What determines the composition of a firm's total cash reserves?*

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April 2015

Abstract:

We investigate what determines the variation in the composition of the financial assets that make up firms' total cash reserves. We find that a firm invests a larger fraction of its cash reserves in longer-maturity securities that are less liquid, but earn a higher yield (i) if the firm faces less uncertainty with respect to its short-term liquidity needs or (ii) if it is more difficult for the firm to access external capital markets and most of its cash reserves are held for precautionary purposes to meet its longer-term liquidity needs. We also document evidence that suggests in poorly governed firms managers hold a larger fraction of corporate cash reserves in highly liquid securities that earn a lower yield so they can more easily spend these reserves on self-serving projects. We use several different identification strategies to establish causality of our results. Our findings provide insights on an important component of corporate liquidity management practices.

* We thank Neil Brisley, Igor Cunha, Matthew Erickson, Chitru Fernando, Nathan Goldman, Matthew Hill, Kathy Kahle, Ken Klassen, Lubo Litov, Bill Megginson, Pat O'Brien, Hernan Ortiz-Molina, Matthew Serfling, Angel Tengulov, Ryan Williams, Pradeep Yadav, Jing Wang, Chunchi Wu, and seminar participants at the University of Arizona, University of Nebraska, University of Oklahoma, University of Waterloo, Texas Tech University, and Washington State University for helpful comments.

The total cash reserves held by U.S. firms has markedly increased over the last few decades and these reserves now make up more than twenty percent of the total assets of typical publicly traded firms in the U.S. (Foley, Hartzell, Titman, and Twite (2007) and Bates, Kahle, and Stulz (2009)). A growing body of work documents that firms choose the level of their total cash reserves by trading off the benefits and costs of these reserves. For instance, benefits of large cash reserves include that they reduce underinvestment problems for financially constrained firms (Almeida, Campello, and Weisbach (2004), Denis and Sibilkov (2010), and Almeida, Campello, Cunha, and Weisbach (2014)). On the other hand, costs of large cash holdings include the low return typically earned on these holdings (Kim, Mauer, and Sherman (1998)) and that in poorly governed firms these holdings can lead to managers investing in self-serving, value-decreasing projects (Jensen (1986) and Harford (1999)).

Despite the significant attention given to explaining the variation in the *total* amount of firms' cash reserves, we know surprisingly little about the determinants of the variation in the composition of the financial assets that constitute these reserves.[1] Yet, a proper understanding of this issue is central to the comprehension of corporate liquidity management practices. The importance of this understanding is underscored by the survey evidence documented in Lins, Servaes, and Tufano (2010) that CFOs report that three of the top four roles key to value creation are related to liquidity management.

To provide insights on what leads to the variation in the composition of firms' total cash reserves, we investigate what determines the variation in the extent to which firms hold more of these reserves in cash and cash equivalents (hereafter referred to as CCE) versus short-term investments (hereafter referred to as STI). Firms distinguish between these two types of cash reserves on the balance sheet, and most prior work defines a firm's total cash reserves as the sum of these two types of cash holdings. CCE consists of liquid cash and of

[1] Two contemporaneous papers provide some insights on firms' investment in financial assets. Duchin, Gilbert, Harford, and Hrdlicka (2014) exploit SFAS No. 157, which starting with the 2009 fiscal year requires all firms to report the fair value of their financial assets, to provide detailed evidence for S&P 500 firms over the 2009-2012 period on all the financial assets into which these firms invest. Brown (2014) collects aggregate data from the Flow of Funds Accounts maintained by the Federal Board of Governors and reports that the securities in which firms invest have become riskier over time.

highly liquid financial assets that had a maturity of 90 days or less when issued or at the time they were purchased by a firm, that earn a low return and are readily available to be converted to cash, such as overnight repos, commercial paper, and short-term certificates of deposit. STI consists mostly of (i) financial assets that had a remaining maturity of more than three months at the time of purchase and currently have a remaining maturity of 12 months or less that a firm has a strong intent to hold until maturity or (ii) financial assets that had a remaining maturity of more than three months when purchased that could currently have any remaining maturity, but for which it is possible that the firm would sell an asset in the next twelve months due to liquidity needs or if circumstances arise that make it financially attractive to sell the asset (i.e. its price increases).[2] We hand-collect data on the composition of STI for a random sample of firms and find that compared to CCE that STI investments are relatively less liquid, but earn higher yields, and that the most common types of STI are U.S. government debt and highly rated corporate and municipal bonds with low default rates.[3]

If a firm chooses to hold a larger proportion of its cash reserves in STI, it obtains the benefit of a greater yield but also reduces its access to liquidity because securities held in STI typically have higher transaction costs than those held in cash equivalents. Importantly, the longer maturity of STI securities also reduce a firm's access to liquidity because it increases the firm's interest rate risk (the risk that if interest rates rise the prices of the debt securities in the firm's investment portfolio will decrease). Because of this interest rate risk, when firms invest in STI they usually plan on holding all the STI securities until maturity (this is very often stated in firms' 10-Ks), which curtails their ability to rapidly convert STI securities into cash.[4] The above discussion leads to the premise that firms trade off the costs of reduced

[2] As we discuss in Section 2.1, financial assets into which firms invest their cash reserves are also categorized as STI if these assets fall under the category of 'trading securities', which are bought and sold with the objective of generating profits from short-term price fluctuations. However, as reported in this section, we find that, on average, trading securities make up only about two percent of firms' total STI.

[3] We note that financial investments classified as STI remain so until their maturity. That is, these investments do not become classified as cash equivalents when their maturity becomes less than 90 days (See FASB Statement No. 95, Footnote 2.). As discussed above, a firm will only classify a financial asset as a cash equivalent if it had a maturity of 90 days or less when issued or at the time it was purchased by the firm.

[4] In FASB Statement No. 95 it is stated that an important distinction between securities classified as cash equivalents versus STI is that securities classified as cash equivalents face significantly lower interest rate risk than do those classified as STI.

access to liquidity in the short-term with the benefits of higher yields on STI to determine the percent of their total cash reserves held in STI.[5] Survey evidence is consistent with this premise. For example, in discussing the results of a survey conducted by Sungard that asked corporate treasurers what are the key considerations in their cash investment policies, Michael Vogel, Senior VP at Sungard, explains that access to liquidity and maximization of return on cash investment instruments are two of the most important considerations.[6]

Over the 1980-2011 period, we document significant variation with respect to the proportion of firms' cash reserves held in STI. For our sample of Compustat industrial firms over this period, on average, 20% of a firm's total cash reserves consists of STI. However, during years when firms hold STI, on average, 50% of their total cash reserves are invested in STI.

To examine what determines variation in the fraction of total cash reserves invested in STI, we test several empirical predictions generated from the premise that firms trade off the costs of reduced access to liquidity in the short-term with the benefits of higher yields on STI when deciding on the percent of their total cash reserves held in STI. We first test the prediction that firms that have more difficulty forecasting their short-term liquidity needs hold less of their cash reserves in STI because the lower liquidity of STI in the short-term makes it less desirable when firms unexpectedly need to access significant amounts of their cash reserves. Consistent with our prediction, we find multivariate evidence that the fraction of a firm's cash reserves invested in STI is negatively associated with several different proxies for whether it could be harder for the firm to forecast its short-term liquidity needs.

We next investigate the effect of financial constraints on the composition of a firm's total cash reserves. Prior work convincingly shows that financially constrained firms maintain large cash reserves to ensure they have the required capital for their future

[5] Recent work in the fixed income literature suggests that cross-sectional differences in the liquidity of debt instruments can explain a greater fraction of the variation in yield spreads than can default risk (e.g., Chen, Lesmond, and Wei (2007) and Bao, Pan, and Wang (2011)), which is consistent with the notion that firms will trade off the lower liquidity of STI securities with the higher yields of these securities.

[6] See "Spotlight on Corporate Cash Investment Priorities," *Treasury Management International Magazine*, February, 2012.

investment and operating needs. Because typically a substantial portion of these reserves are held to meet longer-term liquidity needs, the lower liquidity of STI in the short-term should be less of a concern for financially constrained firms. Thus, we predict that such firms will hold more of their cash reserves in STI in order to earn additional yield on these reserves. Conversely, financially unconstrained firms are characterized by their ability to go to the capital markets for their financing needs, and as such, their generally smaller cash reserves are used to finance present day-to-day operations. Consequently, for these firms it should be beneficial if a larger portion of cash reserves are held in very liquid assets, such as CCE.[7] To test our predictions regarding financial constraints, we first run a series of different multivariate tests to provide within and across firm evidence on the association between the fraction of a firm's cash reserves that consists of STI and measures for financial constraints. Next, we examine whether during years when large amounts of their cash reserves are needed to fund new investment if financially constrained firms shift funds from STI to CCE. Finally, we employ three different identification strategies in which we exploit exogenous changes to a firm's ability to access external capital to provide evidence of a causal link from financial constraints to the extent to which a firm invests its cash reserves in STI.

Supporting our prediction for financial constraints, we first document that the fraction of a firm's cash reserves held in STI is positively associated with proxies for if the firm is financially constrained (the firm does not have a bond rating or it has a low leverage ratio (Faulkender and Petersen (2006)). To test our prediction, we also consider bank lines of credit because extant work shows that lack of access to or limited availability of funds from a credit line are powerful measures for whether a firm is financially constrained (e.g., Sufi (2009)). Providing additional evidence that financially constrained firms hold a larger fraction of their cash reserves in STI, we find that this fraction is negatively associated with whether a firm

[7] We acknowledge that some financially unconstrained firms that are large and successful, such as Google and Microsoft, have very large cash reserves and because these firms do not have urgent liquidity needs, they might invest a significant fraction of these reserves in STI. However, our prediction that, *on average*, financially unconstrained firms hold less of their cash reserves in STI is based on the findings from prior work that these firms typically hold smaller cash reserves because they can more easily rely on external capital markets for their longer-term financing needs (e.g., Opler, Pinkowitz, Stulz, and Williamson (1999)).

has a credit line. Further, contingent on having a credit line, this fraction is also negatively associated with the amount of credit available from a firm's credit line(s).

We also run tests that consider how firms accumulate cash. If firms that invest more in STI are financially constrained they should save more of their cash inflows (Almeida, Campello, and Weisbach (2004)). We document that firms that hold more of their cash reserves in STI save a larger fraction of their internally generated cash flows and also save a higher proportion of the proceeds they raise from equity and debt issues. Further, these firms put a larger fraction of each of these three cash inflows into STI relative to CCE. These results are further evidence consistent with the proposition that financially constrained firms invest more of their cash reserves in STI.

The notion that financially constrained firms put a significant fraction of their large cash reserves into STI in order to earn some additional yield while these reserves are held for long-term investment and operating needs relies on the assumption that during years when important amounts of these reserves are needed to fund new investment or a firm's operations that these firms transfer funds from STI to CCE. We document evidence that suggests during years when large amounts of their cash reserves are needed to fund real investment that financially constrained firms move funds from STI to CCE in order to increase the amount of very liquid funds they have available for investment. Specifically, we find that the positive effect of a firm's total cash reserves on its investment is more pronounced during years when the firm shifts large amounts of funds from STI to CCE. Importantly, we also show that this result only holds for financially constrained firms.

Next, we investigate whether exogenous decreases to the supply of externally available credit impact the fraction of financially constrained firms' cash reserves invested in STI. We expect that when the supply of credit contracts that these firms transfer funds from STI to CCE so they can more easily finance their investment or operating expenses with their cash reserves. To proxy for the aggregate supply of credit, we follow Harford (2005), Officer (2007), and Harford, Klasa, and Maxwell (2014) and measure it using the average spread of commercial and industrial loan rates relative to the federal funds rate. When this

spread increases (decreases) the aggregate supply of credit contracts (grows). We document that when the spread of commercial and industrial loan rates relative to the federal funds rate widens that firms shift liquid funds from STI to CCE. Further, we also show that this finding only holds for financially constrained firms. These results support our prediction and also the notion of a causal link from financial constraints to holdings of STI.

To further examine whether exogenous decreases in the supply of credit affect financially constrained firms' STI holdings, we focus on firms with a speculative grade debt rating (below investment grade) whose debt is considered high-yield debt. In doing so, we first follow Chernenko and Sunderam (2011) and proxy for the supply of credit available to these firms with net flows into high-yield bond mutual funds. We use a differences-in-differences approach and compare speculative grade firms to firms in a matched sample which are similar to firms with a speculative grade rating, but unlikely to be affected by flows into high-yield bond mutual funds. Consistent with expectations, we find that compared to the firms in the matched sample that firms with a speculative grade rating move liquid funds from STI to CCE when fund flows into high-yield bond mutual funds decrease.

Second, we follow Lemmon and Roberts (2010) and investigate the impact of a negative shock to the supply of speculative grade debt after 1989 as a result of the collapse of Drexel Burnham Lambert, Inc.; the passage of the Financial Institutions Reform, Recovery, and Enforcement Act of 1989; and regulatory changes in the insurance industry. Using a differences-in-differences methodology, in which we compare speculative grade firms to firms that are unlikely to have experienced a decrease in their supply of available credit, we find that during the years immediately following 1989 that speculative grade firms shifted funds from STI to CCE. Further, as discussed in Lemmon and Roberts (2010), in the Northeast U.S. in 1990 and 1991 bank lending also contracted sharply due to declining real estate prices, which reduced the ability of speculative grade firms to switch to alternative

financing sources during this period. Thus, we use the location of firms' headquarters to identify cross-sectional variation in the effect of a shock to access to credit on firms' STI holdings. Providing additional evidence of a causal effect from financial constraints to STI holdings, we find in a differences-in-differences framework that during the years right after 1989 that speculative grade firms in the Northeast of the U.S. moved funds from STI to CCE to a greater extent than did other speculative grade firms.

Finally, we examine the impact of a firm's corporate governance on the extent to which it invests its cash reserves into STI, and in doing so, provide additional insights on the effect of the lower liquidity of STI securities on firms' propensities to invest in these securities. As discussed earlier, prior work predicts and shows that managers in poorly governed firms use corporate cash holdings to invest in self-serving projects. Due to the lower liquidity of STI relative to CCE, such managers should prefer if their firm's cash reserves are held mostly in CCE rather than STI. This would provide these managers with easier access to their firm's cash reserves when they want to spend portions of these reserves on self-serving projects. Supporting this prediction, we find that firms with a weaker governance environment hold less of their cash reserves in STI. This result is robust to the use of several different proxies for a firm's corporate governance, including the G-index and the E-index, the presence of large blockholders, and the level and concentration of institutional ownership. Further, to provide evidence of a causal link from corporate governance to STI holdings, we use staggered state adoptions of antitakeover laws as an exogenous shock that reduces the quality of a firm's governance environment, and find again that a worse corporate governance environment leads to a firm holding less of its cash reserves in STI.[8]

[8] To mitigate concerns that our results could somehow be driven by firms with cash trapped overseas due to high repatriation taxes, we show that all of the results of our tests that examine the determinants of the extent to which firms hold their cash reserves in STI are robust to controlling for whether a firm has foreign sales and also the firm's tax costs of repatriating its foreign earnings. We also note that in Section 4.1 we report evidence that

Our study contributes in several ways. Importantly, we provide evidence on key determinants of the significant variation in the fraction of firms' total cash reserves that consists of STI. This allows us to shed light on what drives firms' choices with respect to the financial assets in which they invest their cash reserves, which is a critical component of corporate liquidity management practices. We also provide novel evidence on the composition of the large cash reserves held by financially constrained firms, and in doing so, show how these firms try to minimize the costs of maintaining these reserves. Further, our results increase the understanding of the substitutability between credit lines and cash reserves and imply that credit line access affects not only the magnitude of cash reserves, but also the composition of these reserves.[9] Likewise, our findings provide insights into the result documented in Harford, Mansi, and Maxwell (2008) that firms with poor corporate governance have smaller cash reserves because they spend more heavily. Our evidence implies this result could be in part due to managers in such firms holding more of their firm's cash reserves in CCE so they can more easily spend these reserves.

The remainder of this paper is organized as follows. Section 1 develops empirical predictions. Section 2 discusses differences between CCE and STI and reports detailed information on the composition of STI. Section 3 discusses our sample and reports univariate findings. Section 4 provides the results of our multivariate tests. Finally, Section 5 concludes.

1. Development of Empirical Predictions

Large corporate cash reserves can be beneficial for firms that are financially constrained because they reduce underinvestment problems for these firms and help ensure that a firm will have the funds needed to pay for its future operating expenses (e.g., Opler, Pinkowitz, Stulz, and Williamson (1999), Almeida, Campello, and Weisbach (2004), Denis

suggests firms with cash trapped overseas due to high repatriation taxes hold *less* STI than other firms. In this section, we explain that this result is consistent with growing anecdotal evidence that many foreign subsidiaries of U.S. multinational firms hold much of their cash reserves in bank accounts so they can more easily provide their U.S. based parents with liquidity via short-term loans to the parent firm.

[9] For evidence on how credit line access can impact corporate cash holdings, see Sufi (2009), Lins, Servaes, and Tufano (2010), Campello, Giambona, Graham, and Harvey (2011), Acharya, Almeida, and Campello (2013), and Harford, Klasa, and Maxwell (2014).

and Sibilkov (2010), and Almeida, Campello, Cunha, and Weisbach (2014)). Further, Haushalter, Klasa, and Maxwell (2007) and Fresard (2010) show that the ability to fully invest in growth opportunities provided by cash holdings enables firms to compete more successfully in the product markets.[10]

Large cash reserves can also lead to costs for a firm because in firms with agency problems these reserves enable managers to invest in value-decreasing projects (e.g., Jensen (1986), Harford (1999), and Harford, Mansi, and Maxwell (2008)). Other costs of large cash reserves include the small yield that is usually earned on these reserves (Kim, Mauer, and Sherman (1998)) and the reduction in the bargaining position of a firm relative to unionized labor (Klasa, Maxwell, and Ortiz-Molina (2009)).

Given that extant work provides strong evidence that firms choose the level of their total cash reserves by trading off the benefits and costs of these reserves, we presume that it is also the case that firms determine how much of these reserves should be invested in STI by trading off the benefits and costs of holding more of these reserves in STI. Importantly, this premise generates a number of empirical predictions concerning what determines variation with respect to the fraction of firms' cash reserves that are held in STI. First, the lower liquidity of STI in the short-term makes STI relatively less desirable for firms that face more uncertainty concerning their short-term liquidity needs. Thus, such firms hold less of their cash reserves in STI. Second, financial constraints impact the extent to which a firm invests its cash holdings into STI. Because financially constrained firms typically maintain large cash balances to ensure that they have the required capital for their long-term investment and operating needs, the lower liquidity of STI in the short-term is less of a concern for these firms. Thus, financially constrained firms hold more of their total cash reserves in STI to increase the yield earned on their large cash reserves.

Third, during years when their cash reserves are needed to fund significant new investment or their operations financially constrained firms transfer funds from STI to CCE.

[10] See also earlier work by Keynes (1936), Baumol (1952), Tobin (1956), and Miller and Orr (1966) on how financial constraints resulting from frictions in the capital markets relate to firms' cash reserves.

Survey evidence is consistent with this prediction and the notion that financially constrained firms invest large fractions of their cash reserves into STI until the time when these reserves are needed by the firm. For instance, a survey of corporate treasurers conducted by J.P. Morgan Chase finds that more than half of firms report that they formally segment their cash reserves into different tranches, and that within these tranches, the financial assets that are invested in are a function of the intended uses of the cash holdings in a particular tranche.[11] Namely, cash reserves held primarily for short-term operating needs are placed in a tranche in which only highly liquid securities are invested in. Conversely, cash holdings held for a firm's long-term investment or operating needs are put in a cash reserves tranche where financial investments are made into less liquid securities that earn a higher yield.

Fourth, the impact of financial constraints on investment into STI securities and the costs involved with managing a portfolio of these securities jointly generate a prediction regarding the relation between the fraction of a firm's cash reserves invested into STI and firm size. Very small firms may hold less STI because the fixed costs involved with trying to manage a portfolio of STI securities, such as hiring personnel to manage this portfolio and ensuring the portfolio is sufficiently diversified, could be disproportionally large for these firms.[12] However, large firms are expected to hold less STI because these firms are less likely financially constrained. Put together, this leads to a prediction that overall the fraction of a firm's cash reserves invested in STI is an inverted U-shaped function of firm size.

Finally, we anticipate that in firms with poor corporate governance managers' self-interest could skew their tradeoff decision concerning the investment of cash reserves in STI and lead to these firms holding less STI. Specifically, the managers of such firms could prefer

[11] See http://www.jpmgloballiquidity.com/blobcontent/245/892/1320477437636_survey-2011.pdf.

[12] Admittedly, small firms could try to use an external vendor to manage the investment of their cash reserves. However, the fees of these vendors limit the benefits of economies of scale for small firms. Namely, fixed costs in the vendor fees are born more heavily by smaller firms as they have fewer assets to spread the cost over. Further, even if these fees are completely variable based on liquid assets under management, the cost is disproportionately high for the smallest firms as cash as a proportion of assets is significantly larger for these firms.

if their firm's cash reserves are held mostly in CCE so they can have easier and quicker access to their firm's cash reserves when they want to invest in self-serving projects.[13]

2. Description of CCE and STI

2.1 The composition of CCE and STI

Firms separately report two important components of their total cash holdings on their balance sheet: CCE (Compustat variable 'CH') and STI (Compustat variable 'IVST'). Most prior work on corporate cash holdings defines a firm's total cash holdings as the sum of its CCE and its STI. This total amount of a firm's cash holdings is captured by the variable 'CHE' (=CH+IVST) in the Compustat database.[14] CCE includes both liquid cash and highly liquid financial assets that had a maturity of 90 days or less when issued or at the time they were purchased by a firm.[15] Firms usually do not report the weights of each security type held in cash equivalents. However, they occasionally list which particular security types they hold in cash equivalents. Cash equivalents are most commonly invested in securities such as overnight repos, commercial paper, and certificates of deposit with a maturity of 90 days or less. Typically, these securities are highly liquid and readily available to be converted to cash, have a short maturity, and earn a low yield.

Securities that are reported as STI on a firm's balance sheet are classified into three different types. STI securities are classified as *held-to-maturity* if they had a remaining maturity of more than three months at the time of purchase and currently have a remaining maturity of twelve months or less and the firm has a strong intent to hold the securities to maturity. STI securities are classified as *available-for-sale* if they had a remaining maturity

[13] In making our prediction on the effect of agency problems in a firm on the composition of its cash reserves, we focus on agency problems relating to a firm's top managers. Duchin, Gilbert, Harford, and Hrdlicka (2014) conjecture that agency conflicts further down in an organization could affect whether a firm invests in financial assets that earn a higher yield. They argue that treasury personnel could try to increase the yield earned on the financial assets into which their firm invests to make their job more interesting or to build human capital that could be useful elsewhere in the asset management industry.

[14] The reporting distinction between cash equivalents and STI is outlined in FASB Statement No. 95 and No. 115 for all firm-years with fiscal years beginning after December 1993. Prior to this time, reporting was determined by ARB NO. 43 (1947) and FASB Statement No. 12 (1975).

[15] In most cases, the description of cash equivalents in firms' annual reports include phrases such as the following taken from Microsoft's 2010 10-K, "Cash equivalents consist of highly liquid investments with original maturities of three months or less."

of more than three months when purchased and the possibility exists that the firm would sell some of the securities in the next twelve months either to meet liquidity needs or if changes in market conditions, such as an increase in price, make it financially attractive for the firm to sell some of the securities (there is no restriction on the remaining maturity of these securities). Finally, STI securities that are bought and sold with the principal objective of generating profits from short-term price fluctuations are classified as *trading securities*.

Similar to cash equivalents, firms are not required to report the composition of STI.[16] However, unlike the reporting of cash equivalents, firms frequently report the composition of STI on a voluntary basis. To provide some insights into the extent to which STI is made up of securities classified as held-to-maturity, trading securities, or available-for-sale and how the composition of STI differs from cash equivalents, we randomly identified 1,000 firms over the 1997-2011 period with positive amounts of STI and collected this information from their 10-Ks.[17] In doing so, we were able to collect data for 434 of the 1,000 randomly identified firms. Table 1 documents the results of this analysis.

Panel A of Table 1 reports our findings for the average fraction of firms' STI that consists of held-to-maturity securities, available-for-sale securities, or trading securities. We note that for 93% of the observations firms classify all of their STI into only one of the classification types. For the 7% of observations in which a firm classifies its STI investments into two or all three of the classification types, we determine the market value of the firm's STI investments in each classification type. Next, we calculate the percent held in each type as the market value of the securities held in that type divided by the market value of the firm's total STI. Panel A shows that, on average, firms classify approximately 13% of their STI securities as held-to-maturity, 85% as available-for-sale, and the remaining 2% as trading securities. An important point, however, is that many firms report that although they

[16] Under SFAS, No. 157, beginning in the 2009 fiscal year all firms are required to report the fair value of all of their financial assets. However, in many cases from these disclosures it is not possible to determine whether a particular financial asset is included in STI on the balance sheet or elsewhere on the balance sheet, for example, under long-term investments or other assets.

[17] We randomly selected these firms from all sample firms with a fiscal year greater than or equal to 1997 to ensure the availability of an electronically filed 10-K.

typically plan on holding all of their STI securities until maturity due to interest rate risk they choose to classify these securities as available-for-sale rather than as held-to-maturity in order to preserve flexibility if unanticipated liquidity needs arise.[18] For instance, in its 2004 10-K, Genaera Corporation acknowledged that it "generally holds investments to maturity; however, since the Company may, from time to time, sell securities to meet cash requirements, the Company classifies its investments as available-for-sale." Similarly, Linear Technology Corporation reported in its 1997 10-K that "all of the Company's investments in debt securities were classified as available-for-sale, which means that, although the Company principally holds securities until maturity, they may be sold under certain circumstances." Put together, the Table 1, Panel A results and the above discussion suggest that most of a firm's STI securities are typically held to maturity.

Panel B of Table 1 reports average values for each particular STI security type as a percent of total STI, total cash holdings, and total book assets for firms with positive amounts of STI in the sample for which we hand-collect data.[19] The evidence in this panel is consistent with the notion that relative to cash equivalents STI tends to consist of securities that earn a higher yield, but that would also reduce a firm's access to liquidity. The most common type of STI is U.S. government debt, which accounts, on average, for almost 30% of STI.[20]

[18] Importantly, the classification of a security as available-for-sale does not rule out the possibility that a firm will hold the security to maturity. In contrast, according to SFAS 115, the selling of a security originally classified as held-to-maturity "should be rare" and a rationale for such a sale must be reported in the notes to the financial statements. In any case, the sale of a security originally classified as held-to-maturity should not be motivated by changes in market interest rates, needs for liquidity, or changes in the yields of alternative investments.

[19] The Compustat variable 'IVST', which represents STI, includes both investment in STI securities and holdings of restricted cash. Restricted cash is cash that is held by corporations due to contractual obligations such as bond restrictions or escrow accounts. For the 434 firms for which we collect data on the composition of STI, we also verify if some of a firm's total cash holdings consist of restricted cash. We find that only 25 (5.8%) of these 434 firms hold cash that is considered restricted cash. This finding suggests that the inclusion of restricted cash in the 'IVST' variable is unlikely to lead to important measurement error for the amount of a firm's total cash holdings that are invested in STI.

[20] In collecting the data on the common types of STI, we found that many firms classify both debt issued by the U.S. government and agency securities, such as those issued by the Government National Mortgage Association (Ginnie Mae) or the Student Loan Marketing Association (Sallie Mae), as U.S. government debt, aggregating them on the balance sheet. As a result, we similarly aggregate these two types of debt and classify agency securities as U.S. government debt. We note that the default risk inherent in agency securities is extremely low due to the U.S. government's reliance on the operations of the various agencies to finance particular federal government programs (Bildersee (1978)).

Investments in the debt of other U.S. publicly traded corporations (27.4%) and municipal debt (14.5%) are also prevalent. Thus, these three types of debt securities account for over 70% of total STI. As already discussed, due to interest rate risk firms will usually plan on holding STI in the form of debt securities to maturity, which reduces firms' access to liquidity. Investments in municipal and corporate bonds further reduce a firm's access to liquidity because these bonds are typically more costly to liquidate due to fragmentation and opacity in corporate and municipal bond markets (Biais and Green (2007)).

It is important to point out that although U.S. government debt does not have default risk, corporate and municipal debt is subject to this type of risk. However, the probability that a typical firm would suffer a significant loss as a result of holding corporate or municipal debt in its portfolio of STI securities is very low for three reasons. First, as already explained, most firms plan on holding all or a large fraction of their STI investments to maturity. Consequently, as long as corporate and municipal debt issuers do not default on their outstanding debt, most firms should not be affected to a large extent by decreases in the prices of the corporate and municipal debt in their investment portfolio resulting from changes in credit quality prior to the maturity of these securities. Second, firms often report in their 10-Ks that they hold a diversified portfolio within asset classes to avoid credit risk concentrating in one asset. Third, and perhaps most importantly, firms usually maintain minimum rating requirements on financial assets, and as a result, the default risk of these assets is typically very low. For instance, according to the survey of corporate treasurers conducted by JP Morgan Chase, that was previously discussed, approximately 68% of surveyed firms require the debt securities in which they invest to have a credit rating that is at least 'high grade' (a letter credit rating of AA or better). Further, all of the firms surveyed required debt securities to be at least 'investment grade' (a letter credit rating of BBB or better). Over the 1970-2009 period, which includes the years of the recent financial crisis

when default rates were higher, the one-year probability of default for corporate bonds with a credit rating of AA (BBB) is only 0.02% (0.18%). Also, over this period, the one-year probability of default for municipal bonds with an AA (BBB) rating is 0.00% (0.01%).[21]

Panel B of Table 1 documents that other financial assets that account for sizeable percentages of STI include commercial paper with a maturity of more than 90 days (7.5%), auction-rate securities (6.9%), non-block equity ownership stakes of other U.S. firms (4.2%), and certificates of deposit with a maturity of more than 90 days (4.1%). Like investment into U.S. government, corporate, and municipal debt with a maturity of more than 90 days, investment into these assets would allow a firm to earn a higher yield on its cash reserves, but would reduce the firm's access to liquidity. As well, investment in equity securities would increase a firm's financial risk. Finally, Panel B shows that for firms that invest in STI the most common types of STI not only account for a large fraction of total STI, but also account for important fractions of firms' total cash holdings and book assets. For instance, on average, these firms' investments in U.S. government, corporate, and municipal debt as a fraction of their total cash holdings (book assets) equals, respectively, 16.1%, 15.8%, and 8.0% (7.7%, 8.0%, and 3.5%).

2.2 Differences in yields earned on CCE and STI

The premise that firms trade off the higher yields on STI securities with the reduced access to liquidity in the short term associated with these securities relies on the assumption that the difference in yields on STI versus cash equivalents is economically important. Using our sample described in Section 3, we estimate the additional return firms earn, on average, by shifting liquid funds from cash equivalents to STI. To do so, we use the difference in the yield on Moody's Aaa rated corporate bonds and the yield on 90-day commercial paper with

[21] For additional information on these default rates, see https://www.assetdedication.com/wp-content/uploads/2012/10/Asset_Dedication_White_Paper-Safety_of_Investment_Grade_Bonds.pdf. To further shed light on the risk exposure from investing in bonds with AA and BBB ratings, we also collected information on the default rates of corporate bonds during 2008 and 2009, which were the worst years during the financial crisis in terms of bond defaults (these default rates are available at http://www.standardandpoors.com/ratings/articles/en/us/ ?articleType=HTML&assetID=1245330814766). During 2008 the default rate of corporate bonds rated AA (BBB) was 0.38% (0.48%), while during 2009 these default rates were 0.22% (0.54%).

a superior rating (the highest commercial paper rating) as a proxy for the additional yield earned from shifting cash holdings from cash equivalents to STI. We select these two asset types because commercial paper with a maturity less than 90 days and corporate debt are assets commonly held as cash equivalents and STI, respectively. We multiply this yield difference by the year-end STI balance to estimate the additional income generated from STI investment. Conditional on having positive STI, the average additional interest the firms in our sample earn by shifting funds from cash equivalents to STI is estimated as $4.5 million or 4.0% of EBIT.[22] We also find that for firms with low STI (firms in the bottom four quintiles of our sample over a given year for STI/total cash holdings) average realized interest and related income (Compustat variable 'IDIT') is 9.9% of EBIT, while for firms with high STI (firms in the top quintile of our sample over a given year for STI/total cash holdings) average realized interest and related income is 24.6% of EBIT. Overall, the above estimates are consistent with the notion that differences in yields on STI versus cash equivalents are important enough to impact firms' choices with respect to how much of their total cash reserves they should invest in STI.

2.3 Why does the paper not consider long-term investments as a component of total cash reserves?

It is important to acknowledge that firms also invest in securities that are classified as held-to-maturity, but do not qualify as STI because their maturity is greater than twelve months. Likewise, firms invest in securities that are classified as available-for-sale, but are not considered STI because although the possibility exists the firm might sell the securities before their maturity for liquidity needs or if market conditions make it attractive to do so, such a sale is unlikely to happen over the next twelve months. These investments are included in non-current assets on the balance sheet and are classified as long-term

[22] Firms with negative EBIT are removed from this estimation. The yield difference is negative for 9.8% of firm-years. These time periods are included in this analysis. As expected, the estimated additional interest earned if cash holdings are shifted from cash equivalents to STI increases if we omit these firm-years.

investments (LTI). We do not consider LTI in our analyses of the determinants of the composition of total cash reserves for several reasons.

First, in the Compustat database LTI are aggregated with non-LTI investments under the category 'Investments and Advances – Other' (Compustat variable 'IVAO'). These other non-LTI investments would not be included in a firm's cash management portfolio. For instance, IVAO also includes block ownership stakes in the equity of other corporations. As well, IVAO includes long-term notes receivable. These assets arise when a firm extends credit via long-term contracts to corporate customers, promoters, and other related parties. As such, long-term notes receivable are assets that are used in the context of contracting between a firm and its various stakeholders.

From a firm's balance sheet and the footnotes to its financial statements, it is possible to collect data on the components of IVAO. Thus, to get a sense for the composition of the investments that are aggregated in IVAO, we randomly identified 100 firms over the 1997-2011 period with a positive value for IVAO and then collected information from their 10-Ks on the amount of IVAO that consists of investment in LTI securities, block ownership stakes of the equity of other firms, and investment in a firm's relationships with its customers and other stakeholders via long-term notes receivable. We were able to collect this data for 74 of the 100 firms. We find that, on average, investment in LTI securities makes up only 50.5% of IVAO. Further, we document that, on average, block ownership stakes of the equity of other firms and long-term notes receivable constitute, respectively, 9.6% and 28.7% of IVAO.

The second reason why we do not consider LTI in our analyses is that for some firms LTI securities are intended to be held for long periods of time, and so in these cases they are held as part of a long-term financial investment strategy as opposed to being included in a cash management portfolio. A third reason why we focus only on CCE and STI in our tests is that most prior work on corporate cash holdings defines these holdings as the sum of these two types of liquid assets. Because we similarly define the total level of a firm's cash holdings, this allows us to provide greater insights on the results found in prior work that examines the determinants of corporate cash holdings and also enables us to provide some guidance for

future research that will define a firm's cash holdings as the sum of its CCE and its STI. Finally, focusing on CCE and STI allows us to study a large number of firms over a significant time period, which provides us with a sample that has significant cross-sectional and within firm variation in firm characteristics that determine the fraction of firms' cash holdings invested in STI. Thus, focusing on these two types of cash holdings in our analyses allows us to run powerful tests with regards to what determines the composition of firms' cash reserves.

Nevertheless, we acknowledge that a drawback to ignoring LTI in our tests is that some firms could invest in LTI as part of their cash management practices. Duchin, Gilbert, Harford, and Hrdlicka (2014), who exploit SFAS No. 157, which starting in 2009 requires all firms to report the fair value of their financial assets, show that over the 2009-2012 period, on average, the value of the total financial assets that S&P 500 firms invest in is 16.9% larger than is the value of the Compustat variable CHE (the sum of CCE and STI) for these firms. Thus, to the extent some firms could invest in LTI as part of their cash management practices, ignoring LTI can lead to an underestimation of a firm's total cash reserves.

3. Sample Selection and Univariate Statistics

Our sample consists of industrial firms incorporated in the U.S. over the 1980-2011 period that are included in Compustat and that have positive values for assets and sales. We exclude utilities (SIC codes 4900-4999), financial firms (SIC codes 6000-6999), and quasi-public firms (SIC codes greater than or equal to 9900). We further drop firm-years for which we are unable to construct variables for our Table 4 models that explain the fraction of a firm's cash reserves held in STI. Our final sample includes 107,048 firm-year observations.

Table 2 presents summary statistics for the composition of corporate cash holdings over our sample period. Panel A shows that, on average, total cash holdings are 17.3% of a firm's book assets. This panel also shows that CCE and STI make up, respectively, 11.1% and 6.1% of book assets. For the full sample, STI makes up 20.4% of cash holdings. While these average amounts for STI are significant, they underestimate the proportion of assets held in STI for firm-years with positive values for STI. In approximately 59% of firm-years a firm

has zero STI holdings. Panel B reports that conditional on having positive holdings in STI, CCE and STI are, respectively, 12.6% and 14.9% of book assets. Also, STI makes up 50.1% of total cash reserves for firm-years with positive STI. Panel B also reveals that firms that hold STI have larger total cash reserves. Notably, for these firms total cash reserves are 27.7% of book assets. Panel C reports the summary statistics for firms that have positive STI during at least one year over our sample period. In all of our multivariate analyses we run separate tests on this sample to ensure that the study's results are not merely driven by differences between firms that invest in STI and those that never invest in STI. The findings in Panel C provide further evidence that firms that invest in STI have higher total cash holdings.

Panel D of Table 2 provides statistics across the Fama-French 49 industries for the average values of the fraction of firms' total cash holdings that consist of STI unconditional and conditional on having positive STI. This panel also reports information on the percentage of firm-years in an industry that have a positive value for STI. The industries are sorted by the average unconditional value for STI as a fraction of total cash holdings. Panel D reveals that the ten industries with the highest values for STI/total cash holdings are from a broad spectrum of the economy (pharmaceutical products, agriculture, computers, defense, medical and electronic equipment, computer software, tobacco products, measuring and control equipment, and construction materials). Panel D further shows that the ten industries with the lowest values for STI/total cash holdings are also generally quite diverse (shipping containers, communication, steel works, apparel, retail, business supplies, wholesale, shipbuilding and railroad equipment, textiles, and aircraft).

As previously discussed, we predict that financially constrained firms invest a larger fraction of their cash reserves in STI than do financially unconstrained firms. Table 3 reports univariate results that provide strong support for this prediction. Given the evidence and arguments in Faulkender and Petersen (2006) that firms without a bond rating and firms with lower leverage are more likely financially constrained, we first compare firms without and with a bond rating and firms whose leverage is below or above the sample median value for a given year. Table 3 shows that the average fraction of cash reserves held in STI is

markedly higher for firms without a bond rating than for firms with a bond rating (0.219 versus 0.140) and that this fraction is also higher for firms whose leverage is below rather than above the sample median in a given year (0.274 versus 0.135).

Sufi (2009) shows that lack of access to a credit line or having only limited funds available from a credit line are powerful proxies for whether a firm is financially constrained. We use the data on credit lines from Sufi (2009) to further examine whether financially constrained firms are more likely to hold a large fraction of their cash reserves in STI. Providing additional support to this proposition, Table 3 reports that for firms without or with a line of credit the average values of STI/total cash holdings are, respectively, 0.346 and 0.126. Further, this table shows that among the firms with a line of credit those firms with a smaller line of credit relative to book assets or with less unused funds from their line of credit relative to book assets hold more of their cash reserves in STI. Specifically, for firms with a value for total line of credit/book assets that is below (above) the median sample value over a particular year, average STI/total cash holdings is 0.254 (0.073). Also, for firms with a value for unused credit line funds/book assets that is below (above) the median sample value over a given year, average STI/total cash holdings is 0.248 (0.080).

Finally, because a significant amount of prior work shows that financially constrained firms typically hold large cash reserves, Table 3 also compares STI/total cash holdings for firms with a ratio of total cash holdings/book assets that is above (below) the median sample value over a given year. Here again, we find evidence consistent with the notion that financially constrained firms invest a larger fraction of their cash reserves in STI. In particular, we document that for firms with cash holdings that are above (below) the median sample value in a given year the average value of STI/total cash holdings is 0.333 (0.076).

4. Multivariate Tests

4.1 Determinants of the proportion of total cash reserves held in STI

Table 4 reports the results of OLS regressions in which the dependent variable is the fraction of a firm's total cash reserves that consists of STI. In the models in this table we

report evidence on the association of this fraction with variables that capture a firm's uncertainty with respect to its short-liquidity needs, whether a firm is financially constrained, and the costs involved with managing a portfolio of STI securities. The first two models in this table are estimated on the full sample unconditional on whether a firm invests in STI. The third and fourth models are only estimated using firms that have positive STI during at least one year over our sample period. As previously discussed, we analyze this restricted sample to make sure that our multivariate results are not simply driven by differences between firms that invest in STI and those that never invest in STI.[23]

Tables 2 and 3 show that, on average, firms with larger cash reserves invest more of these reserves in STI. Hence, we control for a firm's cash reserves to ensure that the coefficients on the main variables of interest in Table 4 do not merely reflect the association between these variables and the size of a firm's cash reserves. In doing so, we implicitly assume that firms first decide on the amount of the cash reserves they should hold and then, conditional on this decision, determine in which financial assets they should invest these reserves. This assumption is consistent with guidelines provided to corporate treasurers on the procedures to use when investing cash reserves in financial securities.[24] Additionally, we control for cash flow/book assets because during years when a firm's cash flow rises this could lead to a temporary increase in the fraction of its cash reserves consisting of CCE.

In our models we also try to control for the issue that many U.S. multinational firms have large cash reserves due to the cost for these firms of repatriating their foreign earnings.

[23] In the third and fourth models of Table 4, studying the entire time series of any firm that ever invests in STI enables us to consider both years when firms choose to invest in STI and years when they choose to not invest in STI. Thus, this approach allows us to exploit within firm variation in our main variables of interest more fully.

[24] For instance, in the Association for Financial Professionals' (the professional society that grants corporate treasurers the Certified Treasury Professional designation, a worldwide recognition signifying competency in liquidity management) 'Guide to Short-Term Investment Strategies to Manage Financial Risk' it is stated that before deciding on where to invest cash reserves a treasurer needs to know the amount of cash available to be invested, the location of these cash reserves, and for how long the cash reserves will be available for investment (see https://www.treasury-management.com/docs/Reval-AFP-GlobalLiquidityGuide-3-ShortTermInvestmentStrategies.pdf). Similarly, BlackRock's Cash Investment Policy Statement states that prior to making financial investment decisions, "as an initial step, the appropriate staff should inventory the company's cash flow forecasts, including payroll, buyback plans and shareholder dividend payments, as well as any other data that could affect the level of cash on the balance sheet, to quantify how much cash in available for strategic investment." (see https://www.blackrock.com/cash/literature/whitepaper/the-cash-investment-policy-statement.pdf).

Specifically, these firms can defer paying taxes to the U.S. government on their foreign earnings until the earnings are repatriated, and as a result, many of these firms delay repatriating their foreign earnings.[25] This can lead to these firms' foreign subsidiaries having large cash balances and also to the firms themselves reporting large cash holdings on their consolidated balance sheets (Foley, Hartzell, Titman, and Twite (2007)). If these firms tend to invest their cash reserves trapped overseas in STI to earn additional yield then this could result in these firms holding a larger fraction of their total cash reserves in STI. However, anecdotal evidence suggests that many foreign subsidiaries of U.S. multinationals hold their cash reserves in U.S. or foreign banks and use the funds in these bank accounts to provide the parent firm with a significant amount of its short-term loans. As long as U.S. tax rules are carefully followed, the foreign subsidiary can lend funds to its parent and not jeopardize the untaxed status of its earnings.[26] To the extent that this type of lending is commonplace, many foreign subsidiaries of U.S. multinationals could place a large fraction of their cash reserves in bank accounts providing the necessary liquidity to move cash back and forth between the subsidiary and the parent firm on a short-term basis. This would result in these reserves being categorized as CCE on the consolidated balance sheet of the parent firm.

We include two variables in the Table 4 models to control for the possibility that a firm has a large amount of cash reserves trapped abroad due to the tax costs for it of repatriating its foreign earnings. We first include an indicator variable for whether a firm

[25] Typically, U.S. multinationals will only have to pay taxes to the U.S. government upon repatriating their foreign earnings to the U.S. if the corporate tax rates in the foreign jurisdictions are lower than those in the U.S.

[26] U.S. Multinationals are not required to disclose these loans. However, Hewlett-Packard acknowledged that during the 2011 fiscal year its foreign subsidiaries lent it $6 billion dollars and that the average outstanding balance of these loans was $1.6 billion, which is comparable to Hewlett-Packard's average outstanding balance of $1.9 billion in the commercial paper market during 2011. In a 2008 internal presentation Hewlett-Packard called these loans "the most important source of U.S. liquidity for repurchases and acquisitions." Generally, under U.S. tax rules a foreign subsidiary can lend funds to its parent without jeopardizing the untaxed status of its earnings if the loan remains outstanding during a given fiscal quarter, but it does not cross the fiscal quarter end. If the loan does cross a fiscal quarter than it can remain outstanding for a total of 30 days. For additional discussion about short-term loans provided by foreign subsidiaries of U.S. multinationals to the parent firm see Kate Linebaugh, "Firms Keep Stockpiles of Foreign Cash in U.S.," *The Wall Street Journal*, January 22, 2013. Also, see Victor Fleischer, "Overseas Cash and the Tax Games Multinationals Play," *The New York Times*, October 2, 2012. Finally, see the written testimony for the Senate Permanent Subcommittee on investigations provided by Beth Carr from Ernst & Young LLP on short-term lending from foreign subsidiaries of U.S. multinationals to the parent firm (see http://www.hsgac.senate.gov/download/?id=47a0da59-0d31-4b64-ad0a-47cca27d0e46).

has foreign sales over a particular year. We also include a variable that approximates the tax cost that a firm would incur if it were to repatriate its foreign earnings. This variable is calculated as in Foley, Hartzell, Titman, and Twite (2007) as the greater of zero or the firm's repatriation tax cost divided by its book assets, where repatriation tax cost is defined as pre-tax foreign income times the firm's marginal tax rate in the U.S. minus the income taxes paid in foreign jurisdictions.

Finally, in the Table 4 models, we include both year and industry or firm fixed effects. Year fixed effects control for any nation-wide fluctuations or trends in our variables of interest over our sample period. Industry fixed effects are included in the first and third models in Table 4 to control for unobserved time-invariant heterogeneity in industry characteristics that could be correlated with the fraction of firms' total cash reserves that are invested in STI. Firm fixed effects are included in the second and fourth models in Table 4 to capture within firm variation in financial policies and ensure that the Table 4 results are not merely driven by simple cross-sectional correlations across firms.

Table 4 first provides evidence on whether firms' uncertainty about their short-term liquidity needs is associated with the fraction of their cash reserves that are invested in STI. In the Table 4 models we include several variables that proxy for if it could be difficult for a firm to forecast its short-term liquidity needs. First, we expect that if a firm operates in an industry with greater cash flow volatility it is more difficult for the firm to predict when it would need to use a portion of its cash reserves to fund investment or cover some of its operating needs. Consistent with the proposition that when a firm's uncertainty about its short-term liquidity needs is larger the firm invests less of its cash reserves in STI due to the lower liquidity of STI, the results for the first model in Table 4 show that the fraction of a firm's cash reserves that consists of STI is negatively associated with cash flow volatility in the firm's industry. We evaluate the economic importance of this result and estimate that a one standard deviation increase in industry cash flow volatility leads to a 1.5% increase in the fraction of a firm's cash reserves that consists of STI.

To further examine whether a firm's uncertainty about its short-term liquidity needs is associated with the fraction of its cash reserves invested in STI, we consider whether a firm has significant growth opportunities. Firms with larger growth opportunities often invest in new projects that have less predictable cash flows. As a result, it could be harder for these firms to forecast what amount of their cash reserves they will need to use in the short-term. To proxy for a firm's growth opportunities and the extent to which it invests in projects with less predictable future cash flows, we include a firm's market-to-book assets ratio and its research and development expenses scaled by sales in the Table 4 models. The results for the first model in Table 4 show that firms with a larger value for market-to-book assets or research and development expenses/sales hold a smaller fraction of their cash reserves in STI. These findings are also economically important. Specifically, one standard deviation increases in market-to-book assets or research and development expenses/sales are associated with, respectively, 5.1% and 5.8% decreases in the fraction of a firm's cash reserves held in STI. These results are additional evidence that if it is more difficult for a firm to forecast its short-term liquidity needs, the firm invests less of its cash reserves in STI.

As an initial multivariate test of the prediction that financially constrained firms hold a larger fraction of their cash reserves in STI, we include in the Table 4 models an indicator variable for whether a firm has a bond rating and the firm's leverage ratio (Faulkender and Petersen (2006)). The results for the first model in Table 4 show that the coefficients on these two variables are significant and negative, which provides support to our prediction. Further, these two results are economically important. If a firm has a bond rating it holds 15.2% less of its cash reserves in STI. Also, a one standard deviation increase in firm leverage is associated with an 8.1% decrease in this fraction.

To provide additional evidence on whether financial constraints likely affect a firm's decision to invest more of its cash holdings into STI and also provide insights into if the costs involved with managing a portfolio of STI securities impacts this decision, we investigate the effect of firm size on the degree to which a firm invests in STI. As discussed in Section 1, very small firms may hold less STI because the fixed costs involved with managing a portfolio of

STI securities could be disproportionally large for these firms. On the other hand, large firms should also hold less STI because they are less likely financially constrained. Put together, this leads to the prediction that overall the fraction of a firm's cash holdings invested in STI is an inverted U-shaped function of firm size. To test this prediction, we include the natural logarithm of real book assets and the square of this variable in the Table 4 models. The results for the first model in Table 4 show that the coefficient on the real natural logarithm of book assets is positive and significant and that the coefficient on the square of this variable is negative and significant. These findings support our prediction for the relation between the fraction of firms' cash holdings invested in STI and firm size. Here, to consider economic importance, we examine if we also find support for this inverted U-shaped relation in a univariate framework. Although not tabulated, we find univariate-level support for this relation. For the smallest firms, defined as firms in the first sample quartile based on total book assets over a particular year, the mean fraction of total cash reserves held in STI is 0.195. This increases to 0.232 in the second size quartile. However, the fraction of cash reserves held in STI decline in the top two quartiles of firm size (0.220 and 0.218, respectively). Further, the mean value for STI/total cash holdings for the second size quartile is statistically different from the mean values for the other three quartiles.

In the first model in Table 4 the significant coefficients on the total cash holdings variable and the two variables meant to control for if a firm may have cash trapped abroad due to the tax costs of repatriating its foreign earnings imply that these variables are potentially useful controls. The positive coefficient on the total cash holdings variable is consistent with the Table 2 and 3 univariate results of a positive association between total cash holdings and the fraction of a firm's total cash reserves invested in STI. Interestingly, the significant negative coefficients on the foreign sales dummy variable and the tax cost of repatriating foreign earnings variable are consistent with the proposition that the foreign subsidiaries of U.S. multinational firms keep a large fraction of their cash reserves in bank accounts so that they can more easily provide their U.S. based parents with liquidity via short-term loans. We note that the results for these variables are economically meaningful.

If a firm has foreign sales then it holds 8.8% less of its total cash reserves in STI. Also, a one standard deviation increase in the tax cost of repatriating foreign earnings variable is associated with a 1.2% decrease in the fraction of firms' cash reserves held in STI.[27]

In the second model in Table 4 we report the results when industry fixed effects are replaced with firm fixed effects. We find that, except for the industry cash flow volatility and tax cost of repatriating foreign earnings variables, all of the other variables with significant coefficients in the first model of Table 4 retain their significant coefficients.[28] The fact that when we rely on within firm variation to estimate our regression model, almost all of the variables retain their significant coefficients provides confidence that the Table 4 results are not simply due to cross-sectional correlations across our sample firms.

The third and fourth models in Table 4 provide the results when we drop firms that never invest in STI over our sample period. The results for these models are very similar to those for the first two models in this table, which suggests the Table 4 results are unlikely merely driven by differences between firms that invest or never invest in STI.[29]

4.2 The proportion of total cash reserves held in STI and the use of a bank line of credit

As already discussed, Sufi (2009) reports that lack of access to a credit line or having only limited funds available from a credit line are powerful measures for whether a firm is financially constrained. To further investigate whether financially constrained firms invest

[27] We note that our main objective in controlling for whether a firm may have cash trapped abroad due to the tax costs for the firm of repatriating its foreign earnings is to ensure that our findings are not somehow driven by the tax considerations of multinational firms. As such, although we provide a potential explanation for what leads to the negative coefficients on the foreign sales dummy variable and the tax cost of repatriating foreign earnings variable, a careful examination of this issue is beyond the scope of our study.

[28] Following Bates, Kahle, and Stulz (2009), industry cash flow volatility is calculated by first determining for each firm-year the standard deviation of cash flow to assets during the prior ten years (a minimum of three annual observations is required) and then averaging the standard deviation values each year across each two-digit SIC industry. Because for a given firm from year to year there is a large overlap in terms of the years that are used to calculate the industry cash flow volatility variable this makes it difficult using firm fixed effects to estimate the effect of industry cash flow volatility on the fraction of a firm's cash reserves invested in STI. Likewise, because for some firms the difference between their corporate tax rate in the U.S. and the tax rates where they have foreign operations varies very little from year to year this makes it hard using firm fixed effects to estimate the effect of the tax cost of repatriating foreign earnings on the fraction of a firm's cash reserves invested in STI.

[29] It is possible that the recent financial crisis may have affected the extent to which firms invest a large fraction of their cash reserves in STI, which could potentially affect the study's results. To mitigate this concern, we reran all of the analyses in Tables 4-11 after dropping firm-years that take place during or after 2007. We find that all of the Table 4-11 results are robust to dropping these observations.

a larger fraction of their cash reserves in STI, we examine whether this fraction is negatively associated with a firm having a credit line. Also, contingent on having a credit line, we investigate if there is a negative association between this fraction and the total amount of the firm's credit line or the total amount of its unused credit line. To do so, we use the data on credit lines from Sufi (2009), obtained from Amir Sufi's website. Data on if a firm has a credit line is available for most non-financial Compustat firms over the 1996-2003 period and was collected using a computerized text search algorithm. Data on the amount of a firm's credit line and the unused amount of its line was hand-collected for a random sample of 300 non-financial Compustat firms (1,908 firm-year observations) over the 1996-2003 period.

Table 5 provides the results of regression models that are the same as those in Table 4, except that we include as independent variables an indicator for if a firm has a credit line, the total amount of a firm's credit line scaled by its book assets, or the unused amount of a firm's credit line scaled by its book assets. Following Sufi (2009), we do not include firm fixed effects in the Table 5 models because the short time series and little time-series variation in whether a firm has a credit line makes firm fixed effects estimation difficult.

The results for the first model in Table 5 show that, as predicted, there is a negative association between the fraction of a firm's cash reserves invested in STI and if the firm has a credit line. We estimate that if a firm does not have a credit line it holds 28.8% more of its total cash reserves in STI. The results for the second and third models in this table document that the fraction of a firm's cash reserves invested in STI is also negatively associated with the firm's total line of credit scaled by its book assets and its unused line of credit scaled by its book assets. Here also, the results are economically significant. One standard deviation decreases in a firm's total line of credit/book assets or its unused line of credit/book assets are associated with, respectively, 25.7% or 23.9% increases in the fraction of its cash reserves consisting of STI. The findings for the fourth to sixth models in Table 5 show that the results documented in the first three models are robust to dropping firms that never invest in STI over our sample period. Overall, the Table 5 results are further support for the prediction that financially constrained firms invest a larger fraction of their cash holdings in STI.

4.3 The proportion of total cash reserves held in STI and a firm's propensity to save cash from cash inflows

Almeida, Campello, and Weisbach (2004) show that financially constrained firms save a larger fraction of their internally generated cash flows. The intuition behind this result is that by putting more of their cash flows into cash reserves financially constrained firms increase their ability to internally finance future investment projects.[30] Also, McLean (2011) reports that over the last few decades firms have begun to save a larger fraction of the funds they raise externally, and he argues that this can be explained by an increasing precautionary motive for holding cash over time.

To further examine whether firms that invest more of their cash reserves in STI are likely financially constrained, we investigate if these firms save more of their cash inflows. We report the results of this analysis in Table 6. We follow the empirical model from Table 4 in McLean (2011), in which the annual change in a firm's total cash holdings/book assets is regressed on cash flow/book assets, proceeds raised from equity issues/book assets, proceeds raised from debt issues/book assets, capital inflows from all other sources/book assets, and the natural logarithm of book assets. As well, following McLean (2011) we include year and firm fixed effects. The coefficients on the cash flow variable and on the equity and debt issued variables provide evidence on what fraction of each of these types of cash flows is put into cash reserves. In the first model of Panel A of Table 6, we also include STI/total cash holdings and the interaction of this variable with the cash flow variable and the equity and debt issued variables. This enables us to document whether when firms hold a greater fraction of their cash reserves in STI if they save a larger fraction of their internally generated cash flows and the proceeds from their equity and debt issues.

The significant positive coefficients on the three interaction variables in the first model imply that during time periods when a firms holds more of its cash reserves in STI, it indeed saves a larger fraction of its cash flows and the proceeds from its equity and debt

[30] Riddick and Whited (2009) question the notion that financially constrained firms save cash out of their cash flows and use the saved cash to pay for investment.

issues, which is additional evidence that firms with high STI balances are likely financially constrained. In the second model, we replace the STI/total cash holdings variable with an indicator for if a firm's value for STI/total cash holdings is in the top sample quintile over a given year, and also interact this variable with the cash flow variable and the equity and debt issued variables. Here, we also find significant positive coefficients on the three interaction variables. The coefficient estimates on these variables imply that when firms are in the top quintile for STI/total cash holdings they save 11.1 cents more from a dollar of internally generated cash flows, 18.9 cents more from a dollar obtained from equity issues, and 19.2 cents more from a dollar obtained from debt issues.[31]

In the third and fourth models in Panel A of Table 6 we change the dependent variable to be the change in STI/book assets and in the fifth and sixth models we define it as the change in CCE/book assets. This allows us to provide evidence on where high STI firms store their saved cash inflows. We expect that high STI firms will put much of these saved cash inflows into STI where they will be held to meet longer-term investment or operating needs. The significant positive coefficients on the interaction variables in the third and fourth models indicate that during times when a firm has larger STI holdings it invests more of its internally generated cash flows and the proceeds from its debt and equity issues into STI than at other times. Further, the results for the fifth and sixth models show that when a firm holds more STI it puts a *smaller* fraction of its internally generated cash flows and the proceeds from its equity issues into CCE than it does at other times.[32] Panel B of Table 6 documents that the Panel A results are robust to dropping firms that never invest in STI. Put together, the Table 6 results are additional evidence consistent with the prediction that firms that are financially constrained hold a larger fraction of their cash reserves in STI.[33]

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[31] We note that all of the Table 6, Panel A and B results are similar if we replace firm fixed effects with industry fixed effects. Therefore, firms that invest a larger fraction of their cash reserves in STI than do other firms also save a greater fraction of their cash inflows compared to other firms.

[32] Although in the fifth and sixth models of Panel A of Table 6 the coefficients on the interactions involving debt issued/book assets are positive, the magnitude of these positive coefficients is smaller than those on the interactions involving debt issued/book assets in the third and fourth models, which is consistent with high STI firms putting more of their saved debt issuance cash flows into STI relative to CCE.

[33] To ensure that the STI-related variables are not proxying for total cash holdings, we re-estimated all the models in Table 6 including total cash holdings/book assets as a control or including as controls total cash holdings/book

4.4 Corporate investment and changes in the proportion of total cash reserves held in STI

The notion that financially constrained firms hold a large fraction of their cash reserves in STI to increase the yield earned on these reserves while they are being held to finance long-term investment or operating needs relies on the assumption that during years when large amounts of these reserves are needed to fund new investment or a firm's operations that these firms transfer funds from STI to CCE. In Table 7, we provide evidence on whether financially constrained firms are likely to transfer funds from STI to CCE during years when large amounts of their cash reserves are needed to fund new investment. To do so, we use the investment model from Harford, Klasa and Maxwell (2014), in which investment is defined as the sum of capital expenditures, research and development, and advertising expenses. The control variables are the natural logarithm of the real market value of assets, market-to-book assets, pre-investment earnings/book assets, and year and firm fixed effects. Additionally, in the first model of Panel A of Table 7 we include lagged total cash holdings/book assets, which represents a firm's cash holdings at the beginning of its fiscal year. We also include the change in STI/total cash holdings between the prior and current year, and the interaction of this variable with lagged total cash holdings/book assets.

The results for the first model of Panel A of Table 7 show that the coefficient on the lagged total cash holdings variable is positive and significant, which is consistent with larger total cash holdings having a positive effect on investment in a given year. Importantly, the coefficient on the interaction of lagged total cash holdings and the change in STI/total cash holdings between the prior and current year is negative and significant. Thus, the positive effect of a firm's total cash reserves on its investment is more pronounced during years when the firm increases the fraction of its cash reserves held in CCE relative to STI. This finding is consistent with the notion that during years when large amounts of their cash reserves are needed to fund new investment, financially constrained firms shift funds from STI to CCE to increase the amount of very liquid funds they have at their disposal to fund investment.

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assets and its interactions with the cash flow variable and the equity and debt issue variables. We find that the Table 6 results are robust to the inclusion of these additional control variables.

In the second model of Panel A of Table 7, we replace the change in STI variable with an indicator for whether the change in STI/total cash holdings is large and negative to capture periods when a firm shifts a large amount of funds from STI to CCE. The indicator takes a value of one when this change is in the bottom sample quintile over a particular year, and zero otherwise. We also interact this indicator with lagged total cash holdings. The coefficient on the interaction variable is positive and significant. From the regression coefficients in the second model, we estimate that for firms that do not markedly increase their holdings in CCE relative to STI that an incremental dollar of total cash reserves leads to 6.4 cents of additional investment that year. However, for firms that significantly increase their holdings in CCE relative to STI, an extra dollar of total cash reserves leads to 9.0 cents of additional investment during the year. Thus, the Table 7, Panel A results are economically important. In the third and fourth models of this panel we show that the results in this panel are robust to excluding firms from the analysis that never invest in STI.

We expect that the Panel A results should be driven by financially constrained firms as constrained firms are more likely to finance investment from their cash reserves. We find that this is indeed the case. In the first two models of Panel B of Table 7 we report the results for only firms that are financially constrained (firms without a bond rating), while in the third and fourth models of this panel we report the results for only firms that are not financially constrained (firms with a bond rating). All of the Panel A main results hold when we only analyze financially constrained firms. However, these results do not hold if we only consider unconstrained firms. Further, the finding that the investment-related results are driven by constrained firms is robust to only studying firms that have positive STI at some point during our sample period, as documented in the fifth to eighth models of Panel B.[34]

[34] The results reported in Table 7 are based on calculating the change in STI/total cash holdings as STI/total cash holdings minus its lagged value. A potential concern with measuring the change this way is that in some instances a change in total cash holdings could affect the change in the proportion of total cash holdings invested in STI. However, in non-tabulated results we alleviate this concern by documenting that the Table 7 results are robust to calculating the change in STI variable as the balance of STI minus its lagged value all scaled by the current value of total cash holdings.

4.5 The impact of exogenous changes in the supply of credit on the proportion of total cash reserves held in STI

4.5.1 Changes in the aggregate supply of credit and the proportion of total cash reserves held in STI

Next, we examine if exogenous decreases to the aggregate supply of credit impact the fraction of financially constrained firms' cash reserves held in STI. This allows us to provide some evidence on if there is a causal link from financial constraints to the extent to which firms invest their cash reserves in STI. We expect that when the supply of credit contracts that because this further reduces the ability of financially constrained firms to obtain credit that these firms transfer funds from STI to CCE so they can more easily finance their investment or operating expenses out of their cash reserves. To examine this issue, we follow Harford (2005), Officer (2007), and Harford, Klasa, and Maxwell (2014) and proxy for the supply of credit with the C&I rate spread, calculated as the average spread of commercial and industrial loan rates (on loans greater than $1 million) relative to the federal funds rate. When this spread increases (decreases) the supply of credit contracts (grows).

Table 8 provides the results of our analyses that examine the impact of exogenous changes to the aggregate supply of credit on the fraction of firms' cash reserves invested in STI. The first two models in this table are the same as the first two models in Table 4, except that the C&I rate spread over a firm's fiscal year is included as an explanatory variable. The results for the first model in Table 8 show that, as predicted, there is a negative association between the C&I rate spread and the fraction of a firm's cash reserves held in STI, which suggests that when credit conditions tighten firms transfer funds from STI to CCE.[35] We estimate that a one standard deviation increase in the C&I rate spread leads to a 6.4% decrease in the fraction of a firm's cash reserves held in STI. The results for the second model in Table 8 show that the negative effect of the C&I rate spread on the proportion of a firm's cash reserves held in STI is robust to replacing industry fixed effects with firm fixed effects.

[35] We note that in the presence of year fixed effects the C&I rate spread variable captures the spread over a firm's fiscal year minus the mean value of this variable for all sample firms during that year. This difference in nonzero due to firms' fiscal years ending in different months. Thus, in the Table 8 regression models this variable captures both cross-sectional variation across firms and also time-series variation for a given firm over our sample period.

Presumably, the C&I rate spread-related results are driven by financially constrained firms as these firms are the ones that would be most likely to need to finance their investments or operating expenses with their cash reserves when the aggregate supply of credit tightens. We document evidence that supports this notion. The third and fourth models in Table 8 report the results if we only consider firms that are financially constrained (firms without a bond rating), while the fifth and sixth models report the results for only firms that are not financially constrained (firms with a bond rating). We find that the C&I rate spread-related results only hold for firms that are financially constrained. Finally, Panel B of Table 8 shows that the results are similar if we consider only firms that have positive STI at some point during our sample period.

4.5.2 Changes in the supply of credit for speculative grade firms and the proportion of total cash reserves held in STI

To further investigate whether exogenous decreases in the supply of available credit impact the fraction of financially constrained firms' cash reserves held in STI, we study firms with a speculative grade debt rating (below investment grade) whose debt is considered high-yield debt. Because of these firms' greater credit risk they are expected to face more difficulty in accessing external capital. In doing so, we first follow Chernenko and Sunderam (2011) and proxy for the supply of credit available to speculative grade firms with net flows into high-yield bond mutual funds collected by the Investment Company Institute, the national association of U.S. investment companies. Over the 1984-2011 period, we are able to examine how firms with a speculative grade debt rating respond to fluctuations in high-yield bond mutual fund flows *relative* to firms in a control sample that are similar to firms with a speculative grade debt rating, but that are unlikely to be impacted by these flows. As in Chernenko and Sunderam (2011), we compare firms with a debt rating of BB+, whose rating is just below investment grade and considered speculative grade, to firms with a debt rating of BBB-, the investment grade rating cutoff.

Using the sample of firms consisting of the speculative grade firms and the control firms, we regress the proportion of total cash holdings held in STI on net flows into high-yield

bond mutual funds over the current year, an indicator for whether a firm has a speculative grade debt rating, and the interaction of these two variables. The interaction variable reveals how BB+ rated firms respond to changes in the supply of credit available to speculative grade firms relative to the firms in the control sample. We also include as controls all of the independent variables in our Table 4 models except for the bond rating indicator.

The results of this analysis are presented in Table 9, Panel A. The findings for the first model show that the coefficient on the interaction of net fund flows and the indicator variable for whether a firm has a speculative grade rating is significant and positive, which suggests that firms with a speculative grade rating transfer funds from STI to CCE to a greater extent than do the control firms when the supply of available credit for the prior group of firms contracts. This result is economically important. Using the coefficient on the interaction variable, we estimate that a one standard deviation increase in net fund flows into high-yield bond mutual funds results in firms with a BB+ debt rating increasing the proportion of their cash reserves held in STI by 19.3% relative to the sample mean. The results for the second, third, and fourth models in Panel A of Table 9 show that the findings documented in the first model are robust to replacing industry fixed effects with firm fixed effects and to excluding from the analysis firms that never hold STI during our sample period.

In Panel B of Table 9, we report the results of tests in which we specify regressions that are similar to those in Chernenko and Sunderam (2011) and in which we use their procedure to match a BBB- rated firm to each BB+ rated firm. Each year a BBB- rated firm is matched with replacement to a BB+ rated firm that is within the same Fama-French industry 48 industry classification and is closest in terms of leverage, market-to-book assets, natural logarithm of real book assets, total cash holdings scaled by book assets, Z-score, and sales growth. Distance of the match is based on the Mahalanobis distance. Following Chernenko and Sunderam (2011), if the difference between the treatment and control firm

for any matching variable is greater than the sample standard deviation of that variable, that firm-pair is dropped from the analysis. The dependent variable in the Table 9, Panel B models is the difference in the fraction of total cash holdings held in STI between the BB+ rated firm and its matched BBB- rated firm. The control variables include the independent variables from the Table 4 models other than the bond rating indicator and each control variable is measured as the difference for that variable between the BB+ rated firm and its matched BBB- rated firm.

The results for the first model in Panel B of Table 9 show that the coefficient on net fund flows is positive and significant. This result is economically important. We estimate that that a one standard deviation increase in net fund flows into high-yield bond mutual funds results in firms with a BB+ bond rating increasing the fraction of their cash reserves held in STI relative to this fraction for the matched firms by 9.6%. The results for the second model in this panel show that the findings documented in the first model are robust to excluding from the analysis firms that never hold STI during our sample period. Overall, the Table 9, Panel A and B results provide further evidence of a causal effect from financial constraints to the fraction of a firm's cash reserves invested in STI.[36]

As a second source of exogenous variation in the supply of credit available to firms with a speculative grade debt rating, we follow Lemmon and Roberts (2010) and investigate the impact of a negative shock to this supply after 1989 as a result of the collapse of Drexel

[36] Chernenko and Sunderam (2011) examine whether their results that the investment of BB+ rated firms is more sensitive to flows into high-yield mutual funds than is the investment of the matched BBB- rated firms are robust to controlling for macroeconomic variables. They conduct this robustness test to ensure that their results are not due to the investment opportunities of lower rated firms being more sensitive to the business cycle and that high-yield fund flows potentially pick up this sensitivity. Similarly, if the investment opportunities of BB+ rated firms are more sensitive to the business cycle then are those of BBB- rated firms and high-yield fund flows capture this then this could perhaps explain why the BB+ rated firms are more likely to shift liquid funds from STI to CCE when these fund flows decrease. Thus, we examine whether the Table 9, Panel A and B results are robust to controlling for the macroeconomic variables used by Chernenko and Sunderam (2011) that are available over our entire sample period (i.e., the term spread, the Baa-Aaa credit spread, the aggregate stock market return, and GDP growth). We find that the results from these two panels are robust to the inclusion of these additional controls.

Burnham Lambert, Inc.; the passage of the Financial Institutions Reform, Recovery, and Enforcement Act of 1989; and regulatory changes in the insurance industry. We examine changes in the proportion of total cash reserves held in STI surrounding this shock for firms with a speculative grade debt rating.

We perform this test using a differences-in-differences methodology which is very similar to the methodology used in Lemmon and Roberts (2010). The first difference is the change in the fraction of cash reserves held in STI for firms with a speculative grade debt rating from before to after the shock to the supply of credit available for these firms. We use the mean value of this fraction for a firm from 1986-1989 to measure this fraction prior to the shock and similarly use the average of this fraction from 1990-1993 to measure this fraction subsequent to the shock. As in Lemmon and Roberts (2010), the second difference is obtained by calculating the first difference for the treatment group (firms with a speculative grade debt rating) *relative* to a control group of firms that were largely unaffected by the shock to the supply of capital to speculative grade firms (firms without a bond rating). This second difference allows us to remove any fluctuations in STI balances unrelated to the credit supply shock. In order to select control firms that are as similar as possible to the treated firms, we follow Lemmon and Roberts (2010) and use their propensity score matching model. We match each treated firm to four control firms (with replacement) with the closest propensity scores.

We present our findings in Table 10, Panel A. The results in the first column of Panel A show that firms with a speculative grade debt rating decrease the proportion of their cash reserves held in STI by 0.115 around a negative shock to their credit supply relative to the control group. This result supports the findings based on fund flows and suggests that a tightening of access to capital results in financially constrained firms shifting cash reserves from STI to CCE. The findings documented in the second column of Panel A show that the Panel A results are robust to dropping firms that never invest in STI.

As discussed in Lemmon and Roberts (2010), in the Northeast part of the U.S. in 1990 and 1991 bank lending also contracted sharply due to declining real estate prices. This reduced the ability of speculative grade firms to switch to alternative financing sources during this period. Consequently, we also use the location of firms' headquarters to identify in a differences-in-differences framework cross-sectional variation in the effect of a shock to access to credit on the fraction of speculative grade firms' cash reserves consisting of STI. We report the results of this analysis in Panel B of Table 10. The findings in the first column show that the treatment firms (speculative grade firms in the Northeast U.S.) decrease the proportion of their cash reserves held in STI by 0.083 around a negative shock to the credit supply relative to the control firms (speculative grade U.S. firms not headquartered in the Northeast). This is further evidence of a causal link from financial constraints to a firm's STI holdings. Finally, the results in the second column of Panel B show that the results in this panel are robust to dropping firms that never invest in STI.[37]

4.6 Corporate governance and the proportion of total cash reserves held in STI

As argued earlier, we expect that due to the lower liquidity of STI securities relative to CCE, managers of firms with poor corporate governance should prefer if more of their firm's cash reserves are held in CCE. This would make it easier for such managers to have quick access to these reserves when they want to spend portions of these reserves on self-

[37] We interpret the results in Tables 8-10 of firms decreasing the proportion of their total cash reserves held in STI as evidence of firms shifting funds from STI to CCE. However, a potential concern with our interpretation is that this fraction could also decrease over a year if a firm increases its total cash reserves, but invests a relatively small fraction of its new liquid funds into STI. To mitigate this concern, we first reran the Table 8 and Table 9, Panel A analyses after dropping all firm-years in which total cash holdings/book assets increases relative to the prior year. We find that the results from these analyses hold when we drop these firm-years from the analysis and only consider firm-years over which total cash holdings/book assets is decreasing. Next, for Table 9, Panel B we dropped treatment firms during years when their ratio of total cash holdings/book assets increases and find that the results in this panel are robust to doing this. Finally, for Table 10, Panels A and B, we dropped treatment firms whose average ratio of total cash holdings/book assets increases from the 1986-1989 to the 1990-1993 periods and we find that our results for this table are robust to dropping these firms from the analysis.

serving projects. Thus, this leads to the prediction that when a firm has weaker corporate governance a smaller fraction of its total cash reserves is invested in STI.

To test this prediction, we re-estimate the Table 4 firm fixed effect model that examines the determinants of the fraction of a firm's cash reserves invested in STI several times after adding to this model a number of measures for the quality of a firm's corporate governance. We first proxy for a firm's governance using two governance indices, the G-index and the E-index. The G-index developed in Gompers, Ishii, and Metrick (2003) is the sum of the presence of 24 governance provisions with a higher value implying lower quality corporate governance. The E-index developed in Bebchuk, Cohen, and Ferrell (2009) is calculated in a similar manner, but it includes only the six provisions the authors find to be the most important. We also use two measures for the presence of large blockholders given that these shareholders are better able to bear the cost of monitoring than shareholders with smaller fractional ownership shares (Shleifer and Vishny (1986)). 5% Block (10% Block) is an indicator variable that takes the value of one for firm-years when a firm has at least one shareholder owning at least 5% (10%) of its shares. Further, given that prior work argues that institutional investors can help to reduce agency problems between managers and shareholders (e.g., Hartzell and Starks (2003)), we also use three measures of institutional ownership to proxy for a firm's governance environment: (i) Inst Tot is the percent of shares held by institutional investors, (ii) Inst Top 5 is the percent of total institutional investor ownership accounted for by the top five institutional investors in the firm, (iii) and Inst HHI is the Herfindahl index of the fractions of shares held by institutional shareholders.

Consistent with our prediction, the results for the first seven models in Panel A of Table 11 document that, for each of the seven governance measures, weaker governance is associated with a smaller fraction of total cash reserves held in STI. While magnitudes vary, all of the governance measures are economically important for explaining the percent of total cash reserves invested in STI. The mean economic significance of this association across the seven governance measures suggests that a one standard deviation increase in the quality of a firm's governance (as measured by continuous variables) or the presence of good governance

(as measured by indicator variables) is associated with a 6.0% increase in the percent of the firm's total cash reserves held in STI. The corresponding median is 5.7%.[38]

Because antitakeover laws reduce the ability of the takeover market to serve an external monitoring role, prior work has identified the staggered adoption of antitakeover laws at the state level as an exogenous shock to a firm's governance environment (e.g., Bertrand and Mullainathan (2003)). Thus, we can exploit the passage of these laws to provide causal evidence on the relation between corporate governance and investment in STI. In the eighth model of Panel A of Table 11, we include an independent variable named BC Laws, which takes the value of one in all years following the adoption of antitakeover laws in the state in which a firm is incorporated, and zero otherwise. The results for this model show that an exogenous decrease to the quality of a firm's governance environment leads to a reduction in the fraction of its cash reserves held in STI. This result is economically important. Specifically, following the adoption of antitakeover laws a firm reduces the fraction of its cash reserves held in STI by 23.5%. This finding provides causal support for the results in the first seven models of Panel A of Table 11. Finally, the results in Panel B show that the Panel A results are robust to dropping sample firms that never invest in STI.

5. Conclusion

Although a large body of prior work provides evidence on what determines the variation in the total amount of firms' cash reserves, we know little about the determinants of the variation in the financial assets that constitute these total reserves. This is surprising because a good comprehension of this issue is central to understanding corporate liquidity management practices. In this study, we shed light on what determines the variation in the composition of corporate cash reserves by focusing our attention on the extent to which firms hold these reserves in cash and cash equivalents (CCE) versus short-term investments (STI).

[38] Survey evidence supports the notion that the extent to which a firm is well governed could have an impact on the fraction of its cash reserves invested in STI. For instance, the survey conducted by J.P. Morgan Chase, discussed earlier in the paper, reports that most firms have a formal written investment policy with regards to the types of financial securities in which their cash reserves are to be invested in. Further, these policies are typically reviewed annually and require approval from the board of directors before changes can be made to them.

CCE consists of liquid cash and also of very liquid financial investments that had a maturity of less than three months when issued or at the time they were purchased by a firm that typically earn a low yield. Compared to CCE, STI securities have a longer maturity, earn higher yields, but reduce a firm's access to liquidity in the short-term.

We presume that firms trade off the costs of reduced access to liquidity in the short-term with the benefits of higher yields on STI to determine how much of their total cash reserves should be held in STI. In our empirical analyses, we test predictions generated from this premise and provide evidence on key determinants of the variation in the extent to which firms invest their cash reserves in STI.

We first document that a firm holds more of its total cash reserves in STI when it faces less uncertainty with respect to its short-term liquidity needs. Next, we run a battery of tests whose results show that financially constrained firms, who typically hold large cash reserves to ensure they have the required capital for their long-term investment or operating needs, hold a greater fraction of these reserves in STI. We argue that because a significant portion of these firms' large cash reserves are held to meet longer-term liquidity needs, the lower liquidity of STI in the short-term should be less of a concern for these firms. Thus, these firms invest more of their cash reserves in STI in order to increase the yield earned on their cash reserves. As predicted, we also document that during periods when financially constrained firms need access to a greater amount of their total cash reserves, they transfer liquid funds from STI to CCE. Finally, we provide evidence that suggests managers of poorly governed firms hold more of their firm's cash reserves in CCE because these financial assets are highly liquid and allow such managers to more easily spend cash reserves on self-serving projects. Overall, our findings provide insights on what determines firms' choices with respect to the financial assets in which they invest their cash reserves. These choices are a critical component of firms' corporate liquidity management practices.

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Table 1
Components of short-term investments

Table 1 presents univariate descriptive statistics for a random sample of 434 firm-years on the accounting classifications of firms' short-term investment (STI) securities and also on the types of financial securities held in STI. To identify these firm-years, we first randomly draw from the study's main sample 1,000 firm-years over the years 1997-2011 with positive balances of STI. Next, we find that we are able to collect detailed data on the breakdown of STI for 434 of these firm-years. Panel A reports the mean values for the percent of firms' STI consisting of held-to-maturity, available-for-sale, or trading securities. STI securities are classified as held-to-maturity if they had a remaining maturity of more than three months when purchased and currently have a remaining maturity of twelve months or less and the firm has a strong intent to hold the securities to maturity. STI securities are classified as available-for-sale if they had a remaining maturity of more than three months when purchased and the possibility exists that the firm would sell some of these securities in the next twelve months due to liquidity needs or if circumstances arise that make it financially attractive to sell some of the securities (all or most of these securities are typically held to maturity). STI securities are classified as trading securities if they are bought and sold with the objective of generating profits from short-term price fluctuations. Panel B reports the mean values across the 434 randomly identified firm-years for the percentage of firms' total STI, total cash holdings (cash and cash equivalents plus STI), and total assets that consist of various types of STI securities. 'Other short-term investments' includes both assets that the company reported as 'Other' and assets that were held by only a small number of firms.

Panel A: Accounting classifications of STI securities

	Held-to-maturity	Available-for-sale	Trading
Mean percent of STI balance	12.65%	85.05%	2.30%

Panel B: STI security types

	Mean values for asset type as a percent of:		
Asset type	Short-term investments	Total cash holdings	Total book assets
U.S. government debt	29.96	16.08	7.66
U.S. corporate debt	27.37	15.76	7.99
Municipal debt	14.54	8.01	3.49
Commercial paper	7.45	3.61	1.98
Auction rate securities	6.87	3.40	1.06
Equity securities	4.24	2.30	0.77
Certificates of deposit	4.12	1.62	0.78
Mutual funds (incl. money market funds)	2.39	1.41	0.43
Asset-backed securities (incl. mortgage-backed securities)	1.57	0.75	0.25
Other short-term investments	0.86	0.37	0.10
Foreign debt	0.63	0.28	0.12

Table 2
Summary statistics for the composition of total cash holdings

Table 2 presents univariate descriptive statistics for the composition of total cash holdings. Total cash holdings is the sum of cash and cash equivalents and STI. Panel A reports statistics for Compustat industrial firms over the 1980-2011 period for which we are able to construct the variables needed for the Table 4 regression models. Panel B reports statistics for the subset of Panel A firm-years with positive STI balances. Panel C reports statistics for all firm-years for the subset of firms examined in Panel A that have a positive STI balance in at least one year in the sample period. Panel D reports industry-level statistics for STI. The industries are defined based on the Fama and French 49 industry classification. Percent positive STI is the percent of firm-years in a given industry over our sample period for which investment in STI securities is nonzero. All continuous variables are winsorized at the 1st and 99th percentiles.

Panel A: Full sample

	N	Mean	P25	Median	P75
Total cash holdings/book assets	107,048	0.173	0.024	0.082	0.243
Cash and cash equivalents/book assets	107,048	0.111	0.016	0.049	0.143
STI/book assets	107,048	0.061	0.000	0.000	0.045
STI/total cash holdings	107,048	0.204	0.000	0.000	0.368

Panel B: Sample firm-years with positive balances of STI

	N	Mean	P25	Median	P75
Total cash holdings/book assets	43,692	0.277	0.084	0.204	0.415
Cash and cash equivalents/book assets	43,692	0.126	0.021	0.070	0.178
STI/book assets	43,692	0.149	0.019	0.078	0.221
STI/total cash holdings	43,692	0.501	0.200	0.507	0.802

Panel C: Sample firms that invest in STI during at least one year

	N	Mean	P25	Median	P75
Total cash holdings/book assets	83,875	0.198	0.034	0.109	0.288
Cash and cash equivalents/book assets	83,875	0.119	0.019	0.058	0.158
STI/book assets	83,875	0.077	0.000	0.001	0.085
STI/total cash holdings	83,875	0.261	0.000	0.016	0.531

Table 2 – *continued*

Panel D: Industry-level statistics for STI

Industry number	Industry name	All sample firms: Mean STI/total cash holdings	All sample firms: Percent positive STI	All sample firms: N	Positive STI firm-years: Mean STI/total cash holdings	Positive STI firm-years: N
13	Pharmaceutical products	0.356	66.4	5,118	0.536	3,397
1	Agriculture	0.322	44.8	29	0.718	13
35	Computers	0.267	51.5	3,829	0.518	1,972
26	Defense	0.265	46.7	257	0.567	120
12	Medical equipment	0.261	49.3	4,013	0.530	1,978
37	Electronic equipment	0.259	51.1	6,747	0.507	3,450
36	Computer software	0.248	56.8	6,655	0.437	3,780
5	Tobacco products	0.244	43.3	194	0.562	84
38	Measuring and control equipment	0.241	46.0	2,789	0.525	1,283
17	Construction materials	0.223	36.4	3,087	0.611	1,125
34	Business services	0.220	45.5	7,389	0.482	3,365
41	Transportation	0.219	44.2	2,877	0.496	1,271
11	Healthcare	0.213	41.6	2,916	0.513	1,212
22	Electrical equipment	0.213	41.0	3,581	0.520	1,467
20	Fabricated products	0.212	32.1	480	0.661	154
3	Candy and soda	0.210	46.6	363	0.450	169
9	Consumer goods	0.201	37.1	2,560	0.540	950
28	Non-metallic and metal mining	0.198	41.9	551	0.472	231
30	Printing and publishing	0.192	37.4	5,840	0.512	2,185
27	Precious metals	0.190	44.4	468	0.428	208
4	Beer and liquor	0.190	33.8	408	0.562	138
2	Food products	0.190	34.3	2,127	0.553	730
6	Recreation	0.186	33.7	1,272	0.552	429
14	Petroleum and natural gas	0.186	38.0	2,347	0.491	891
29	Coal	0.185	34.7	262	0.533	91
8	Printing and publishing	0.184	34.1	1,439	0.541	490
18	Construction	0.180	41.0	1,504	0.439	617
15	Rubber and plastic products	0.175	27.3	1,186	0.641	324
44	Restaurants, hotels, and motels	0.171	36.8	3,151	0.466	1,158
7	Entertainment	0.170	38.4	1,943	0.442	746
23	Automobiles and trucks	0.167	33.3	1,649	0.502	549
21	Machinery	0.166	33.2	4,410	0.500	1,466
33	Personal services	0.164	41.3	1,507	0.398	622

40	Shipping containers	0.162	30.1	549	0.540	165
32	Communication	0.160	40.8	3,381	0.392	1,379
19	Steel works	0.148	29.1	1,897	0.510	552
10	Apparel	0.142	27.5	1,752	0.517	481
43	Retail	0.140	27.4	6,942	0.512	1,905
39	Business supplies	0.139	28.2	1,364	0.492	385
42	Wholesale	0.130	26.9	6,001	0.485	1,612
25	Shipbuilding and railroad equipment	0.120	24.7	190	0.487	47
16	Textiles	0.119	19.4	898	0.616	174
24	Aircraft	0.116	23.9	595	0.485	142

Table 3

Short-term investments holdings for constrained and unconstrained firms

Table 3 presents the mean values of STI/total cash holdings for constrained and unconstrained firms based on several classifications of financial constraints. The sample consists of Compustat industrial firms over the 1980-2011 period for which we are able to construct the variables needed for the Table 4 regression models. Data on credit lines are from Sufi (2009) and are for the 1996-2003 period. These data are obtained from Amir Sufi's website. Bond rating is an indicator variable for if a firm has a bond rating. Leverage is the sum of long-term debt and debt in current liabilities divided by total assets. A firm-year is classified as unconstrained (constrained) based on bond rating and line of credit if the firm has (does not have) a bond rating or line of credit. A firm-year is classified as unconstrained (constrained) based on leverage, credit line size, or unused credit line if it falls above (below) the cross-sectional median of that variable that year. A firm-year is classified as unconstrained (constrained) based on total cash holdings if it falls below (above) the cross-sectional median of total cash holdings for that year. ***, **, and * indicate statistical significance levels at the 1, 5, and 10 percent levels, respectively, for two-tailed t-tests of differences in mean values between constrained and unconstrained firms.

Financial constraints measure		N	Mean
Bond rating	Constrained	87,293	0.219
	Unconstrained	19,755	0.140***
Leverage	Constrained	53,515	0.274
	Unconstrained	53,533	0.135***
Line of credit	Constrained	3,198	0.346
	Unconstrained	17,682	0.126***
Credit line size/book assets	Constrained	708	0.254
	Unconstrained	708	0.073***
Unused credit line/book assets	Constrained	706	0.248
	Unconstrained	710	0.080***
Total cash holdings/book assets	Constrained	53,533	0.333
	Unconstrained	53,515	0.076***

Table 4

Determinants of the proportion of total cash holdings held in short-term investments

Table 4 presents the results from OLS regressions where the dependent variable is the fraction of total cash holdings held in STI, defined as STI divided by the sum of cash and cash equivalents and STI. The sample consists of Compustat industrial firms over the 1980-2011 period. Industry cash flow volatility is calculated for each firm-year as the two-digit industry median of the firm-level standard deviation of cash flows/book assets over the last ten years (a minimum of three observations is needed for the calculation). Bond rating is an indicator variable that takes the value of one if the firm has a bond rating, and zero otherwise. Leverage is the sum of long-term debt and debt in current liabilities divided by total assets. Tax cost of repatriating foreign earnings is the maximum of zero and a firm's pre-tax foreign income times its marginal tax rate in the U.S. minus the income taxes paid in the foreign jurisdictions divided by total assets. Marginal tax rates are obtained from John Graham's website, where available. See Graham (1996) for a description of the methodology used to calculate the marginal tax rates. We supplement the marginal tax rates with the maximum statutory rate in the U.S. for firm-years where the marginal tax rate is unavailable. Cash flow is earnings before interest and taxes plus depreciation expense minus interest expense minus tax expense minus common dividends. All continuous variables are winsorized at the 1st and 99th percentiles. The industry fixed effects are based on the Fama and French 49 industry classification. Models (3) and (4) include only firms that have STI during at least one year. *t*-statistics based on standard errors clustered at the firm level and robust to heteroskedasticity are presented in parentheses. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

Table 4 – *continued*
Determinants of the proportion of total cash holdings held in short-term investments

	Full Sample		Firms that invest in STI	
	(1)	(2)	(3)	(4)
Intercept	0.022	-0.141**	0.106	-0.191***
	(0.20)	(-2.43)	(0.85)	(-2.83)
Industry cash flow volatility	-0.002**	-0.001	-0.002*	-0.001
	(-2.42)	(-1.18)	(-1.87)	(-0.93)
Market-to-book assets	-0.006***	-0.006***	-0.008***	-0.007***
	(-6.51)	(-6.90)	(-7.35)	(-6.51)
R&D expenses/sales	-0.013***	-0.005*	-0.012***	-0.005**
	(-6.01)	(-1.91)	(-5.40)	(-2.08)
Bond rating	-0.034***	-0.026***	-0.038***	-0.023***
	(-6.63)	(-4.22)	(-6.16)	(-3.26)
Leverage	-0.077***	-0.044***	-0.062***	-0.060***
	(-9.41)	(-4.64)	(-6.34)	(-5.19)
Natural logarithm of real book assets	0.053***	0.082***	0.048***	0.100***
	(6.86)	(6.82)	(5.40)	(7.27)
Natural logarithm of real book assets squared	-0.001***	-0.002***	-0.001**	-0.003***
	(-2.70)	(-3.87)	(-2.24)	(-4.33)
Total cash holdings/book assets	0.703***	0.524***	0.690***	0.574***
	(66.63)	(43.05)	(61.02)	(42.97)
Cash flow/book assets	-0.007	-0.051***	-0.009	-0.053***
	(-0.95)	(-6.24)	(-0.97)	(-5.45)
Foreign sales dummy	-0.018***	-0.010**	-0.026***	-0.011*
	(-4.74)	(-1.98)	(-5.74)	(-1.93)
Tax cost of repatriating foreign earnings	-0.587**	-0.193	-0.568**	-0.204
	(-2.19)	(-0.94)	(-2.00)	(-0.93)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes
Observations	107,048	107,048	83,875	83,875
Adjusted R^2	0.305	0.543	0.313	0.511

Table 5
Line of credit availability and short-term investments

Table 5 presents the results from OLS regressions where the dependent variable is the fraction of total cash holdings held in STI, defined as STI divided by the sum of cash and cash equivalents and STI. The sample consists of Compustat industrial firms over the 1996-2003 period for which we are able to obtain the credit line-related variables used in Sufi (2009). The data on credit lines are obtained from Amir Sufi's website. All continuous variables are winsorized at the 1st and 99th percentiles. Unreported control variables are the independent variables appearing in the Table 4 models. The industry fixed effects are based on the Fama and French 49 industry classification. Models (4), (5), and (6) include only firms that have STI during at least one year. *t*-statistics based on standard errors clustered at the firm level and robust to heteroskedasticity are presented in parentheses. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

	Full sample			Firms that invest in STI		
	(1)	(2)	(3)	(4)	(5)	(6)
Line of credit dummy	-0.047***			-0.052***		
	(-4.71)			(-4.86)		
Total line of credit/book assets		-0.242***			-0.293***	
		(-4.37)			(-3.83)	
Unused line of credit/book assets			-0.300***			-0.341***
			(-4.06)			(-3.61)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,880	1,416	1,416	17,159	1,165	1,165
Adjusted R^2	0.301	0.401	0.401	0.280	0.372	0.372

Table 6
Savings rates and types of cash holdings

Table 6 presents results from OLS regressions where the dependent variable is the change in portions of cash holdings. The sample consists of Compustat industrial firms over the 1980-2011 period. The dependent variable in models (1) and (2) is the one-year change in the sum of cash and cash equivalents and STI scaled by book assets. The dependent variable in models (3) and (4) is the one-year change in STI scaled by book assets. The dependent variable in models (5) and (6) is the one-year change in cash and cash equivalents scaled by book assets. Cash flow is scaled by book assets. Equity issued is the proceeds from the sale of common and preferred stock scaled by book assets. Debt issued is the proceeds from long-term debt issuance scaled by book assets. Top STI/total cash holdings quintile is an indicator variable that equals one for firm-years where STI/total cash holdings is in the top quintile of the sample cross-sectional distribution for a given year, and equals zero otherwise. Panel B reports the results for only firms that have STI during at least one year. All continuous variables are winsorized at the 1st and 99th percentiles. *t*-statistics based on standard errors clustered at the firm level and robust to heteroskedasticity are presented in parentheses. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

Table 6 – *continued*
Savings rates and types of cash holdings

Panel A: Full sample

Dependent variable	Δ(Total cash holdings/ book assets)		Δ (STI/book assets)		Δ(Cash and cash equivalents/ book assets)	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.199***	-0.144***	-0.079***	-0.041***	-0.094***	-0.082***
	(-18.57)	(-13.62)	(-12.95)	(-6.77)	(-11.73)	(-10.33)
Cash flow/book assets * STI/total cash holdings	0.167***		0.161***		-0.030**	
	(8.86)		(12.33)		(-2.43)	
Equity issued/book assets * STI/total cash holdings	0.241***		0.507***		-0.332***	
	(15.39)		(57.96)		(-29.99)	
Debt issued/book assets * STI/total cash holdings	0.248***		0.124***		0.097***	
	(11.62)		(9.33)		(10.73)	
Cash flow/book assets * Top STI/total cash holdings quintile		0.111***		0.010***		-0.013
		(8.35)		(11.28)		(-1.24)
Equity issued/book assets * Top STI/total cash holdings quintile		0.189***		0.349***		-0.380***
		(17.11)		(54.65)		(-64.71)
Debt issued/book assets * Top STI/total cash holdings quintile		0.192***		0.094***		0.079***
		(11.57)		(9.57)		(9.29)
Cash flow/book assets	0.179***	0.190***	0.032***	0.047***	0.144***	0.137***
	(24.08)	(26.37)	(11.34)	(14.85)	(22.98)	(23.17)
Equity issued/book assets	0.479***	0.488***	0.011***	0.045***	0.417***	0.380***
	(57.85)	(62.01)	(4.44)	(13.11)	(65.93)	(74.71)
Debt issued/book assets	0.013***	0.021***	0.005***	0.009***	0.008***	0.011***
	(3.18)	(5.14)	(4.06)	(6.15)	(2.52)	(3.62)
STI/total cash holdings	-0.024***		0.073***		-0.090***	
	(-7.36)		(28.75)		(-33.49)	
Top STI/total cash holdings quintile		0.019***		0.083***		-0.065***
		(8.99)		(53.20)		(-41.03)
Capital inflows from other sources/book assets	0.009	0.012	-0.064***	-0.061***	0.074***	0.073***
	(0.85)	(1.12)	(-8.99)	(-8.33)	(9.80)	(9.50)
Natural logarithm of real book assets	0.017***	0.016***	0.004***	0.003***	0.011***	0.011***
	(14.68)	(14.41)	(5.62)	(5.41)	(12.32)	(12.26)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	92,610	92,610	92,610	92,610	92,610	92,610
Adjusted R^2	0.463	0.463	0.359	0.325	0.328	0.308

Table 6 – *continued*
Savings rates and types of cash holdings

Panel B: Firms that invest in STI

Dependent variable	Δ (Total cash holdings/ book assets)		Δ (STI/book assets)		Δ(Cash and cash equivalents/ book assets)	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.206***	-0.147***	-0.091***	-0.048***	-0.088***	-0.078***
	(-17.34)	(-11.28)	(-12.81)	(-6.86)	(-10.09)	(-8.98)
Cash flow/book assets * STI/total cash holdings	0.137***		0.153***		-0.053***	
	(7.10)		(11.56)		(-4.12)	
Equity issued/book assets * STI/total cash holdings	0.199***		0.500***		-0.365***	
	(12.10)		(54.63)		(-31.36)	
Debt issued/book assets * STI/total cash holdings	0.246***		0.121***		0.096***	
	(11.33)		(8.99)		(10.39)	
Cash flow/book assets * Top STI/total cash holdings quintile		0.091***		0.090***		-0.021**
		(6.73)		(9.98)		(-2.03)
Equity issued/book assets * Top STI/total cash holdings quintile		0.160***		0.337***		-0.191***
		(13.99)		(49.77)		(-18.60)
Debt issued/book assets * Top STI/total cash holdings quintile		0.187***		0.090***		0.078***
		(11.28)		(9.24)		(9.04)
Cash flow/book assets	0.200***	0.211***	0.040***	0.059***	0.158***	0.145***
	(23.91)	(26.36)	(11.37)	(15.39)	(22.43)	(22.14)
Equity issued/book assets	0.508***	0.515***	0.016***	0.057***	0.441***	0.391***
	(54.98)	(59.69)	(4.84)	(15.37)	(62.65)	(60.80)
Debt issued/book assets	0.015***	0.025***	0.007***	0.012***	0.009**	0.012***
	(2.87)	(5.04)	(4.11)	(6.37)	(2.13)	(3.26)
STI/total cash holdings	-0.020***		0.076***		-0.088***	
	(-5.99)		(29.25)		(-32.69)	
Top STI/total cash holdings quintile		0.019***		0.083***		-0.065***
		(9.04)		(53.34)		(-41.20)
Capital inflows from other sources/book assets	0.004	0.007	-0.069***	-0.064***	0.073***	0.072***
	(0.41)	(0.69)	(-9.12)	(-8.33)	(9.70)	(9.20)
Natural logarithm of real book assets	0.017***	0.017***	0.004***	0.004***	0.011***	0.011***
	(13.78)	(13.56)	(5.31)	(5.31)	(11.50)	(11.33)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	73,728	73,728	73,728	73,728	73,728	73,728
Adjusted R^2	0.481	0.482	0.372	0.339	0.333	0.306

Table 7

Corporate investment and changes in the composition of total cash holdings

Table 7 presents results from OLS regressions where the dependent variable is the sum of research and development expenses, capital expenditures, and advertising expenses scaled by book assets. The sample consists of Compustat industrial firms over the 1980-2011 period. Market value of assets is book assets minus book equity plus the market value of equity. $\Delta(\text{STI/total cash holdings})_t$ is the ratio of STI_t to total cash holdings_t minus its lagged value. Large negative $\Delta(\text{STI/total cash holdings})_t$ is an indicator variable that equals one for firm-years where $\Delta(\text{STI/total cash holdings})_t$ is in the bottom quintile of the cross-sectional sample distribution for a given year, and equals zero otherwise. Pre-investment earnings is income before extraordinary items plus interest expense plus tax expense plus depreciation plus the sum of research and development expenses, capital expenditures, and advertising expenses. All continuous variables are winsorized at the 1st and 99th percentiles. In Panel A, models (3) and (4) include only firms that have STI during at least one year. In Panel B, models (5)-(8) include only firms that have STI during at least one year. *t*-statistics based on standard errors clustered at the firm level and robust to heteroskedasticity are presented in parentheses. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

Panel A: All firm-years

	Full sample		Firms that invest in STI	
	(1)	(2)	(3)	(4)
Intercept	0.214***	0.214***	0.229***	0.230***
	(27.28)	(26.98)	(25.47)	(25.17)
$\text{Total cash holdings}_{t-1}$ * $\Delta(\text{STI/total cash holdings})_t$	-0.087***		-0.086***	
	(-4.87)		(-4.86)	
$\text{Total cash holdings}_{t-1}$ * Large negative $\Delta(\text{STI/total cash holdings})_t$		0.026**		0.028**
		(2.17)		(2.15)
$\text{Total cash holdings}_{t-1}$	0.072***	0.064***	0.068***	0.059**
	(3.13)	(2.52)	(2.74)	(2.12)
$\Delta(\text{STI/total cash holdings})_t$	-0.001		-0.001	
	(-0.24)		(-0.03)	
Large negative $\Delta(\text{STI/total cash holdings})_t$		0.004**		0.003*
		(1.98)		(1.69)
Natural logarithm of real market value of assets_t	-0.020***	-0.020***	-0.022***	-0.022***
	(-10.45)	(-10.55)	(-9.18)	(-9.27)
Market-to-book assets_t	0.019***	0.019***	0.019***	0.019***
	(16.33)	(16.31)	(15.46)	(15.45)
Pre-investment earnings/book assets_t	-0.039*	-0.039*	-0.060*	-0.060*
	(-1.65)	(-1.66)	(-1.75)	(-1.75)
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	94,470	94,470	75,363	75,363
Adjusted R^2	0.428	0.427	0.391	0.390

Table 7 – *continued*
Corporate investment and changes in the composition of total cash holdings

Panel B: Corporate investment for constrained and unconstrained firms

	Full sample				Firms that invest in STI			
	Firm-years without a bond rating		Firm-years with a bond rating		Firm-years without a bond rating		Firm-years with a bond rating	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.215***	0.215***	0.158***	0.157***	0.231***	0.232***	0.162***	0.161***
	(22.49)	(22.18)	(14.35)	(14.14)	(20.75)	(20.42)	(13.16)	(12.93)
Total cash holdings$_{t-1}$ * Δ(STI/total cash holdings)$_t$	-0.089***		-0.029		-0.085***		-0.028	
	(-4.54)		(-1.26)		(-4.54)		(-1.23)	
Total cash holdings$_{t-1}$ * large negative Δ(STI/total cash holdings)$_t$		0.024*		0.010		0.025*		0.011
		(1.85)		(0.69)		(1.82)		(0.74)
Total cash holdings$_{t-1}$	0.078***	0.070***	0.017	0.014	0.075***	0.066**	0.017	0.014
	(3.04)	(2.48)	(1.55)	(1.13)	(2.66)	(2.11)	(1.49)	(1.04)
Δ(STI/total cash holdings)$_t$	-0.002		-0.001		-0.001		-0.001	
	(-0.39)		(-0.32)		(-0.15)		(-0.39)	
Large negative Δ(STI/total cash holdings)$_t$		0.005**		0.001		0.004*		0.001
		(2.21)		(0.78)		(1.95)		(0.71)
Natural logarithm of real market value of assets$_t$	-0.024***	-0.025***	-0.006***	-0.006***	-0.026***	-0.026***	-0.006***	-0.006***
	(-9.66)	(-9.76)	(-3.86)	(-3.89)	(-8.45)	(-8.54)	(-3.70)	(-3.73)
Market-to-book assets$_t$	0.020***	0.020***	0.004***	0.004***	0.021***	0.021***	0.003***	0.003**
	(15.66)	(15.64)	(2.96)	(2.93)	(15.05)	(15.04)	(2.41)	(2.38)
Pre-investment earnings/book assets$_t$	-0.043*	-0.043*	0.147***	0.147***	-0.066*	-0.066*	0.146***	0.146***
	(-1.76)	(-1.76)	(8.78)	(8.73)	(-1.86)	(-1.90)	(7.79)	(7.74)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	75,891	75,891	18,579	18,579	59,941	59,941	15,422	15,422
Adjusted R^2	0.407	0.407	0.731	0.731	0.369	0.369	0.719	0.712

Table 8
The impact of exogenous changes in the aggregate supply of credit on holdings of short-term investments

Table 8 presents the results from OLS regressions where the dependent variable is the fraction of total cash holdings held in STI, defined as STI divided by the sum of cash and cash equivalents and STI. The sample consists of Compustat industrial firms over the 1980-2011 period. C&I rate spread is the trailing four-quarter average of the spread between commercial and industrial loan rates (on loans greater than $1 million) and the federal funds rate calculated over the period ending closest to but not after a firm's fiscal year end based on data provided by the Federal Reserve of St. Louis. This trailing four-quarter average is calculated at the end of every quarter during and after 1984 and at the end of each calendar year prior to 1984. All continuous variables are winsorized at the 1st and 99th percentiles. Unreported control variables are the independent variables appearing in the Table 4 models. Panel B reports the results for only firms that have STI during at least one year. *t*-statistics based on standard errors clustered at the firm level and robust to heteroskedasticity are presented in parentheses. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

Panel A: Full sample

	All firm-years		Firm-years without a bond rating		Firm-years with a bond rating	
	(1)	(2)	(3)	(4)	(5)	(6)
C&I rate spread	-0.027**	-0.020**	-0.030**	-0.024**	-0.005	-0.013
	(-2.37)	(-2.04)	(-2.33)	(-2.17)	(-0.20)	(-0.61)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
N	107,048	107,048	87,293	87,293	19,755	19,755
Adjusted R^2	0.306	0.544	0.302	0.557	0.340	0.575

Panel B: Firms that invest in STI

	All firm-years		Firm-years without a bond rating		Firm-years with a bond rating	
	(1)	(2)	(3)	(4)	(5)	(6)
C&I rate spread	-0.028**	-0.021*	-0.032**	-0.026*	-0.018	-0.024
	(-2.12)	(-1.77)	(-2.11)	(-1.88)	(-0.67)	(-0.99)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
N	83,875	83,875	67,357	67,357	16,518	16,518
Adjusted R^2	0.313	0.511	0.303	0.517	0.335	0.560

Table 9
The impact of net flows into high yield bond mutual funds on holdings of short-term investments for speculative grade firms

Table 9 investigates the impact of net flows into high yield bond mutual funds on the fraction of total cash holdings held in STI for firms with a speculative grade rating. The sample consists of Compustat industrial firms over the 1984-2011 period with a public bond rating of either BBB- or BB+. Panel A presents the results of OLS regressions where the dependent variable is the fraction of total cash holdings held in STI, defined as STI divided by the sum of cash and cash equivalents and STI. The regressions in this panel are run using all firms with a public bond rating of either BBB- or BB+ that have necessary data to construct the variables in the models. Speculative grade firm is an indicator variable that takes the value of one if a firm is rated BB+ and zero if it is rated BBB-. Fund flows is the sum of the four quarters of net flows into high-yield bond mutual funds ending closest to but on or before the month of a firm's fiscal year-end. The mutual fund data is provided by the Investment Company Institute and is available starting in 1984. Unreported control variables are the independent variables appearing in the Table 4 models other than the bond rating indicator. Panel B presents the results of OLS regressions in which the sample consists of firms with a public bond rating of BB+ and matched firms that are identified following the matching procedure used in Chernenko and Sunderam (2011). Each BB+ rated firm is matched to a BBB- rated firm (with replacement) in the same year and Fama-French 48 industry that is closest based on the following matching variables: leverage, market-to-book assets, natural logarithm of real book assets, total cash holdings scaled by book assets, Z-score, and sales growth. The matched firm is the one with the shortest Mahalanobis distance. If the difference between the treatment and matched firm for any matching variable is greater than the sample standard deviation of that variable, that firm-pair is removed from the sample. The dependent variable in the Panel B regression models is the difference in the fraction of total cash holdings held as STI between the BB+ rated firm and its matched BBB- rated firm. Further, each control variable is the difference for that variable between the BB+ rated firm and its matched BBB- rated firm. Unreported control variables include those from Table 4 other than the bond rating indicator. All continuous variables are winsorized at the 1st and 99th percentiles. *t*-statistics based on standard errors clustered at the firm level and robust to heteroskedasticity are presented in parentheses. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

Table 9 – *continued*
The impact of net flows into high yield bond mutual funds on holdings of short-term investments for speculative grade firms

Panel A: All sample firms with a BB+ or BBB- rating

	Full sample		Firms that invest in STI	
	(1)	(2)	(3)	(4)
Speculative grade firm * Fund flows	0.002**	0.001*	0.002**	0.002*
	(2.44)	(1.94)	(2.24)	(1.96)
Speculative grade firm	0.009	0.015	0.003	0.018
	(0.84)	(1.41)	(0.28)	(1.38)
Fund flows	-0.001	-0.000	-0.002	-0.000
	(-0.42)	(-0.08)	(-0.88)	(-0.25)
Controls from Table 4	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes
N	2,769	2,769	2,215	2,215
Adjusted R^2	0.311	0.618	0.306	0.603

Panel B: Differences between firms with a BB+ rating and matched firms with a BBB- rating

	Full sample	Firms that invest in STI
	(1)	(2)
Fund flows	0.001*	0.002*
	(1.78)	(1.81)
Controls from Table 4	Yes	Yes
N	719	561
Adjusted R^2	0.105	0.107

Table 10
The impact of a negative shock to the supply of speculative grade debt on holdings of short-term investments for speculative grade firms

Table 10 reports the results of differences-in-differences tests of the fraction of total cash holdings held in STI around a shock to the supply of public debt for speculative grade firms. The sample consists of Compustat industrial firms over the 1986-1993 period that have a speculative grade public bond rating and matched firms that do not have a bond rating. Panel A presents the results for the difference between a treatment group (firms with a speculative grade bond rating) relative to a control group (a matched sample of firms without a bond rating). Each treatment firm is matched to the closest four unrated firms (with replacement) based on propensity scores calculated from a model for the propensity to have a speculative grade bond rating. The resulting sample of treatment and matched firms consists of 1,256 firms. The propensity model used for matching is estimated using the variables in Lemmon and Roberts (2010), which include the one-year growth in long-term debt issuance, the one-year growth in short-term debt issuance, the one-year growth in equity issuance, the one-year growth in book leverage, the one-year growth in capital expenditures, the one-year growth for acquisition expenditures, cash flow, market-to-book assets, Z-score, the natural logarithm of total sales, firm age, an indicator for if a firm is included in the S&P 500, an indicator for if a firm is listed on the New York Stock Exchange, and industry fixed effects. The continuous variables used in the propensity model are averaged at the firm-level over the 1986-1989 time period. Indicator variables take the value of one in the model if a firm meets a given criteria in any year from 1986 through 1989. Speculative grade firm difference is the difference in the average fraction of total cash holdings held in STI for the treatment group in the post-period (1990-1993) relative to the pre-period (1986-1989). To calculate this difference, we first determine the average values for the pre-period and the post-period for every firm, next we calculate the difference between these average values, and finally we calculate the average sample value (Avg) and standard error (SE) for this difference. Unrated difference is the corresponding difference for the control group. Panel B presents the results of cross-sectional variation within speculative grade firms resulting from a firm's geographic location in the U.S. A firm is defined to be located in the Northeast (NE) region if it is headquartered in Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Pennsylvania, or Vermont. NE speculative grade firm difference and other speculative grade firm difference are calculated as in Panel A by comparing the post-period to the pre-period. Difference-in-Difference is the difference between the average differences of the treatment group and the control group for Panel A and between firms headquartered in the NE region and elsewhere in Panel B. The *t*-statistic from a difference in means test for whether the average differences across treatment and control groups significantly differ is reported below. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

Panel A: Matched sample

	Full sample	Firms that invest in STI
	(1)	(2)
Avg: Speculative grade firm difference	-0.131	-0.140
SE: Speculative grade firm difference	(0.018)	(0.020)
Avg: Unrated firm difference	-0.016	-0.009
SE: Unrated firm difference	(0.012)	(0.014)
Difference-in-Difference	-0.115***	-0.131***
t-stat: Difference-in-Difference	(-3.81)	(-3.79)

Panel B: Cross-sectional variation based on geographic location for speculative grade firms

	Full sample	Firms that invest in STI
	(1)	(2)
Avg: NE speculative grade firm difference	-0.180	-0.195
SE: NE Speculative grade firm difference	(0.033)	(0.035)
Avg: Other speculative grade firm difference	-0.097	-0.111
SE: Other speculative grade firm difference	(0.021)	(0.024)
Difference-in-Difference	-0.083**	-0.084**
t-stat: Difference-in-Difference	(-2.11)	(-2.01)

Table 11
Corporate governance and the proportion of total cash holdings held in short-term investments

Table 11 presents the results from OLS regressions where the dependent variable is the fraction of total cash holdings held in STI, defined as STI divided by the sum of cash and cash equivalents and STI. The sample consists of Compustat industrial firms. The periods examined for the various models is a function of the availability of the governance variables used. G-Index is the Gompers et al. (2003) governance index based on 24 antitakeover provisions and the data is available from RiskMetrics for the 1990-2006 period. E-Index is the Bebchuk et al. (2009) governance index based on 6 antitakeover provisions and the data is available from RiskMetrics for the 1990-2006 period and from the IRRC database for the 2007-2011 period. Data for the G- and E- Index are only used for the years over which the data are collected. 5% (10%) Block is an indicator for a firm with a shareholder that owns at least 5% (10%) of its shares. Inst Tot is the percent of shares held by institutional investors. Inst Top 5 is the proportion of institutional investor ownership accounted for by the top five institutional investors. Inst HHI is the Herfindahl index of the fractions of shares held by institutional shareholders. The data for the blockholder and institutional ownership variables are obtained from Thomson CDA Spectrum for the 1980-2011 period. BC Laws is an indicator that equals one following the adoption of antitakeover laws in the state in which a firm is incorporated, and zero otherwise. For model (8), we follow Bertrand and Mullainathan (2003) by ending our sample period in 1995 as the last adoption of an antitakeover law occurs in 1991. All continuous variables are winsorized at the 1st and 99th percentiles. Unreported control variables are the independent variables appearing in the Table 4 models. Panel B reports the results for only firms that have STI during at least one year. *t*-statistics based on standard errors clustered at the firm level and robust to heteroskedasticity are presented in parentheses. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

Panel A: Full sample

Governance measure	G-Index	E-Index	5% Block	10% Block	Inst Tot	Inst Top 5	Inst HHI	BC Laws
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Governance	-0.009***	-0.007**	0.012***	0.007**	0.040***	0.031***	0.085*	-0.047***
	(-3.11)	(-2.11)	(4.43)	(2.45)	(4.52)	(6.26)	(1.84)	(-4.86)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,823	13,488	104,877	104,877	104,877	104,877	104,877	48,501
Adjusted R^2	0.614	0.605	0.545	0.545	0.545	0.545	0.545	0.578

Panel B: Firms that invest in STI

Governance measure	G-Index	E-Index	5% Block	10% Block	Inst Tot	Inst Top 5	Inst HHI	BC Laws
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Governance	-0.010***	-0.007**	0.014***	0.008**	0.044***	0.030***	0.105*	-0.053***
	(-3.15)	(-2.00)	(4.15)	(2.39)	(4.18)	(4.57)	(1.81)	(-4.66)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,644	11,603	82,161	82,161	82,161	82,161	82,161	37,962
Adjusted R^2	0.599	0.588	0.513	0.513	0.513	0.513	0.513	0.512