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

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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 when (i) 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, (ii) it faces less uncertainty with respect to its short-term liquidity needs, or (iii) it does not have cash trapped abroad due to high repatriation tax costs. 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. Overall, our findings provide insights on an important component of corporate liquidity management practices.

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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 larger cash reserves include that they reduce underinvestment problems for financially constrained firms (Almeida, Campello, and Weisbach (2004) 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 (e.g., Jensen (1986) and Harford (1999)).

Despite the significant attention given to explaining the variation in the *total* level 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 versus short-term investments (hereafter referred to as STI). Firms distinguish between these two main 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. Cash and cash equivalents represent liquid cash and also highly

[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.

liquid financial investments with a maturity of less than three months. Common investments that fall into this category earn a low return and include commercial paper, overnight repos, and short-term certificates of deposit. STI consists mostly of (i) financial assets that currently have a maturity of between three and twelve months that a firm has a strong intent to hold until maturity and (ii) financial assets that currently have a maturity of greater than three months (and potentially a maturity greater than twelve months) that are expected to be held to 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 cash and cash equivalents 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.

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. The longer maturity of STI securities also reduce a firm's access to liquidity because it increases a 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 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. The above discussion leads to the premise that firms trade off the costs of insufficient liquidity with the benefits of higher yields on STI to determine the percent of their total cash reserves held in STI. Survey and anecdotal evidence is consistent with this premise. For example, in discussing the results of a survey conducted by Sungard that asked corporate treasurers what

[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.

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. Also, Robert Deutsch, head of global liquidity at J.P. Morgan Asset Management reports that to raise the 0.05% to a 0.10% yield their firm earns on the safest short-term financial investments, many treasurers will extend the maturity of these investments from 30 or 60 days to six months to a year to boost the yield earned on these investments by 0.25% to 0.50%.[3]

We document significant variation with respect to the proportion of corporate cash reserves held in STI. For our sample of Compustat industrial firms over the 1980-2011 period, on average, 20% of a firm's total cash reserves consists of STI. However, in approximately 59% of the firm-years that we study a firm does not invest in STI. Conditional on holding STI, on average, 50% of a firm's total cash reserves is invested in STI.

To investigate what determines the variation in the proportion of cash reserves invested in STI, we test empirical predictions generated from the premise that firms trade off the higher yields of STI with the reduced liquidity of STI securities. In identifying these determinants we rely primarily on firm fixed effects to ensure that our models capture within firm variation and not simply cross-sectional correlations. 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 makes it relatively less desirable when firms unexpectedly need to access significant amounts of their cash reserves. We expect that if a firm operates in an industry with greater cash flow volatility it is harder for the firm to predict its short-term liquidity needs. Similarly, because firms with larger growth opportunities often invest in new projects with less predictable cash flows, it is more difficult for these firms to predict how much of their cash reserves they may need to use in the short-term. Consistent with our prediction, we find that the fraction of a firm's cash reserves invested in STI is negatively associated with cash flow volatility in its industry and if it has

[3] See "Spotlight on Corporate Cash Investment Priorities," *Treasury Management International Magazine*, February, 2012 and "J.P. Morgan Sees Renewed Appetite for Risk," *The Wall Street Journal*, December 7, 2011.

large growth opportunities, as proxied for by its market-to-book assets ratio and research and development expenses.

We next run a series of tests that investigate the effect of financial constraints on the composition of a firm's cash reserves. Prior work convincingly shows that financially constrained firms maintain large cash reserves to ensure they have the required capital for their future investment and operating needs. Because a large 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 argue that these firms will hold more of their cash reserves in STI. 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 current year 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 cash and cash equivalents.[4] Supporting the above arguments, we document that the fraction of a firm's cash reserves held in STI is positively associated with proxies for whether the firm is financially constrained (the firm does not have a bond rating or it has a low leverage ratio (Faulkender and Petersen (2006)).

Extant work shows that bank lines of credit are a viable liquidity substitute for cash holdings for firms that are financially unconstrained and 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)). We use data on credit lines from Sufi (2009) to examine how the fraction of firms' cash reserves invested in STI relates to the liquidity provided by a credit line. 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

[4] 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 long-term financing needs (e.g., Opler, Pinkowitz, Stulz, and Williamson (1999) and Almeida, Campello, and Weisbach (2004)).

a firm 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).

To further shed light on whether financially constrained firms hold a larger fraction of their cash reserves in STI, we 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 more important fraction of their internally generated cash flows and also save a higher proportion of the proceeds they raise from equity and debt issues. Also, these firms put a larger fraction of each of these three cash inflows into STI relative to cash and cash equivalents. These results further strengthen the argument that financially constrained firms invest more of their cash reserves in STI.

We also examine the relation between firm size and a firm's decision to invest more of its cash reserves into STI. This allows us to provide further evidence on whether financial constraints impact this decision and also to shed light on the effect of the resulting increase in interest rate risk from holding STI on this decision. Large firms are expected to hold less STI because these firms are less likely financially constrained. On the other hand, very small firms may also hold less STI because for these firms the fixed cost of hedging interest rate risk resulting from investing heavily in STI could be too large. This leads to a prediction that the fraction of a firm's cash reserves invested in STI is an inverted U-shaped function of firm size. Supporting this prediction, we find that the fraction of firms' cash reserves held in STI is positively associated with firm size and negatively associated with firm size squared.

The notion that financially constrained firms invest a large fraction of their cash reserves into STI in order to earn some additional yield while these reserves are held for future investment and operating needs relies on the assumption that during years when significant amounts of these reserves are needed to fund new investment or a firm's operations that financially constrained firms transfer funds from STI to cash and cash equivalents. We run several tests that provide evidence that is supportive of this assumption. First, we find that 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 cash and cash equivalents relative to STI. Further, we show that this result only holds for firms that are financially constrained.

Second, we examine how exogenous decreases to the supply of externally available credit impact the fraction of a firm's cash reserves invested in STI. We expect that when the supply of credit contracts that firms transfer funds from STI to cash and cash equivalents 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 decreases (increases) the supply of credit contracts grows (contracts). Supporting our prediction, we find that when the spread of commercial and industrial loan rates relative to the federal funds rate widens that firms increase the fraction of their cash holdings held in cash and cash equivalents and that this finding only holds for financially constrained firms.

To further examine how exogenous decreases in the supply of available credit impact the fraction of a firm's cash reserves invested in STI, we run tests that focus on firms with a speculative grade debt rating (below investment grade) whose outstanding debt is considered high-yield debt. In doing so, we follow Chernenko and Sundaram (2011) and proxy for the supply of credit available to speculate grade firms with net flows into high-yield corporate bond mutual funds. Consistent with expectations, we find that relative to the firms in a control sample which are similar to firms with a speculative grade rating, but unlikely to be affected by flows into high-yield corporate bond mutual funds, that firms with a speculative grade rating increase the fraction of their cash reserves held in cash and cash equivalents when fund flows into high-yield corporate bond mutual funds decrease. We also follow Lemmon and Roberts (2010) and examine 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. We examine changes in the proportion of total cash held in STI surrounding this shock for firms with a speculative-grade bond rating. Using a difference-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 debt financing, we find that during the years immediately following 1989 that speculative-grade firms increased the fraction of their cash reserves held in cash and cash equivalents. This evidence further supports our predictions.

Next, 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 finds that managers in poorly governed firms use their firm's cash holdings to invest in self-serving projects (e.g., Jensen (1986), Harford (1999), and Harford, Mansi, and Maxwell (2008)). Due to the lower liquidity of STI securities relative to cash and cash equivalents, such managers could prefer if their firm's cash reserves are held predominantly in cash and cash equivalents rather than STI. This would provide these managers with easier and quicker access to their firm's cash reserves when they want to spend portions of these reserves on self-serving projects. Consistent with this proposition, we document 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, using staggered state adoptions of antitakeover provisions as an exogenous shock that reduces the quality of a firm's governance environment, we find again that a worse corporate governance environment results in a firm holding less of its cash reserves in STI.

Finally, prior work shows that an important determinant of a firm's total cash reserves is whether it has cash trapped overseas due to the tax costs of repatriating its foreign

earnings (e.g., Foley, Hartzell, Titman, and Twite (2007)). Because the importance for a firm of keeping its cash trapped abroad in more liquid assets may differ from that of the remainder of its cash reserves, we examine whether the fraction of a firm's cash reserves held in STI is associated with the likelihood it has cash trapped overseas. We find that when this likelihood is higher, firms hold less of their cash reserves in STI. This result is consistent with growing anecdotal evidence that suggests many subsidiaries of U.S. multinational firms keep an important fraction of their cash reserves in cash and cash equivalents held in bank accounts so they can provide their U.S. based parents with liquidity via short-term loans.

Our study contributes in several ways. Importantly, we provide evidence on the determinants of the significant variation in the fraction of firms' total cash reserves that consist 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.[5] Likewise, our findings provide insights into the result documented in Harford, Mansi, and Maxwell (2008) that firms with poor 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 cash and cash equivalents so they can more easily spend these reserves.

The remainder of this paper is organized as follows. Section 1 develops empirical predictions. Section 2 describes the composition of corporate cash reserves. Section 3 discusses our sample and reports univariate findings. Section 4 provides the results of our multivariate tests. Finally, Section 5 concludes.

[5] 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).

1. Empirical Predictions

Large corporate cash reserves can be beneficial for firms that are financially constrained because they reduce underinvestment problems for these firms (e.g., Opler, Pinkowitz, Stulz, and Williamson (1999), Almeida, Campello, and Weisbach (2004), and Almeida, Campello, Cunha, and Weisbach (2014)). Consistent with this proposition, Harford, Mikkelson, and Partch (2003) report that a large cash balance enables firms to continue investing in their growth opportunities both during and immediately after an industry downturn. 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.[6]

Significant cash reserves can also be costly 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 suggesting 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 holdings that are invested in STI. First, the lower liquidity of securities held in STI 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

[6] 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.

typically maintain large cash balances to ensure that they have the required financing for their long-term investment and operating needs, the reduced liquidity of STI in the short-term imposes smaller costs on these firms. Thus, financially constrained firms hold more of their total cash reserves in STI.

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 cash and cash equivalents. Survey evidence is consistent with this prediction and the notion that financially constrained firms invest important fractions of their cash reserves into STI until the point in time when these reserves are needed for investment. 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.[7] Namely, cash reserves that are held primarily for short-term operating needs are placed in a tranche in which only highly liquid securities with very low risk are invested in. Conversely, cash holdings that are held for a firm's long-term investment needs are put in a cash reserves tranche where financial investments are made into relatively more risky and less liquid securities with a higher yield.

Fourth, we expect that interest rate risk resulting from investing in STI impacts the fraction of a firm's cash reserves that are invested in STI. Here, we anticipate that very small firms will hold less of their cash reserves in STI because for these firms it is too costly to adequately manage interest rate risk.[8] However, given that large firms will also hold less STI because they are less likely financially constrained, we predict that overall the fraction of firms' cash reserves held in STI is an inverted U-shaped function of firm size.

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

[8] 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.

Fifth, 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 if their firm's cash reserves are held mostly in cash and cash equivalents so they can have easier access to their firm's cash reserves when they want to pursue self-serving projects.[9]

Finally, whether a firm has cash trapped abroad due to the tax costs for the firm of repatriating its foreign earnings could have opposing effects on the fraction of its total cash reserves invested in STI.[10] If firms have cash trapped overseas for tax reasons this may make them willing to give up some liquidity on these funds and to invest them in STI to earn some additional yield. This could then result in these firms holding a larger fraction of their total cash reserves in STI. Conversely, there is growing anecdotal evidence that suggests many foreign subsidiaries of U.S. multinational firms place emphasis on the liquidity of their cash reserves and hold these reserves in U.S. or foreign banks so they can provide their 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.[11] To the extent that this type of lending is commonplace, many foreign

[9] 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 risky securities. They argue that treasury personnel could invest cash reserves into risky securities to make their job more interesting or to build human capital that could be useful elsewhere in the asset management industry.

[10] U.S. multinationals 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. 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)). We note, however, that 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.

[11] U.S. multinationals are not required to disclose these short-term 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 then 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

subsidiaries of U.S. multinationals could hold 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 cash and cash equivalents on the balance sheet of the parent firm and to a negative association between the likelihood a firm has cash trapped overseas due to high repatriation tax costs and the fraction of its cash reserves invested in STI.

2. Description of the Components of Total Corporate Cash Reserves

2.1 The composition of cash and cash equivalents and STI

Firms separately report two important components of their total cash holdings on their balance sheet: cash and cash equivalents (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 cash and cash equivalents and its STI. This total amount of a firm's cash holdings is captured by the variable 'CHE' (=CH+IVST) in the Compustat database.[12] Cash and cash equivalents includes both liquid cash and highly liquid financial investments with a maturity of less than three months. Firms usually do not report the weights of each security type held in cash equivalents.[13] 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 and commercial paper and certificates of deposit with a maturity of 90 days or less. Typically, these securities are highly liquid, have a short maturity, and earn a low yield.

Generally, STI includes financial investments with a contractual maturity that is relatively short but greater than three months. Securities that are reported as STI on a firm's balance sheet are classified into three different types. A firm will classify STI securities as

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U.S. multinationals to the parent firm (http://www. hsgac.senate.gov/download/?id=47a0da59-0d31-4b64-ad0a-47cca27d0e46).

[12] The reporting distinction between cash and cash equivalents and short-term investments is outlined in FASB Statement 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).

[13] In most cases, 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."

held-to-maturity if they have a maturity between three and twelve months and the firm has a strong intent to hold the securities to maturity. STI securities are classified as *available-for-sale* if they have a maturity greater than three months and the possibility exists that the firm would sell the securities in the next twelve months 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 the securities. Finally, STI securities that are bought and sold with the principal objective of generating profits in the next twelve months from short-term price fluctuations are classified as *trading securities*.

Similar to cash equivalents, firms are not required to report the composition of STI.[14] 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.[15] 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 seven percent 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

[14] 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.

[15] 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.

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 typically plan on holding their STI securities until maturity 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 or if it becomes economically profitable to sell some of these securities.[16] 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 the percent of total STI, total cash holdings, and total book assets that, on average, consists of each particular STI security type. We note that, as we will show in Table 2, STI is non-zero for only about 41 percent of firm-years. Thus, the average values reported in Panel B of Table 1 for the percent of total cash holdings made up by each of the eleven STI security types, as well as the average values for each security type scaled by book assets, are higher than would be the case if the sample for this analysis consisted of both firms with and without STI.[17]

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[16] 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.

[17] The Compustat variable 'IVST', which represents STI, includes both investment in STI securities as well as 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 whether 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

The evidence in Panel B 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.[18] 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. 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 investment portfolio 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 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 to avoid bearing too much default risk. 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

cash holdings that are invested in STI.

[18] 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)).

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%).[19]

Although firms considerably reduce default-related risk resulting from investment in debt securities through the selection of the securities they invest in, these investments still increase a firm's interest rate risk given that if a firm unexpectedly needs to sell debt securities before they mature due to unforeseen liquidity needs it would be subject to the risk that if interest rates rise the value of the securities will fall. Likewise, due to this interest rate risk, investment in these debt securities reduces a firm's access to liquidity. Further, investments in municipal and corporate bonds would also 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)).

Panel B of Table 1 shows 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 obtain a higher yield on its STI investments, but would reduce the firm's access to liquidity. Also, we note that investment in the equity of other corporations would increase a firm's overall financial risk. Finally, Panel B also documents that 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, firms' investments in U.S. government debt, corporate

[19] 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%).

debt, 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 cash and cash equivalents and STI

The premise that firms trade off the higher yields on STI securities with the reduced access to liquidity 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 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.[20] We multiply this yield difference by the year-end STI balance and by one minus the firm's marginal tax rate to estimate the additional after-tax income resulting from STI investment.[21] 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 $3.3 million or 9.8% 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) realized interest and related income (Compustat variable 'IDIT') is 9.9% (2.3%) of EBIT at the mean (median), while for firms with high STI (firms in the top quintile of our sample over a given year for STI/total cash holdings) realized interest and related income is 24.6% (10.0%) of EBIT at the mean (median). 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.

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[20] 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.

[21] We use the marginal tax rates from Graham (1996). We thank John Graham for making this data available.

[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.

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 their maturity is greater than twelve months and 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 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 a short-term cash management portfolio. A third reason why we focus only on cash and cash equivalents 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 consider 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 cash and cash equivalents and its STI. Finally, we note that focusing on cash and cash equivalents and STI allows us to study a large sample of firms over a significant time period. This sample should consequently have 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 reserves 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 investment in LTI securities in our tests is that some firms could invest in LTI securities 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 cash and cash equivalents 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 drawn from the Compustat Annual File over the 1980-2011 period. 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). Also, we require our sample firms to be incorporated in the United States and exclude firms without strictly positive sales and assets. 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 cash and cash equivalents 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 firms with positive values for STI. In approximately 59% of firm-years a firm has zero STI holdings. Panel B of Table 2 reports that conditional on having positive holdings in STI, cash and cash equivalents 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. Finally, Panel B of Table 2 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 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 firms 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. Firms in the pharmaceutical products industry hold the largest fraction of their cash reserves in STI. On average, approximately 35.6% of these firms' total cash reserves are invested in STI. For firms in this industry with a positive value for STI (66.4% of firms in the industry), on average, about 53.6% of a firm's total cash reserves consist of STI. Panel C reveals that the

other industries among the ten industries with the highest values for STI/total cash holdings are from a broad spectrum of the economy including agriculture, computers and computer software, defense, tobacco products, and construction materials. Panel C also shows that firms in the aircraft industry have the lowest values for STI/total cash holdings and that the other industries among the ten industries with the lowest values for STI/total cash holdings are generally quite diverse (e.g., communication, retail, wholesale, business supplies, and shipbuilding and railroad equipment).

As previously discussed, we expect that financially constrained firms will invest a larger fraction of their cash reserves in STI than will financially unconstrained firms. Table 3 reports univariate results that provide strong support for this proposition. 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 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 suggesting 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).[23]

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 consist of STI. 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. We analyze this restricted sample to ensure that the Table 4 results are not merely driven by differences between firms that invest in STI and those that never invest in STI.[24]

In the Table 4 models we include explanatory variables that enable us to test predictions generated from the premise that in deciding how much of their total cash reserves should be held in STI, firms trade off the costs of reduced access to liquidity that result from investing in STI with the benefits of higher yields on STI. Tables 2 and 3 document that, on

[23] This result is also consistent with the Table 2 evidence that suggests firms with larger cash holdings typically invest a larger fraction of these holdings in STI. We note that the Table 3 results for total cash holdings are robust to considering only those firm-years in which STI is positive. Specifically, for this sample of observations, we document that for firms with cash holdings that are above or below the median sample value in a given year the average value of STI/total cash holdings are, respectively, 0.581 and 0.421, and that the difference between these two values is statistically significant. We also similarly find that the other Table 3 results are robust to considering only firm-years in which STI is positive.

[24] 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.

average, firms with larger total cash reserves invest a more important fraction of these reserves in STI. Hence, we control for the level of 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 a firm's total cash reserves. In doing so, we implicitly assume that firms first decide on the size of the cash reserves they should maintain and then, conditional on this decision, determine in which financial assets they should invest these reserves. This assumption is consistent with the guidelines that are provided to corporate treasurers concerning the procedures to be used when investing cash reserves in financial securities.[25] Additionally, we control for a firm's cash flow scaled by 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 cash and cash equivalents.

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 how firms' uncertainty about their short-term liquidity needs impacts the fraction of their cash reserves that are invested in STI. Presumably, the lower liquidity of STI securities makes these securities relatively less

[25] 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 http://www.ShortTermInvestmentStrategies.pdf). Also, 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).

attractive for firms that have difficulty forecasting how much of their cash reserves they will need to use in the short-term. In the Table 4 models we include several variables that proxy for if it could be difficult for a firm to forecast what will be 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 firms' uncertainty about their short-term liquidity needs is larger they invest less of their cash reserves in 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 firms' uncertainty about their short-term liquidity needs impacts the fraction of their 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 the firm invests in projects with riskier 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 and 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.

To test 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 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. 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. Put together, these findings support the proposition that financially constrained firms hold more of their cash reserves in STI because a large portion of their cash reserves are held to meet longer-term liquidity needs, while financially unconstrained firms hold more of their cash reserves in cash and cash equivalents because these firms' cash reserves are mostly used to finance their day-to-day short-term financing needs.

To further examine whether financial constraints affect firms' propensities to invest a larger fraction of their cash holdings into STI and also provide insights into if the interest risk resulting from holding cash reserves in STI impacts firms' cash management decisions, we investigate the effect of firm size on the degree to which a firm invests in STI. As discussed earlier, large firms should hold less STI because they are less likely financially constrained. However, very small firms could also hold less STI because the fixed cost of adequately hedging interest rate risk could be too large for these firms. To test these predictions, 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 the prediction that the fraction of firms' cash holdings invested in STI is an inverted U-shaped function of 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.

To investigate whether the likelihood that a firm has cash trapped abroad due to high repatriation taxes is associated with the fraction of its cash reserves invested in STI, we include two variables in the Table 4 models that proxy for this likelihood. We first include an indicator variable for whether a firm 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 exactly 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. In the first model, the coefficients on the foreign sales indicator variable and the tax cost of repatriating earnings variable are negative. These results 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 earnings variable is associated with a 1.2% decrease in the fraction of firms' cash reserves held in STI. Overall, these two results provide some support to the prediction that the foreign subsidiaries of U.S. multinational firms keep a large fraction of their cash reserves in cash and cash equivalents held in bank accounts so that they can more easily provide their U.S. based parents with liquidity via short-term loans.[26]

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

[26] In Section 4.7, we report the results of robustness tests in which we identify 376 of our sample firms as having taken advantage of the temporary cost to repatriate earnings brought about by the American Jobs Creation Act of 2004. These firms are arguably most likely to have cash trapped abroad due to high repatriation taxes. We note that a majority of these 376 firms do not hold any of their cash reserves in STI during the year prior to repatriation. Further, on average, these firms hold less of their total cash reserves in STI than do other firms. These findings are consistent with the Table 4 multivariate results suggesting firms that are more likely to have cash trapped abroad hold less STI as a fraction of their total cash reserves.

tax cost of repatriating earnings variables, all of the other variables with significant coefficients in the first model of Table 4 retain their significant coefficients.[27] 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.

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

Bank lines of credit are an important source of corporate liquidity. 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 test the prediction that financially constrained firms invest 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 whether 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. The 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. The data on the amount of a firm's credit line and the

[27] 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 code. 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 could make it harder using firm fixed effects to estimate the effect of the tax cost of repatriating earnings on the fraction of a firm's cash reserves invested in STI.

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 our analyses using the credit line variables. To test the relation between the use of STI and credit line availability, we estimate models that are the same as those in Table 4, except that we also include in the models as explanatory variables either a dummy variable for whether 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 line of credit 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 whether the firm has a line of credit.[28] This result is economically important. 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 total 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. Specifically, 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 evidence consistent with the prediction that financially constrained firms invest a larger fraction of their cash holdings in STI.

[28] Employing a computerized text search algorithm, Harford, Klasa, and Maxwell (2014) construct an indicator variable over the 1996-2008 period for whether a firm has a credit line. Using the data from that paper for this variable, we find that the significant negative association between whether a firm has a line of credit and the fraction of its cash holdings invested in STI is robust to considering this longer sample period.

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

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. 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, 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 more important 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 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 per dollar of assets from their internally generated cash flows, 18.9 cents more per dollar of assets from their equity issues, and 19.2 cents more per dollar of assets from their debt issues than they would otherwise.

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 cash and cash equivalents/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 needs. The significant positive coefficients on the interaction variables in the third and fourth models, indicate that during times when firms have larger STI holdings they put a larger fraction of their internally generated cash flows and the proceeds from their debt and equity issues into STI than at other times. Further, the results for the fifth and sixth models show that when firms hold more STI they put a *smaller* fraction of their internally generated cash flows and the proceeds from their equity issues into cash and cash equivalents than they do at other times.[29] Panel B of Table 6 documents that the results of the models estimated in Panel A 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.[30]

[29] 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 cash and cash equivalents.

[30] 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 both total cash holdings/book assets and its interaction 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.

4.4 Corporate investment and changes in the composition of total cash reserves

The prediction that financially constrained firms hold more of their cash reserves in STI to earn additional yield while these reserves are being held to finance future investment needs relies in part on the assumption that during years when these reserves are needed to fund important new investment, financially constrained firms transfer funds from STI to cash and cash equivalents. In Table 7, we provide evidence on whether financially constrained firms indeed transfer funds from STI to cash and cash equivalents during these years. To do so, we use the investment model employed in Faulkender and Petersen (2012) and Harford, Klasa and Maxwell (2014). In this model, 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, and pre-investment earnings/book assets. Also, year and firm fixed effects are included in the model. 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 beginning of year total cash holdings having a positive effect on investment that 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. This implies that 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 cash and cash equivalents relative to STI. Thus, this finding is consistent with the notion that financially constrained firms transfer funds from STI to cash and cash equivalents during years when important amounts of these funds are needed to finance new investment.

In the second model of Panel A of Table 7, we replace the change in STI variable with an indicator variable for whether the change in STI/total cash holdings is large and negative

to capture periods when a firm shifts a significant amount of funds from STI to cash and cash equivalents. The indicator variable 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 variable with lagged total cash holdings. The coefficient on the interaction variable is positive and significant. From the regression coefficients in the second model of Panel A, we estimate that for firms that do not markedly decrease their holdings in STI relative to cash and cash equivalents that an incremental dollar of total cash reserves at the beginning of the year leads to 6.4 cents of additional investment that year. However, for firms that significantly decrease their holdings in STI relative to cash and cash equivalents, an extra dollar of total cash reserves at the beginning of the year 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 Panel A of Table 7 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 findings 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.[31]

[31] 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 composition of total cash reserves

The prediction that financially constrained firms hold more of their cash reserves in STI also in part relies on the assumption that during periods when the supply of externally available capital contracts that firms transfer funds from STI to cash and cash equivalents so they can more easily finance their investments or operating expenses with their cash reserves. To examine this issue, we first follow Harford (2005), Officer (2007), and Harford, Klasa, and Maxwell (2014) and proxy for the aggregate supply of externally available credit with the average spread of commercial and industrial loan rates (on loans greater than $1 million) relative to the federal funds rate (the C&I rate spread). When this spread decreases (increases) the supply of credit contracts grows (contracts).

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 four-quarter moving average of the C&I rate spread over the four quarters of 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 invested in STI, which suggests that when credit conditions tighten firms transfer funds from STI to cash and cash equivalents.[32] We estimate that a one standard deviation increase in the C&I rate spread leads to a 6.4% decrease in the fraction of firms' cash reserves invested 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.

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

[32] We note that in the presence of year fixed effects the C&I rate spread variable captures the average spread over the four quarters of 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 having different fiscal year-end 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.

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 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

To further investigate whether exogenous decreases in the supply of available credit impact the fraction of a firm's cash reserves held in STI, we study firms with a speculative grade debt rating (below investment grade) whose outstanding debt is considered high-yield debt. In doing so, we first follow Chernenko and Sundaram (2014) and proxy for the supply of credit available to speculative grade firms with net flows into high-yield corporate bond mutual funds, collected by the Investment Company Institute, the national association of U.S. investment companies. We examine how firms with a speculative-grade rating respond to fluctuations in high-yield corporate bond mutual fund flows *relative* to firms in a control sample that are similar to firms with a speculative grade rating, but that are unlikely to be impacted by these flows. We do so by comparing firms with a bond rating of BB+, whose rating is just below investment grade and considered speculative grade, to firms with a bond rating of BBB-, the investment grade rating cutoff.

Using this sample of 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 bond rating, and the interaction of these two variables. This interaction reveals how firms with a BB+ rating respond to changes in the supply of credit available to speculative grade firms relative to the firms in the control sample. We further control for all the variables from our determinants model in Table 4 except for bond rating.

The results of this analysis are presented in Table 9, Panel A. The results for the first model in this panel show that the coefficient on the interaction variable of fund flows and the indicator variable for whether a firm has a speculative grade rating is significant and positive, which implies that firms with a speculative grade bond rating transfer funds from STI to cash and cash equivalents when the supply of available credit for these 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 corporate bond mutual funds results in firms with a BB+ bond 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 B 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.

As a second source of variation in the supply of credit available to firms with a speculative bond rating, we follow Lemmon and Roberts (2010) and examine the impact of a negative shock to this supply 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. We examine changes in the proportion of total cash held in STI surrounding this shock for firms with a speculative-grade bond rating.

We perform this test using a difference-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 debt rating from before to after the shock to the supply of credit available for these firms. We use the average 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. The second difference is obtained by calculating the first difference for the treatment group (firms with a speculative grade bond 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 a propensity score matching procedure. We match with replacement each treated firm to four control firms with the closest propensity score.

We present our findings in Table 9, Panel B. The results for the first two columns in this panel differ only due to differences in the explanatory variables used in estimation of the propensity score model. The first model uses the same variables used in the Lemmon and Roberts (2010) propensity score model. The results show that firms with a speculative bond rating decrease the proportion of their cash reserves held in STI by 0.115 around a negative shock to the credit supply relative to the control group. This finding supports the findings based on fund flows and suggests that a tightening of access to capital results in firms shifting cash reserves from STI to cash and cash equivalents.

The second model of Table 9, Panel B adds explanatory variable to the propensity score matching. Specifically, we add variables that are in our Table 4 models that were not included in the propensity score model used in Lemmon and Roberts (2010). After adding these additional controls, we continue to find that firms with speculative grade bond ratings decrease the proportion of their cash reserves held in STI around the weakening of the speculative-grade debt market relative to control firms. Further, the findings documented in the first two columns of Panel B are robust to removing firms that never invest in STI, as shown in columns three and four.

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

Extant work predicts and shows that managers of firms with poor corporate governance often use corporate cash reserves to invest in self-serving projects (e.g., Jensen (1986), Harford (1999), and Harford, Mansi, and Maxwell (2008)). Due to the lower liquidity of STI securities relative to cash and cash equivalents, managers of such firms could prefer if more of their firm's cash reserves are held in cash and cash equivalents. This would make it easier for such managers to have quick access to these reserves and spend portions of these reserves on self-serving projects. Thus, this leads to the prediction that when a firm has weaker governance a smaller fraction of its total cash reserves is invested in STI.

To test this prediction, we re-estimate several times the Table 4 firm fixed effect model that examines the determinants of the fraction of a firm's cash reserves invested in STI 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 10 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%.[33]

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 provision 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 10, we include an independent variable named BC Laws, which takes the value of one in all years following the adoption of antitakeover provision 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. The economic importance of this result is large. Specifically, following the adoption of antitakeover provision laws a firm increases the fraction of its cash reserves invested in STI by 23.5%. This finding provides causal support for the results in the first seven models of Panel A of

[33] We note that 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. As such, the Table 10 findings for large block shareholders and institutional investors could also be due to the possibility that these shareholders will pressure a firm to increase the yield it obtains from the financial securities in which it invests its cash reserves.

Table 10. Finally, the results in Panel B of Table 10 show that the Panel A results are robust to dropping sample firms that never invest in STI.

4.7 Robustness tests

We run several sets of robustness tests. First, 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 affect our results. To consider this issue, we re-estimate all of the models in Tables 4-10 after dropping firm-years that take place during or after 2007. This leads to the removal of 12.3% of the firm-years in our sample. We find that all of the Table 4-10 results are robust to dropping these observations.

Second, another potential concern could be the inclusion in our sample of firms early in their life cycle. For example, our sample includes the 1990s, which is characterized by many new, young firms especially in high-tech industries. Young firms typically hold larger cash reserves (Bates, Kahle, and Stulz (2009)) and have higher cash burn rates. Both of these factors can impact how much of a firm's cash reserves are invested in STI. To ensure that young firms do not drive our results, we drop all firms that have been public for five years or less from our sample. This results in the removal of 36.6% of our sample firm-years. We find that all of the Table 4-10 results are robust to excluding these observations from our analysis.

Third, we rerun the models in Tables 4-10 after dropping sample firms that we classify as most likely to have cash reserves trapped overseas. We do this to ensure that the study's findings are not somehow driven by these firms. We classify firms as most likely to have cash reserves trapped abroad if they took advantage of the temporary reduction in the cost to repatriate earnings brought about by the American Jobs Creation Act of 2004 (AJCA).[34]

To identify firms that repatriated earnings under the AJCA, we follow a methodology similar to Faulkender and Petersen (2012). Specifically, using the text harvesting software PHP, we search the text of 10-K filings in the years 2004, 2005, and 2006 for any time that

[34] For examples of papers that consider earnings repatriation resulting from the AJCA, see Blouin and Krull (2009), Dharmapala, Foley, and Forbes (2011), and Faulkender and Petersen (2012).

the sequence of letters 'repatriat' appears to capture instances when a firm mentions either the word repatriate or repatriation. We then retain the text for a firm if in addition to 'repatriat' appearing in its 10-K it also discusses the AJCA. This results in retaining text for 3,328 firm-years. We then manually search this text to determine whether a firm actually repatriated earnings under the AJCA. Many firms discuss the AJCA and its implications for their permanently reinvested earnings, but ultimately decided that repatriation would not be beneficial to shareholders. However, we identified 376 firms that disclosed amounts of earnings that were repatriated under the AJCA. We find that all of the Table 4-10 results are robust to dropping these firms, who account for 7.1% of the firm-years in our sample.

5. Conclusion

Although a large body of prior work provides evidence on the determinants of 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 their total cash reserves in cash and cash equivalents versus short-term investments (STI). Cash and cash equivalents consist of liquid cash as well as very liquid financial investments with a maturity of less than three months that typically have low risk and earn a low yield. STI typically consists of (i) financial assets that have a contractual maturity of between three and twelve months that a firm has a strong intent to hold until maturity and (ii) financial assets with a maturity of more than three months that a firm plans on holding until maturity, but for which it is possible that the firm would sell the asset due to unforeseen liquidity needs or if it becomes financially attractive to sell the asset. Compared to cash and cash equivalents, STI securities earn higher yields, but they reduce a firm's access to liquidity.

We presume that firms trade off the costs of insufficient liquidity with the benefits of higher yields on STI to determine the percent of their total cash reserves held in STI. In our empirical analyses, we test predictions generated from this premise and provide evidence on what determines the variation in the extent to which firms invest their cash reserves in STI.

We document that the variation in the fraction of cash reserves held in STI can be explained by the extent to which a firm faces uncertainty with respect to its shorter-term liquidity needs, whether a firm's cash reserves are used to meet its shorter- or longer-term liquidity needs, and a firm's ability to manage interest rate risk resulting from investing in longer-maturity securities. In doing so, we also document that financially constrained firms, who typically hold large cash reserves to ensure they have the required capital for their long-term investment needs, hold a greater fraction of these reserves in STI. Presumably, these firms invest more of their cash reserves in STI so they can minimize the costs of holding large cash reserves.

We also provide evidence that suggests managers of poorly governed firms hold more of their firm's cash reserves in cash and cash equivalents because these financial assets are highly liquid and allow these managers to more easily spend cash reserves on self-serving projects. Finally, we show that when the likelihood that a firm has cash trapped overseas due to high repatriation tax costs is greater, the firm holds less of its cash reserves in STI. This finding is consistent with growing anecdotal evidence that subsidiaries of U.S. multinationals often keep significant amounts of their cash reserves in bank accounts so they can provide their U.S. based parents with liquidity via short-term loans. 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 decisions.

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Table 1
Composition 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 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 have a maturity of between three and twelve months and a firm has a strong intent to hold the securities to maturity. STI securities are classified as available-for-sale if a firm intends to hold the securities to maturity, but it is possible that the firm would sell some of these securities due to liquidity needs or if circumstances arise that make it financially attractive to sell some of the securities. 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 components of total cash holdings

Table 2 presents univariate descriptive statistics for the composition of total cash holdings. 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. Total cash holdings is the sum of cash and cash equivalents and STI. All continuous variables are winsorized at the 1st and 99th percentiles. Panel C provides 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.

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

Table 2 – *continued*

Panel C: 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 investment use 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 is from Sufi (2009) and is for the 1996-2003 period. 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 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 from Graham (1996). 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*

	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)
Foreign sales dummy	-0.018***	-0.010**	-0.026***	-0.011*
	(-4.74)	(-1.98)	(-5.74)	(-1.93)
Tax cost of repatriating earnings	-0.587**	-0.193	-0.568**	-0.204
	(-2.19)	(-0.94)	(-2.00)	(-0.93)
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)
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). 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 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*

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. C&I Spread is the most recent one-year average of the spread between commercial and industrial loans and the federal funds rate based on data provided by the Federal Reserve of St. Louis. The average is based on data at an annual frequency prior to 1984 and at a quarterly frequency during and after 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 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 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 exogenous changes in the supply of public debt on holdings of short-term investments for speculative grade firms

Panel A 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 and includes sample firms with a public bond rating of either 'BBB-' or 'BB+'. 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 most recent year of net flows into high-yield corporate bond mutual funds. This data is collected by the Investment Company Institute. All continuous variables are winsorized at the 1st and 99th percentiles. Unreported control variables are the independent variables appearing in the Table 4 models. *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 B reports the results of difference-in-differences tests of the fraction of total cash holdings held in STI around a shock to the supply of public debt for 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 based on the propensity to have a speculative-grade bond rating. The propensity model used in models (1) and (3) is the same as in Lemmon and Roberts (2010) and includes the explanatory variables used in their model. Variables are averaged over the 1986-1989 time period. The propensity model in models (2) and (4) additionally includes any variable from Table 4 not already included in models (1) and (3). Speculative grade firm difference is the difference in the average fraction of total cash holdings held in STI in the pre-period (1986-1989) relative to the post period (1990-1993) for the treatment group. Unrated difference is the corresponding average for the control group. The standard error of the average is reported below each average. Dif-in-Dif is the average difference between the treatment group and the control group. The *t*-statistic of the average difference is reported below. *, **, and *** indicate significance for two-tailed tests at the 10%, 5%, and 1% level, respectively.

Panel A: Flows into high-yield corporate bond mutual funds

	Full sample		Firms that invest in STI	
	(1)	(2)	(3)	(4)
Speculative grade firm * Fund flows	0.002***	0.001**	0.002**	0.002**
	(2.75)	(2.07)	(2.55)	(2.09)
Speculative grade firm	0.002	0.010	-0.005	0.012
	(0.17)	(0.96)	(-0.36)	(0.92)
Fund flows	-0.002***	-0.002**	-0.003***	-0.002**
	(-2.93)	(-1.98)	(-2.99)	(-2.20)
Controls	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	0.619	0.306	0.604

Panel B: Shock to supply of public debt for speculative grade firms

	Full sample		Firms that invest in STI	
	(1)	(2)	(3)	(4)
Avg: Speculative grade firm difference	-0.131	-0.125	-0.140	-0.140
SE: Speculative grade firm difference	(0.018)	(0.018)	(0.020)	(0.020)
Avg: Unrated firm difference	-0.016	-0.037	-0.009	-0.009
SE: Unrated firm difference	(0.012)	(0.007)	(0.014)	(0.008)
Dif-in-Dif	-0.115***	-0.088***	-0.131***	-0.131***
t-Stat: Dif-in-Dif	(-3.81)	(-4.49)	(-3.79)	(-6.03)

Table 10

The impact of governance on the proportion of total cash holdings held in short-term investments

Table 10 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 equals zero otherwise. 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