.0141
6 to 10 Years	+2.03% / 159	+1.34% / 183	-0.69%	-1.31	0.1922
11 to 20 Years	+0.48% / 73	+0.97% / 41	+0.49%	+1.88	0.0633
21 to 30 Years	-0.20% / 55	+0.10% / 54	+0.30%	+0.74	0.4624
<u>Bond Term</u>	<u>Median Spread Before / Number of Issues</u>	<u>Median Spread After / Number of Issues</u>	<u>Difference</u>	<u>z-stat</u>	<u>p-value</u>
1 to 5 Years	+0.53%/61	+0.44%/110	-0.09%	-1.77	0.0775
6 to 10 Years	+0.89%/159	+1.12%/183	+0.23%	+1.55	0.1205
11 to 20 Years	+0.60%/73	+0.81%/41	+0.21%	+2.01	0.0444
21 to 30 Years	+0.63%/55	+0.90%/54	+0.27%	+1.31	0.1915

Table 7. Changes in corporate credit ratings around inclusion year.

The table shows evidence of an increase in the number of firms receiving a credit rating after their addition to the S&P 500 Index, and an increase in the credit ratings for firms that were rated in both the 5 year period before and the 5 year period after. Using the point scale for letter ratings reported below, the mean credit rating is found for each firm that appears in the COMPUSTAT credit ratings dataset during the 5-year period before and the 5-year period after their addition year (not including their credit rating in the year of addition). The sample mean of these firm-level means for each 5 year before and after period are determined. Panel A shows the number of firms with a credit rating in each period and the mean credit rating of each group using the point scale. Panel B shows the total number of firms with a credit rating in both the before and the after periods, and the details concerning the level of changes in these credit ratings around addition to the index.

AAA = 20	A = 16	BBB- = 12	B+ = 8	CCC- = 3
AA = 19	A- = 15	BB+ = 11	B = 7	CC = 2
AA- = 18	BBB+ = 14	BB = 10	CCC+ = 5	D = 1
A+ = 17	BBB = 13	BB- = 9	CCC = 4	

Panel A: Number of firms receiving a Credit Rating

	Number of Firms with Credit Rating	Mean Point Scale Rating	Approximate Letter Rating
5 Year Before Addition Period	160	12.46	BBB-
5 Year After Addition Period	309	13.23	BBB

Panel B: Change in Credit Ratings for firms rated in both periods

Total Number of firms with Credit Ratings in Before and After periods: 147					
Decline in Point Rating	# of Firms	% of Firms	Increase in Point Rating	# of Firms	% of Firms
< = 1 Point	26	17.7%	< = 1 Point	38	25.9%
< = 2 Points	8	5.4%	< = 2 Points	18	12.2%
< = 3 Points	5	3.4%	< = 3 Points	11	7.5%
< = 4 Points	3	2.0%	< = 4 Points	6	4.1%
> 4 Points	2	1.4%	> 4 Points	1	0.7%
Total Decreasing:	44	29.9%	Total Increasing:	74	50.3%
Firms with No Change:	29	19.7%			

Table 8. Changes in corporate governance indicators around the inclusion year

The table displays the annual cross-sectional means of the corporate governance variables (Panel A) and their industry-adjusted versions (Panel B) from 5 years before to 5 years after the inclusion into the S&P 500 Index. The sample is 558 newly added S&P 500 firms. Industry adjustment is done using the median industry values (3-digit SICs). The corporate governance indicators are *Inst. Holdings* (percentage of shares outstanding held by institutional investors), *CBOARD* (classified board indicator), *EIndex* (the Bebchuk, et al., 2009 entrenchment index), and *GIM Index* (the Gompers, et al., 2003 anti-takeover index). Year 0 represents the calendar year that a firm was added to the index. Year +1 indicates the first full year of operations after a firm was added to the index, while year -1 is the last full year of operations before a firm was added to the index. *N* is the number of observations used to calculate the cross-sectional mean of the corresponding variable for that event year. The results (*p*-values) of the *t*-test comparing each variable's before and after values are also presented. The mean of before (after) values for each firm is calculated by averaging between -5 through -1 values (+1 through +5 values) of the corresponding variable for that firm. The difference in means is calculated, and then the *p*-values from the *t*-tests for the cross-sectional mean-difference being equal to zero are computed.

Panel A: Annual Cross-Sectional Mean of Corporate Governance Variables

Variables		t = -5	t = -4	t = -3	t = -2	t = -1	t = 0	t = 1	t = 2	t = 3	t = 4	t = 5	[-5,-1] vs. [+1,+5] <i>p</i> -values
Inst. Holdings	Mean	0.4603	0.4771	0.4663	0.4757	0.4555	0.4814	0.4395	0.4594	0.4059	0.4270	0.3981	0.0002
	N	212	240	272	307	346	364	369	368	346	347	334	345
CBOARD	Mean	0.4767	0.4615	0.4750	0.4825	0.5125	0.5257	0.5845	0.5894	0.6087	0.6058	0.6240	0.0852
	N	86	104	120	143	160	175	207	246	230	241	242	159
GIM Index	Mean	8.1047	8.1635	8.0583	8.1958	8.2625	8.4971	8.7488	8.9241	9.1345	9.2684	9.3824	0.0001
	N	86	104	120	143	160	175	207	224	223	231	238	159
EIndex	Mean	2.0814	2.0673	2.0417	2.1329	2.1688	2.2229	2.3671	2.4420	2.5157	2.5022	2.5084	0.0001
	N	86	104	120	143	160	175	207	224	223	231	238	159

Panel B: Annual Cross-Sectional Mean of Corporate Governance Variables (industry-adjusted using median 3-digit SICs)

Variables		t = -5	t = -4	t = -3	t = -2	t = -1	t = 0	t = 1	t = 2	t = 3	t = 4	t = 5	[-5,-1] vs. [+1,+5] <i>p</i> -values
Inst. Holdings	Mean	0.2694	0.2779	0.2671	0.2662	0.2350	0.2660	0.2136	0.2135	0.1639	0.1804	0.1536	0.5016
	N	210	239	271	306	342	364	369	348	339	340	330	345
CBOARD	Mean	-0.0756	-0.0962	-0.0458	-0.0594	-0.0566	-0.0714	-0.0411	-0.0420	-0.0561	-0.0534	-0.0148	0.0755
	N	86	104	120	143	159	175	207	226	223	234	237	155
GIM Index	Mean	-0.5756	-0.5625	-0.5500	-0.3462	-0.2767	-0.1714	-0.0266	0.1027	0.2399	0.2814	0.4557	0.0092
	N	86	104	120	143	159	175	207	224	223	231	237	155
EIndex	Mean	-0.0872	-0.1010	-0.1792	-0.1084	-0.0503	-0.0771	0.0700	0.1607	0.1704	0.1494	0.1835	0.0001
	N	86	104	120	143	159	175	207	224	223	231	237	155

Table 9. Where does the cash go? Evidence from the accounting identity for cash

The table displays the mean and median cash flows from financing (CFF), the cash flows from investing activities (CFI), and cash flows from operations (CFO) for the S&P 500 firms for each year in [-5,+5] (Panel A) and for the averaged before and after periods (*Panel B*). All three accounting items are scaled by assets. The sample is 558 newly added S&P 500 firms. N is the number of firms with the accounting item for that event year. In Panel B, the p -values of the t -test comparing each variable's before and after values are also shown. The mean of before (after) values for each firm is calculated by averaging from -5 through -1 values (+1 through +5 values) of the corresponding variable for that firm. The difference between mean after and mean before for the firm is calculated. The t -test for the cross-sectional mean differences being equal to zero are computed, and the corresponding p -value presented.

Panel A: Mean and Median for Each Year

		t=-5	t=-4	t=-3	t=-2	t=-1	t=0	t=+1	t=+2	t=+3	t=+4	t=+5
CFF	mean	0.0557	0.0876	0.0688	0.0434	0.0332	0.0230	0.0065	-0.0097	-0.0128	-0.0281	-0.0328
	median	0.0173	0.0164	0.0247	0.0139	0.0077	0.0083	0.0069	-0.0071	-0.0164	-0.0226	-0.0242
CFI	mean	-0.1374	-0.1412	-0.1358	-0.1429	-0.1249	-0.1277	-0.1217	-0.0936	-0.0989	-0.0805	-0.0799
	median	-0.1167	-0.1101	-0.1303	-0.1224	-0.1004	-0.1081	-0.1060	-0.0893	-0.0808	-0.0787	-0.0772
CFO	mean	0.1013	0.1128	0.1007	0.1222	0.1327	0.1236	0.1170	0.1138	0.1211	0.1179	0.1156
	median	0.1166	0.1099	0.1061	0.1198	0.1170	0.1164	0.1161	0.1120	0.1187	0.1156	0.1160
N		486	504	522	541	554	558	550	539	496	479	455

Panel B: Mean and Median Before and After the Inclusion.

		Before	After	difference test (p -values)
CFF	mean	0.0489	-0.0156	0.0001
	median	0.0139	-0.0152	0.0001
CFI	mean	-0.1342	-0.0946	0.0001
	median	-0.1137	-0.0845	0.0001
CFO	mean	0.1173	0.1071	0.0416
	median	0.1152	0.1080	0.0749

Table 10. Difference-in-difference analysis for terciles based on cash holding changes

Panel A of the table shows the difference in the mean changes (difference-in-difference) of the firm characteristics between the index firms in the top and bottom terciles of cash holdings. The variables capturing the firm characteristics are described in Table 4. The terciles are based on the magnitude of the change in *cash/assets*; the top (bottom) tercile consists of firms that decrease their cash holdings the least (the most). The mean change of each variable is calculated by finding the mean after and then subtracting from it the mean before. The after period is [+1,+5] and the before period is [-1,-5]. To find the difference-in-difference between the top and the bottom tercile, the mean change of the bottom tercile is subtracted from the mean change of the top tercile. The reported *t*-statistics are for tests of significance for the difference-in-difference between the two terciles. Panel B of the table shows the same difference-in-difference calculations, but for industry-adjusted variables, where adjustment is done using median values of all the firms in COMPUSTAT in the same 3-digit SIC code.

Panel A: Unadjusted Characteristics					Panel B: Industry-Adjusted Characteristics			
Characteristics	Top Tercile Change in Mean	Bottom Tercile Change in Mean	Difference-in- Difference	t-stat	Top Tercile Change in Mean	Bottom Tercile Change in Mean	Difference-in- Difference	t-stat
Size	0.9568	1.1565	-0.2000	-2.42	0.6499	0.5817	0.0681	0.78
Sales/Assets	-0.1530	-0.1310	-0.0230	-0.62	-0.0950	-0.0130	-0.0820	-2.26
Cash Holdings/Assets	0.0779	-0.0860	0.1639	18.58	0.0114	-0.0410	0.0528	4.57
Cash Flow/Assets	-0.0240	-0.0370	0.0123	0.99	-0.0130	-0.0160	0.0031	0.27
Cash Flow Volatility	49.5420	45.9820	3.5609	0.14	39.2980	47.2820	-7.9840	-0.35
Acquisitions/Assets	-0.0070	0.0099	-0.0170	-3.22	0.0048	0.0025	0.0023	0.45
Expenditure/Assets	-0.0220	-0.0200	-0.0030	-0.53	-0.0100	-0.0150	0.0048	1.18
NWC/Assets	-0.0550	-0.0160	-0.0380	-4.72	-0.0220	0.0147	-0.0360	-4.59
Inventory/Assets	-0.0420	-0.0100	-0.0320	-5.59	-0.0160	0.0035	-0.0190	-3.64
R&D/Assets	-0.0080	0.0021	-0.0100	-2.17	-0.0130	-0.0020	-0.0110	-2.44
M/B	-0.1260	-1.7300	1.6042	2.86	-0.7010	-0.7940	0.0924	0.18
Total Debt/Assets	0.0068	0.0495	-0.0430	-2.48	0.0185	0.0330	-0.0150	-1.02
Short Term Debt /Assets	-0.0110	0.0125	-0.0230	-4.18	0.0070	0.0092	-0.0020	-0.42
Net Equity Issue/Assets	-0.0400	-0.0440	0.0041	0.39	-0.0290	-0.0340	0.0048	0.59
Total Dividends/Assets	-0.0020	0.0023	-0.0050	-1.44	0.0018	0.0011	0.0007	0.37