# Understanding Why Firms Hold So Much Cash: A Tax Risk Explanation

**Michelle Hanlon**
Massachusetts Institute of Technology
mhanlon@mit.edu

**Edward L. Maydew**
University of North Carolina
edward_maydew@unc.edu

**Daniel Saavedra**
Massachusetts Institute of Technology
saavedra@mit.edu

Draft: February 17, 2013

Preliminary: Please do not quote without permission

## Abstract

A recent puzzle in the corporate finance literature is the observation that both multinational and domestic U.S. corporations hold large amounts of cash on their balance sheets. We test whether tax risk is a determinant of cash holdings. Because tax authorities can challenge and disallow tax positions, demanding cash tax payments in the future, firms may hold cash in order to satisfy these potential future demands. We find that both domestic and multinational firms that bear tax risk hold significantly larger cash balances than firms that do not. The data suggest that there is a tax-based precautionary motive to hold cash. This particular type of precautionary motive has not been examined before and adds to both our knowledge of why firms hold so much cash and to our knowledge about the real effects of tax avoidance.

*We thank Effrain Benmelech, Nittai Bergman, Amy Dittmar, and David Scharfstein for helpful comments. We also thank workshop participants at London Business School, the University of Miami, and doctoral seminar participants at the University of North Carolina.

## 1. Introduction

U.S. corporations hold large amounts of cash on their balance sheets. Understanding why firms hold so much cash has been the subject of academic research for decades. Foley, Hartzell, Titman, and Twite (2007) state that 10.5% of the aggregate assets of all Compustat firms in 2004 is represented by cash and short term investments. The data from 2011 show that this proportion is now 16.7%. Looking beyond aggregate percentages, the dollar value of cash held by firms also continues to be large. For example, in their most recent financial statements, Microsoft reveals that it holds $63 billion in cash and short-term investments, Cisco holds roughly $49 billion, Apple holds $29 billion in cash and short term investments (plus $92 billion in long-term marketable securities), GE holds $132 billion, and Pfizer roughly $27 billion.

Our paper develops and tests a new hypothesis that a partial explanation for these cash balances is a specific precautionary motive resulting from tax avoidance. To the extent that aggressive tax strategies can be challenged by tax authorities, it is likely that tax avoiders keep excess cash balances for a specific precautionary reason: to pay future tax claims on prior and current uncertain tax positions. To test our predictions we use a recently developed measure of corporate tax avoidance (i.e., a long run cash effective tax rate measured over five years (Dryeng, Hanlon, and Maydew, 2008)) and take advantage of the adoption of FASB Interpretation No. 48 (FIN 48), which requires firms to disclose their uncertain tax positions. We predict that engaging in risky tax avoidance leads firms to hold larger amounts of cash than they would otherwise.

Our research design consists of regressions of cash balances (cash and short-term investments scaled by total assets) on previously identified determinants of cash balances and empirical measures of tax risk. We use a sample of 28,887 firm-year observations. We estimate our regressions across all firms and then separately for domestic-only firms and those with

foreign operations in order to separate any international tax effects on our results. In our first specification, we use the Dryeng, Hanlon, and Maydew (2008) corporate tax avoidance measure (5-year cash effective tax rate) as our independent measure of tax risk. Our results are consistent with tax risk being positively related to cash balances for the full sample, and for both domestic firms and multinational firms separately. In our second test of tax risk, we employ a measure of uncertain (risky) tax positions – the tax reserve required to be disclosed by firms under FIN 48. We view this as a more precise measure of tax risk, but the tradeoff is that the measure is available for fewer years because disclosure is only available since 2007. We find results consistent with our prediction – larger uncertain tax positions are positively associated with larger cash holdings. Overall, we interpret the evidence as showing that risky tax avoidance is associated with larger cash balances due to a precautionary motive to hold cash for potential future tax assessments.

Our results show that uncertainty related to tax avoidance has important real effects. For instance, if we rank companies into ten portfolios based on their 5-year cash effective tax rate (their size of uncertain tax positions), we find that companies that pay the lowest taxes (have the largest uncertain tax positions) have an extra 2% (2.3%) of their total assets in cash as compared to companies that pay the highest taxes (have the lowest uncertain tax positions). Given that firms in our sample on average hold 13.7% of their assets in cash, this result is economically significant.

We conduct a battery of robustness tests. First, we examine our results when employing alternative definitions of cash holdings including 1) cash and short term investments scaled by net assets, 2) log(cash and short term investments scaled by net assets), 3) log(cash and short term investments scaled by sales), and 4) log(1+cash and short term investments scaled by net

assets). Our results obtain in each of these specifications. Second, we test an expanded sample when employing the level of uncertain tax benefits as the proxy for tax risk. We include all the loss firms and firms that do not disclose cash taxes paid (constraints on the sample using the long run cash effective tax rate). Again, our results are unchanged. Third, following Foley, Hartzell, Titman, and Twite (2007) and Bates, Kahle, and Stulz (2009) we conduct a robustness test examining the changes in cash as the dependent variable. We find that changes in the long-run cash effective tax rate are significantly related to changes in cash balances, consistent with our predictions.

Our paper contributes to the literature by providing a coherent explanation about how tax avoidance affects corporate cash holdings. In particular, we provide evidence that tax avoiders hold more cash on their balance sheet. In addition, we provide another important explanatory variable in the quest of learning why firms hold so much cash on their balance sheets. Finally, our paper presents a new channel through which taxes can have real effects on firm behavior.

The remainder of the paper is organized as follows: Section 2 discusses motivation and develops testable predictions. Section 3 presents the research design. Section 4 discusses the sample and empirical results. Section 5 presents robustness tests and Section 6 concludes.

## 2. Prior Research and Hypothesis Development

There are two streams of research that are highly related to our paper. The first consists of papers that examine the determinants firms' cash holdings. The second stream of studies investigates corporate tax avoidance.

### *2.1 Prior Research – Cash Holdings*

Prior literature in the area has generally examined four theories of why firms hold so much cash. The first is the transaction cost motive – firms hold cash to avoid the cost of being

short liquid assets (converting noncash assets to cash is costly) (e.g., Baumol, 1952; Miller and Orr, 1966). This theory suggests that larger firms hold less cash because there are economies of scale related to transaction costs (Mulligan, 1997). The second is the precautionary motive – firms hold cash to protect against adverse shocks when access to capital markets is costly. Consistent with this motive, Opler, Pinkowitz, Stulz, and Williamson (1999) find that firms with riskier cash flows and poor access to capital hold more cash. In addition, Opler, Pinkowitz, Stulz, and Williamson (1999) show that firms with better investment opportunities hold more cash because adverse shocks and distress are more costly for them.

The third theory of cash holdings is the agency motive – managers would rather hold the cash to use for their own purposes (e.g., empire building) than pay it out to shareholders (Jensen, 1986). Consistent with this theory, prior literature has found that firms hold more cash in countries with greater agency problems (Dittmar, Mahrt-Smith, and Servaes, 2003), cash is worth less when agency problems are more severe (Faulkender and Wang, 2006; Dittmar and Mahrt-Smith, 2007; Pinkowitz, Stulz, and Williamson, 2006), and that firms with excess cash invest in more acquisitions and that those acquisitions are value-decreasing (Harford, 1999). In contrast, however, Fresard (2010) provides evidence consistent with large cash balances leading to future market share gains at the expense of industry rivals, suggesting a positive value to excess cash.

The final explanation is a tax motive for holding cash related to the repatriation tax cost of bringing foreign sourced earnings back to the U.S. If these earnings were to be repatriated from the foreign jurisdiction to the parent, a substantial U.S. tax would be incurred – in effect, the cash is then trapped in the foreign subsidiary (and on the balance sheet). Foley, Hartzell,

Titman, and Twite (2007) develop and test this hypothesis showing results consistent with multinational firms with higher repatriation tax costs holding more cash.[1]

Many of these studies have focused on determinants – *why* do firms hold so much cash? For example, Opler, Pinkowitz, Stulz, and Williamson (1999) find evidence that firms with strong growth opportunities and riskier cash flows hold relatively more cash while large firms and those with a credit rating hold less cash. Bates, Kahle, and Stulz (2009) associate the increase in cash holdings to riskier cash flows, fewer inventories and receivables, and increasing R&D expenditures.

Foley, Hartzell, Titman, and Twite (2007) examine a tax-based determinant. These authors provide evidence that the magnitude of U.S. multinational cash holdings are, in part, a consequence of the tax costs associated with repatriating foreign income. The U.S. corporate tax system is one of worldwide taxation with deferral. This means that U.S. multinationals are taxed in the U.S. on their global earnings but that an exception is provided for earnings in foreign subsidiaries that are not repatriated back to the U.S. parent – the U.S. tax on these earnings is deferred until the earnings are repatriated. Foley, Hartzell, Titman, and Twite (2007) argue that because firms will incur a substantial tax cost upon repatriation, the firms do not repatriate the cash to the U.S. parent and the cash becomes 'trapped' in the foreign jurisdiction. As a result, of this trapped cash, the firm has large cash balances on its balance sheet. Foley, Hartzell, Titman, and Twite (2007) report evidence consistent with their predictions – firms with higher repatriation tax costs hold larger cash balances and hold this cash overseas. However, Bates, Kahle, and Stulz (2009) conclude that the average cash-to-assets ratio of U.S. industrial firms has

[1] While evidence exists in the literature that each of these factors is at work, there is considerable debate. For example, Bates, Kahle, and Stulz (2009) conclude that the precautionary motive is important in explaining cash balances but they find no evidence for the agency motive. Bates, Kahle, and Stulz (2009) also find that both domestic and multinational U.S. industrial firms have significantly larger cash-to-assets ratios than they did two decades before, and thus infer that more than just international tax factors are at work.

more than doubled from 1980 to 2006 and that this increase is independent of whether firms have foreign operations. Further, Pinkowitz, Stulz, and Williamson (2012) state that the cash holdings of multinational firms cannot be explained by the tax treatment of profit repatriations.

None of these studies, however, examines how taxes – in terms of tax risk - affects cash holdings. The closest research we are aware of is Dhaliwal, Huang, Moser, and Pereira (2011) and Campbell, Dhaliwal, Krull, and Schwab (2012). Dhaliwal, Huang, Moser, and Pereira (2011) examines tax avoidance and cash, focusing on agency issues. Specifically, Dhaliwal, Huang, Moser, and Pereira (2011) posit that the greater the tax avoidance, the greater likelihood that managers are diverting rents from shareholders and thus, the lower the cash balances because cash is easily diverted. Beyond the difference in focus and predictions, our study has a number of empirical differences. In particular, we examine variation in the riskiness of tax avoidance, control for the repatriation tax costs for multinational firms, and run separate tests over domestic and multinational firms. Campbell, Dhaliwal, Krull, and Schwab (2012) examine whether investors value foreign cash less than domestic cash as a result of the repatriation tax cost. The authors find evidence consistent with investors being able to partially estimate the amount of foreign cash holdings and that the market values foreign cash holdings less.

### *2.2 Prior Research – Tax Avoidance and Tax Risk*

An emerging literature studies tax avoidance, its determinants, and its consequences. The literature has focused more on uncovering determinants rather than the consequences to date. For example, recent studies have examined a variety of determinants of tax avoidance such as 1) ownership (Chen, Chen, Cheng, and Shevlin, 2010; Badertscher, Katz, and Rego, 2010), 2) manager influence (Dyreng, Hanlon, and Maydew, 2010), 3) economies of scale (Rego, 2003;

Zimmerman, 1983), 4) compensation (Armstrong, Blouin, and Larcker, 2011), and 5) other determinants (see Hanlon and Heitzman (2010) for a discussion). In addition, Desai and Dharmapala (2006) and Desai, Dyck, and Zingales (2007) predict a more subtle link – incentives for managerial diversion leading to more tax avoidance (sheltering).

We know even less about the consequences of tax avoidance. For example, Hanlon and Slemrod (2009), Graham, Hanlon, Shevlin, and Shroff (2012), and Gallemore, Maydew, and Thornock (2012) examine whether firms are concerned about reputation effects of tax avoidance and whether firms bear reputational costs upon revelation of tax aggressive activities. These studies have mixed evidence. Gleason and Mills (2008) examine how the market values tax savings or lower reported effective tax rates and find that firms that meet analyst forecasts via the tax expense are discounted by the market. Finally, Kim, Li, and Zhang (2011) hypothesize and find that tax avoidance is positively related to stock price crash risk based on the Desai, Dyck, and Zingales (2007) idea that tax avoidance creates an opaque environment leading to rent diversion and, Kim, Li, and Zhang (2011) assert, the hording of bad news.

We propose a new hypothesis about how taxes are related to cash holdings. We extend and contribute to both of these literatures by examining whether and how corporate tax avoidance is associated with corporate cash holdings. Our paper provides an examination of a new determinant of corporate cash holdings as well as a new consequence – a real effect – of risky corporate tax avoidance.

### *2.3 Hypothesis Development*

We predict that firms engaging in risky tax avoidance hold additional cash balances for a specific precautionary reason – tax strategies that help firms lower their taxes paid can be

challenged by tax authorities. The disputed amounts can be large and take years to resolve. For example, the Internal Revenue Service (IRS) claimed that one firm alone, GlaxoSmithKline P.L.C., owed $5.2 billion in back taxes and penalties related to a transfer pricing strategy dating back to 1989 (Philadelphia Inquirer, 2004). In addition, Merck & Co. in 2007 settled a case with the IRS by paying a settlement amount of $2.3 billion (taxes, penalties, and interest) for the years 1993 – 2001. With an expected positive probability of such a future tax assessment, it seems likely that companies would save cash to pay the expected value of the future assessments. Foreign and state jurisdictions may also assess taxes on prior positions. A recent Wall Street Journal article highlights that many foreign jurisdictions are attempting to collect back taxes from U.S. multinational corporations. For example, France has asked for $252 million from Amazon and 1.7 billion Euros from Google in back taxes and penalties. In addition, the tax authorities in Australia have sent Apple a bill for back taxes in the amount of $29.5 million (Pfanner, 2012).

Even if the company prevails and wins the case, it is expensive to defend such challenges from tax authorities. Thus, the firm will likely need additional cash to mount a defense and litigate the case. For example, if the firm has a dispute with the IRS that is not resolved administratively and goes to court, in some cases the firm must pay the full disputed amount and then sue the IRS for a refund. Specifically, firms can generally choose to litigate Federal tax disputes in U.S. District Court, the U.S. Court of Federal Claims, or U.S. Tax Court. The first two courts require firms to pay the disputed tax upfront, while Tax Court does not. Thus, having sufficient cash on hand to be able to pay the entire disputed amount gives a firm the flexibility to litigate in the most favorable court, and perhaps additional bargaining power with the IRS during the administrative process. If the firm had not saved enough cash, it might have to take costly

actions such as forgoing capital spending or raising external funds to pay back taxes and penalties to tax authorities and thus, precautionary saving of cash in the face of tax risk seems plausible. As a result, our hypothesis, stated in alternate form, is:

***H1:*** *Tax risk is positively associated with cash balances, ceteris paribus.*

## 3. Research Design

### *3.1 Variable Measurement and Sample*

#### *3.1.1 Test Variables*

We are interested in understanding how a firm's risky tax avoidance is related to its cash holdings. We examine two measures of tax risk. Our first measure is the firm's cash effective tax rate (Dyreng, Hanlon, and Maydew, 2008), calculated as the ratio of the firm's cash taxes paid to the firm's pretax income measured over a five-year period:

$$5-year\ CASHETR_{it} = \frac{\sum_{k=t-4}^{t} Cash\ Tax\ Paid_{ik}}{\sum_{k=t-4}^{t} Pretax\ Income_{ik}} \quad (1)$$

The *5-year CASHETR* measure has the advantage of being a broad measure of tax avoidance and also has wide data availability across firms and years. A disadvantage of *5-year CASHETR* for the purposes of this paper is that is can reflect both risky tax avoidance, such as engaging in aggressive tax shelters, and also non-risky tax avoidance, such as holding tax-exempt municipal bonds.

Our second measure of risky tax avoidance is the amount of uncertain tax benefits disclosed by firms under Financial Accounting Standards Board (FASB) Interpretation No. 48 (FIN 48), "Accounting for Uncertainty in Income Taxes," enacted in June 2006.[2] In laymen's

[2] The purpose of FIN 48 is to clarify the accounting for uncertainty in income taxes by providing greater consistency in the criteria used to recognize and measure uncertain tax benefits.

terms, this account represents the amount of tax savings that management expects to be 'at risk' in the sense that a tax authority could demand payment.

To provide a more specific explanation, it is useful to first discuss the concept of an uncertain tax benefit (i.e., a contingent liability or tax reserve). Assume a company engages in tax planning strategies that enable it to reduce tax liabilities and pay fewer taxes. As a result, the firm generates "tax benefits" in the form of cash savings. However, suppose that the tax benefits fall into a grey area such that there is some chance that the tax authority could successfully disallow the tax benefits, either fully or in part. Under the accrual accounting rules (both Generally Accepted Accounting Principles and International Accounting Standards) the firm records a tax reserve (liability) to account for the additional tax payments the company will have to make if the tax benefits are ultimately disallowed. If a tax contingency reserve is recorded, the cash tax savings will not be reflected as a lower tax expense for financial accounting purposes. Thus, even though the cash taxes are saved in this period, if there is an expectation that these tax savings, or benefits, will not be retained, then an accounting expense is required to be recorded (accrued).

Conceptually then, the amount of the expense for the current year (and the balance of the tax liability on the balance sheet) includes management's estimation of the uncertainty, or riskiness, of the company's tax current tax positions (and all tax positions historically from years still subject to potential audit). Under the new accounting interpretation, FIN 48, companies are required to disclose in tabular format, the beginning and ending balance of the contingent tax reserve (termed Uncertain Tax Benefits (UTB) in FIN 48), as well as descriptions of changes in the balance during the current year.[3] We obtain these data from Compustat, but they are available

[3] Prior to FIN 48, companies were required to record a contingent tax reserve under SFAS 5 "Accounting for Contingencies"; thus the concept of a contingent tax reserve is not new. SFAS 5 required an accounting of the

only for the years 2007 – 2011 after the issuance of FIN 48. For firm years with missing *UTB* in fiscal years starting after 2006, we set *UTB* equal to zero.[4]

In sum, we employ two measures of tax risk. The first is the five-year cash effective tax rate. We view the effective tax rate measure as less precise in terms of 'risky' tax avoidance but the measure is available for a longer time period. The second measure we employ is the UTB balance scaled by total assets. The UTB is likely more precise in terms of measuring tax benefits at risk, but the data are not available until 2007, when the FIN 48 disclosure requirements took effect. Another important point to note about the UTB is that prior studies have conjectured that financial accounting incentives affect the reported amount (Hanlon and Heitzman, 2010), which recent studies have started to investigate (e.g., De Simone, Robinson, and Stomberg, 2011). The financial accounting incentives may add noise to the measure for purposes of our tests. Thus, we employ both measures, recognizing the trade-offs involved with each measure.

### *3.1.2 Sample Selection*

We require firms to be incorporated in the U.S., have positive book value of assets, have five consecutive years of non-missing cash taxes paid (to compute the five-year cash tax rate), and non-missing pretax income during the years 1995-2011. We start our sample period in 1995 to mitigate the influence of two important regulatory events in 1993: Accounting for Income Taxes (FAS 109) was introduced and the top statutory corporate income tax rate increased from 34% to 35%. After imposing these requirements we obtain a sample of 64,057 firm-year

liability consistent with the accounting for any contingency. In this case, the accounting is for the contingent event that a tax authority will assess future tax payments on the tax positions taken in the current year. Under SFAS 5, companies recorded a liability and increased tax expense (see Hanlon 2003 and Gleason and Mills, 2002 for discussions). However, prior to FIN 48, the amount of contingent tax liability was almost never disclosed (Gleason and Mills, 2002). In addition to requiring disclosure, FIN 48 provided additional guidance designed to standardize the computation of the contingent tax reserve.

[4] Our inferences are largely unchanged if we limit the sample to only non-missing UTB observations. However, our results are somewhat weaker, likely due to the smaller sample.

observations. We exclude 11,997 observations corresponding to financial (SIC 6000-6999) and regulated firms (4900-4999), because of differing cash and tax avoidance incentives, and consistent with prior research. Next, we require firms to have positive pretax income when summed over the five-year period. Finally, we require firms to have non-missing cash holdings and sufficient data to calculate other determinants of cash holdings as suggested by previous studies (e.g., Opler, Pinkowitz, Stulz, and Williamson 1999; Foley, Hartzell, Titman, and Twite 2007; Bates, Kahle, and Stulz 2009). This leaves us with a final sample of 28,887 firm year observations. Table 1 Panel A details our sample selection.

### *3.2 Empirical Tests*

In this section, we present our research design to examine whether tax risk is an important determinant of cash holdings. We start from regressions that relate the cash ratio to firm characteristics and investigate the incremental effect of our proxies for tax risk. In particular we estimate the following regression model:

$$Cash\ Ratio_{it} = \alpha_0 + \beta_1 TaxRisk_{it} + \Sigma\beta_c Control_{cit} + \varepsilon_{it} \quad (2)$$

*Tax Risk* is measured in one of the two manners discussed above. Previous studies have used several alternative definitions of the cash ratio. These include the following: (1) cash-to-assets, (2) cash-to-net assets, (3) log of cash-to-net assets, and (4) log of cash-to-sales. We follow Bates, Kahle, and Stulz (2009) and use the cash-to-assets ratio in our main tests but test the robustness of our results to the use of other measures (we describe these in the section on robustness analysis below).

We control for several variables that have been shown to affect cash holdings in the existing literature. The variables that we use are as follows:

1. *Market-to-book ratio*. Firms with strong growth opportunities likely hold more cash because it is costly for such firms to be financially constrained and not able to fund their growth. We use the book value of assets minus the book value of equity plus the market value of equity as the numerator of the ratio and the book value of assets as the denominator.
2. *Firm size*. Larger firms likely have greater access to capital and thus need to hold less in cash. To control for firm size, we include the natural logarithm of total assets in our regression.
3. *Leverage*. Firms with high leverage can use cash to reduce debt and the potential costs of financial distress. We measure leverage as long-term debt plus debt in current liabilities divided by book assets.
4. *Capital expenditures*. Investments are expected to be negatively related to cash holdings. We measure capital expenditures as the ratio of capital expenditures to book assets.
5. *Volatility of cash flows*. Prior literature finds that firms with more risky cash flows tend to hold more cash. Following Sufi (2009), we measure the volatility of cash flows by calculating the standard deviation of annual changes of EBITDA over a four-year lagged period, scaled by average non-cash assets in the four-year lagged period.[5]

[5] We also employ an alternative measure of cash flows using data from the cash flow statement. Our inferences are unchanged when using this alternative measure of cash flows.

6. *Dividend payout dummy*. Dividend paying firms are likely to be less risky and, as a result, we expect firms that pay dividends to hold less cash. We define a dummy variable equal to one in years in which a firm pays a common dividend. Otherwise, the dummy equals to zero.
7. *Research and Development*. Another proxy for a firm's growth opportunities. Firms with greater R&D expenditures are more likely to be exposed to the risk of financial distress. As a result, these firms likely hold more cash for precautionary reasons. We measure R&D as research and development expenses scaled by total assets, and R&D is set equal to zero when R&D is missing.
8. *Acquisitions*. Firms that spend cash on acquisitions are expected to have lower cash ending balances. We measure acquisitions as acquisition expenses during the current year over the book value of assets.
9. *Tax Repatriation Costs.* Following Foley, Hartzell, Titman, and Twite (2007), we control for the tax costs associated with repatriating foreign income. They show that firms facing higher repatriation taxes hold higher levels of cash. Tax repatriation costs are computed by subtracting foreign taxes paid from the product of a firm's foreign pretax income and the U.S. statutory tax rate (35%).
10. *After-tax cash flows*. Firms with higher cash flow may accumulate more cash, all else equal. We follow Bates, Kahle, and Stulz (2009) and measure cash flow as earnings after interest, dividends, and taxes but before depreciation divided by book assets.[6]

We winsorize all continuous variables at the 1% and 99% levels to limit the influence of outliers. We winsorize *5-year CASHETR* at 0 and 1. In addition, the specification includes

[6] We also employ an alternative measure of cash flows using the cash flow statement (cash flows from operations minus dividends) and obtain similar results.

industry and year fixed effects. Following Petersen (2009), we cluster standard errors at the firm and year levels.

The coefficient of interest is $\beta_1$, which captures the incremental effect of tax risk on cash holdings. We estimate equation (2) for the entire sample and for sub-samples based on whether a firm has foreign operations or operates purely in the U.S. To classify firms as either domestic or multinational we follow Foley, Hartzell, Titman, and Twite (2007). We classify firms as purely domestic in those firm-years in which they report foreign income as either zero or missing. All other firm-years are classified as the firm having foreign operations (*i.e.*, as the firm being a multinational). Our prediction is that tax risk is positively associated with cash balances. In our regression, we predict that $\beta_1<0$ when tax risk is measured using the *5-year CASHETR* (i.e., the lower the effective tax rate the more tax risk the firm is likely bearing, the higher the cash balance). When we measure tax risk using the *UTB* amount, we predict $\beta_1>0$; the more uncertain tax positions the firm has, the greater the cash balance held in order to pay potential future tax claims.

## 4. Results

### *4.1 Descriptive Statistics*

Table 1 Panel B presents our sample distribution. The total sample consists of a set of 28,887 firm-year observations from 1995 to 2011, with 11,862 firm-year observations corresponding to firms with foreign operations and 17,025 firm-year observations corresponding to firms that only operate domestically.

Table 2 presents descriptive statistics for the variables used in our analysis. Panel A presents statistics for the full sample. The distributions we obtain for the different variables are

largely consistent with previous studies. For example, the *5-year CASHETR* measure in our sample is similar to the one reported in Dyreng, Hanlon, and Maydew (2008), and has a mean of 33.2% and a median of 30.9%.[7] Our mean value for *Tax Repatriation Costs* is 0.002, which is somewhat larger than the one documented in Foley, Hartzell, Titman, and Twite (2007). This is partially due to the different sample period and the fact that we require firms to have positive pretax income over five years. Table 2 Panel B presents statistics for multinational companies and Panel C present statistics for domestic only companies. Multinational companies are on average larger and hold more cash per dollar of assets than domestic firms.

Table 3 presents correlations among the main variables in our sample. Consistent with our hypothesis, the data reveal that the *5-year CASHETR* is negatively correlated with cash holdings and the *UTB* balance is positively associated cash holdings. Consistent with Foley et al. (2007), *Repatriation Tax Cost* is positively associated with cash holdings and, as expected, is negatively correlated with *5-year CASHETR* and positively correlated with the *UTB*. *Cash Flow Volatility* is positively correlated with cash holdings, consistent with prior literature. Interestingly, *UTB* is positively correlated with *Cash Flow* and *5-year CASHETR* is negatively related to *Cash Flow* (i.e., lower taxes paid is correlated with higher cash flows); however, *Cash Flows* are not positively related to cash holdings, consistent with the results in Bates et al. (2009).

### *4.2 Empirical Results*

We start by providing graphical data about cash holdings for our sample firms. Figures 1A and 1B show that the ratio of cash-to-assets and the ratio of cash-to-sales have both increased

[7] In our sample, the mean and median are higher and the standard deviation is greater. Dyreng, Hanlon, and Maydew (2008) add back special items to income in the denominator of the measure. This adjustment allows Dyreng, Hanlon, and Maydew (2008) to retain more firms in their sample but results in lower rates because special items often reduce income. If we adjust our denominator for special items, our descriptive statistics for the *5-year CASHETR* are nearly identical to Dyreng, Hanlon, and Maydew (2008)).

over time. That the ratio of cash-to-sales also increases demonstrates that the phenomena observed in cash-to-assets is not due to a shrinking asset denominator, in which firms have fewer recorded assets over time as they become more intangibles-based. Additionally, the increase in cash holdings is seen in both domestic and multinational firms, so it cannot be fully explained by repatriation taxes causing "trapped cash".

In Figures 2 and 3, we provide graphical evidence with respect to our hypothesis. For purposes of the graphs, we classify firms as having high tax risk based on whether they are below the sample median of the *5-year CASHETR* and separately if they have above the sample median *UTB* (scaled by assets). Using data for the period 1995-2011, Figure 2 reveals that firms with low *5-year CASHETR* have larger cash holdings than firms with high *5-year CASHETR*, for both measures of cash holdings. Using the time period for which UTB data are available (2007-2011), Figure 3 shows a similar pattern using *UTB* as the partitioning variable, with high *UTB* firms holding larger cash balances than low *UTB* firms. Both Figure 2 and Figure 3 provide evidence consistent with our main prediction – that tax risk is an important determinant of cash balances. Firms that engage in risky tax avoidance seem to have, on average, higher cash-to-assets and higher cash-to-sales ratios.

We now move to our regression results. Table 4 reports regression results for our hypothesis. The column (1) of Panel A presents the results for the incremental effect of long-run tax avoidance, our first proxy for tax risk, on cash holdings for our sample. Consistent with *H1*, we find evidence that, on average, firms that engage in risky tax avoidance hold larger cash balances. The estimated coefficient of -0.043 on *Tax Risk*, proxied by *5-year CASHETR*, is statistically significant at the 1% level. The control variables are significant and in the direction that is consistent with prior research (e.g., Bates, Kahle, and Stulz, 2009).

Our results also have important economic implications. To better illustrate this point we rank companies into 10 portfolios based on their *5-year CASHETRs* (untabulated). We find that companies in the top tax risk decile (proxied by the lowest *5-year CASHETRs)* have an extra 2% of their total assets in cash as compared to companies in the lowest tax risk decile. With firms on average holding 13.7% of their assets in cash (Table 2 Panel A), this is equivalent to a 14.5% larger ratio of cash-to-assets relative to an otherwise average firm.

Columns (2) and (3) of Table 4 Panel A present the results for multinational and domestic companies respectively. Our findings are similar to the results in our full sample. *Tax Risk* is significantly related to cash holdings in the manner predicted in both sub-samples. The fact that tax risk is an important determinant of the cash holdings of domestic companies provides strong evidence that taxes play an important role in firm's cash holdings, in addition to their effect through repatriation costs documented in Foley, Hartzell, Titman, and Twite (2007).

Table 4 Panel B reports the results using *UTB* as our proxy for tax risk. Column (1) presents the results for the incremental effect of unrecognized tax benefits on cash holdings for the full sample. Again, consistent with *H1*, we find evidence that, on average, firms that engage in risky tax avoidance (i.e., have a higher *UTB)* hold larger cash balances. The estimated coefficient of 0.483 on *UTB* is statistically significant at the 1% level. Our results also show that risky tax avoidance (i.e., larger *UTB*) is economically significant. The coefficient on *UTB* is a direct measure of the effect of tax risk on cash holdings. With a value of 0.483, this implies that firms hold, on average, 48 cents of cash on hand for every dollar of unrecognized tax benefits. In addition, untabulated regressions show that the average company in the top decile of tax risk (i.e. those that have the largest uncertain tax positions) holds an extra 2.3% of its total assets in

cash as compared to the average company in the bottom decile of tax risk (*i.e.*, those that have the lowest uncertain tax positions).

Columns (2) and (3) of Table 4 Panel B present the results for multinational and domestic companies separately. The results in Panel B corroborate our findings in Panel A – the association between tax risk and cash holdings obtains for both multinational firms and domestic firms.

Overall, our results provide evidence that tax risk is an important determinant of firms' cash holdings. In addition, our analysis of domestic companies shows that tax strategies have important implications for real corporate decisions beyond the potential effects of the tax cost of repatriating foreign earnings, which only affect multinational firms.

## 5. Robustness Tests

### *5.1 Expanded Sample for Tests of UTB*

In untabulated results, we expand the sample of firms for the *UTB* tests. Specifically, we no longer restrict the sample to only firms that have positive cumulative profits over the five-year period and we do not require that data for cash taxes paid be available (i.e., we do not require data to be available to compute the *5-year CASHETR*). We re-estimate our tests using *UTB* as the proxy of tax risk over this expanded sample of firms. We find results similar to those above in our main analysis for our main variable of interest, *UTB.* Specifically, we find a coefficient of 0.76 on the *UTB* variable, which is statistically significant at the 1% level. Thus, the predicted positive relation between tax risk, proxied by the *UTB*, and cash holdings obtains in our expanded sample.

### *5.2 Alternative Cash Definitions*

To further test the robustness of our inferences and to reduce concerns that our results are driven by our choice of dependent variable, we conduct additional tests with different measures of cash holdings. In particular, we estimate equations (2) and (3) using the following alternative cash definitions: (a) log of the ratio of cash to sales, (b) cash to net assets, (c) log of one plus the ratio of cash to net assets, and (d) log of cash to net assets.

Table 5 presents the results of these alternative cash definitions. For parsimony, we present the results for our test variables only for each cash measure. Our inferences in all cases remain unchanged. Thus, our results do not seem to be driven by our choice of dependent variable.

### *5.3 Changes Regression*

Our research question is whether tax risk can explain, at least in part, the large cash balances on firm balance sheets. Thus, our main empirical specification consists of regressions of cash balances on measures of tax risk. An econometric concern with such a levels regression, however, is that our results could be affected by an omitted correlated variable. To mitigate this concern we follow Foley, Hartzell, Titman, and Twite (2007) and Bates, Kahle, and Stulz (2009) in conducting sensitivity analyses that employ a changes model. In Foley, Hartzell, Titman, and Twite (2007) the authors estimate a regression of changes in cash holdings on levels of their test variables. In Bates, Kahle, and Stulz (2009) the authors estimate a regression of changes in cash holdings on changes of their independent variables. They find that some variables have a relation with cash holdings consistent with what they observe in the levels analysis but that some relations are significant in the opposite direction from their levels analysis.

We employ a research design that consists of regressions of changes of cash balances on changes of the *5-year CASHETR*. A problem in our setting is that we employ a five-year measure of cash effective tax rates which have less time-series variation than a yearly cash effective tax rate measure. In addition, the UTB data are not available for a long time series and thus, a changes specification is difficult. We present the results for the long run cash effective tax rate to be consistent with prior literature. We include the lagged change in cash and the lagged level of cash as independent variables to allow for partial adjustment of the cash ratio to the equilibrium level. Further, we winsorize all changes variables at the 1% level. Finally, we cluster standard errors at the firm and year levels.

Table 6 presents our results for the full sample as well as for the sub-samples of multinational and domestic firms. For the full sample and for sample of domestic companies, Table 6 provides evidence consistent with changes in tax risk being a determinant of changes in cash balances. The coefficient on change in tax risk is significant in the predicted direction – as tax risk increases (*5-year CASHETR* decreases), cash holdings rise. For the sub-sample of multinational companies, the coefficient on tax risk has the right sign, but does not reach statistical significance. Overall, despite the empirical challenges in estimating a changes regression in our setting, we find evidence that is generally consistent with our hypothesis.

## 6. Conclusions

A recent puzzle in the corporate finance literature is the observation that both multinational and domestic U.S. corporations hold large (and growing) amounts of cash on their balance sheets. We test whether tax risk is associated with larger cash balances. Because tax authorities can challenge and disallow tax positions, demanding cash tax payments in the future,

firms may hold cash in order to satisfy these potential future demands. We find that both domestic and multinational firms that avoid taxes, particularly those that bear tax risk in doing so, hold significantly larger cash balances. The data suggest that there is a precautionary motive to hold cash balances that result from tax avoidance activities.

Our paper contributes to the literature on the determinants of corporate cash holdings. In particular, we provide evidence that firms engaging in risky tax avoidance hold more cash on their balance sheet due to precautionary reasons related to uncertain outcomes with tax authorities. As such, we provide another important explanatory variable in the quest of learning why firms hold so much cash on their balance sheets. In addition, our paper addresses the call by Hanlon and Heitzman (2010) to examine new channels through which taxes can have real effects on firm policies.

**References**


Armstrong, C., J Blouin, and D. Larcker, 2012. The incentives for tax planning. *Journal of Accounting and Economics* 53: 391-411.

Badertscher, B., S. Katz, and S. Rego. 2010. The impact of private equity ownership on portfolio firms' corporate tax avoidance. Working paper, Indiana University.

Bates, T., K. Kahle, and R. Stulz, 2009. Why do US firms hold so much more cash than they used to? *The Journal of Finance*, 64(5), 1985-2021.

Baumol, W. J. 1952. The transactions demand for cash: An inventory theoretic approach. *Quarterly Journal of Economics* 66, 545-556.

Blouin, J., Gleason, C., Mills, L., Sikes, S., 2010. Pre-empting disclosure? Firms' decisions prior to FIN 48. *The Accounting Review* 85, 791–815.

Campbell, J. L., D. S. Dhaliwal, L. K. Krull, and C. M. Schwab. 2012. Taxes and the market value of foreign cash holdings. Working paper, Universities of Arizona, Georgia, and Oregon.

Chen, S., Chen, X., Cheng, Q., Shevlin, T., 2010. Are family firms more tax aggressive than non-family firms? *Journal of Financial Economics* 95, 41–61.

Dhaliwal, D., S. Huang, W. Moser, and R. Pereira. 2011. Corporate tax avoidance and the level and valuation of firm cash holdings. Working paper, University of Arizona.

Demiroglu, C, and C. James, 2011. The use of bank lines of credit in corporate liquidity management: A review of empirical evidence. *Journal of Banking & Finance* 35, 775-782.

Desai, M., Dharmapala, D., 2006. Corporate tax avoidance and high-powered incentives. *Journal of Financial Economics* 79, 145–179.

Desai, M., Dharmapala, D., 2008. Tax and corporate governance: an economic approach. In: Schoen, W. (Ed.), Tax and Corporate Governance. Springer- Verlag, Berlin, pp. 13–30.

Desai, M., Dyck, I., Zingales, L., 2007. Theft and taxes. *Journal of Financial Economics* 84, 591–623.

De Simone, L., J. R. Robinson, and B. Stomberg. 2011. Distilling the reserve for uncertain tax positions: The revealing case of black liquor. Working paper, University of Texas.

Dittmar, A., Mahrt-Smith, J., 2007. Corporate governance and the value of cash holdings. *Journal of Financial Economics* 83, 599–634.

Dittmar, A., Mahrt-Smith, and H. Servaes. 2003. International corporate governance and corporate cash holdings. *Journal of Financial and Quantitative Analysis* 38, 111-133.

Dyreng, S., Hanlon, M., Maydew, E., 2008. Long-run corporate tax avoidance. *The Accounting Review* 83, 61–82.

Dyreng, S., Hanlon, M., Maydew, E., 2010. The effects of executives on corporate tax avoidance. *The Accounting Review* 85, 1163–1189.

Faulkender, M., and R. Wang. 2006. Corporate financial policy and the value of cash. *Journal of Finance* 61:1957–90.

Foley, C., Hartzell, J., Titman, S., Twite, G., 2007. Why do firms hold so much cash? A tax-based explanation. *Journal of Financial Economics* 86, 579–607.

Fresard, L., 2010. Financial strength and product market behavior: The real effects of corporate cash holdings. *Journal of Finance* 65, 1097-1122.

Gallemore, J., E. L. Maydew, and J. R. Thornock, 2012. The reputational costs of tax avoidance and the under-sheltering puzzle. Working paper, the University of North Carolina.

Gleason, C., Mills, L., 2002. Materiality and contingent tax liability reporting. *The Accounting Review* 77, 317–342.

Gleason, C., Mills, L. 2008. Evidence of differing market responses to beating analysts' targets through tax expense decreases. *Review of Accounting Studies* 13, 295-318.

Graham, J., M. Hanlon, T. Shevlin, and Shroff, N., 2012. Incentives for tax planning and avoidance: evidence from the field. Working paper, Duke University, MIT, and University of California, Irvine.

Hanlon, M., 2003. What can we infer about a firm's taxable income from its financial statements? *National Tax Journal* 56, 831–863.

Hanlon, M., Heitzman, S., 2010. A review of tax research. *Journal of Accounting and Economics* 50, 127–178.

Hanlon, M., Slemrod, J., 2009. What does tax aggressiveness signal? Evidence from stock price reactions to news about tax shelter involvement. *Journal of Public Economics* 93, 126–141.

Harford, J. 1999. Corporate cash reserves and acquisitions. *Journal of Finance* 54 (6), 1969-1997.

Harford, J., S. Mansi, and W. Maxwell. 2008. Corporate governance and firm cash holdings in the U.S. *Journal of Financial Economics* 87:535–55.

Jensen, M., 1986. Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* 76, 323–329.

Kim, J., Y. Li, and L. Zhang. 2011. Corporate tax avoidance and stock price crash risk: Firm level analysis. *Journal of Financial Economics* 100, p. 639-662.

Lisowsky, P., Robinson, L., Schmidt, A., 2010. An examination of FIN 48: tax shelters, auditor independence, and corporate governance. Working Paper, University of Illinois.

Miller, M. H. and D. Orr. 1966. A model of the demand for money by firms. *Quarterly Journal of Economics* 80, 413-435.

Mulligan, C. B. 1997. Scale economies, the value of time, and the demand for money: Longitudinal evidence from firms. *Journal of Political Economy* 105, 1061-1079.

Opler, T., L. Pinkowitz, R. Stulz, and R. Williamson., 1999. The determinants and implications of corporate cash holdings. *Journal of Financial Economics* 52:3–46.

Petersen, M.A., 2009. Estimating standard errors in finance panel data sets: comparing approaches. *Review of Financial Studies* 22, 435–480.

Pfanner, E. 2012. European countries seek more taxes from U.S. multinationals. Wall Street Journal, November 19.

Philadelphia Inquirer, 2004. IRS says Glaxco owes $5.2 billion in taxes, interest. January 8.

Pinkowitz, L., R. M. Stulz, and R. Williamson. 2006. Do firms in countries with poor protection of investor rights hold more cash? *Journal of Finance* 61, 2725-2751.

Pinkowitz, L., R. M. Stulz, and R. Williamson. 2012. Multinationals and the high cash holdings puzzle. Working paper, Georgetown University and Ohio State University.

Rego, S., 2003. Tax avoidance activities of U.S. multinational corporations. *Contemporary Accounting Research* 20, 805–833.

Sufi, A., 2009. Bank lines of credit in corporate finance: An empirical analysis. *Review of Financial Studies* 22, 1057-1088.

Zimmerman, J., 1983. Taxes and firm size. *Journal of Accounting and Economics* 5, 119–149.

**Figure 1**
**Graphs of Cash Holdings**

**Figure 1A**
**Evolution of Cash-to-Assets Ratio**

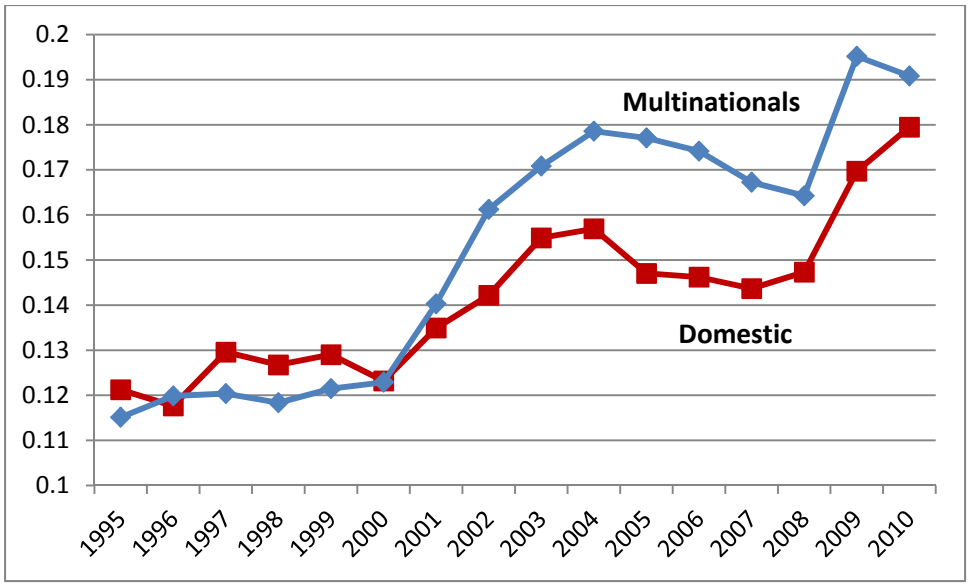
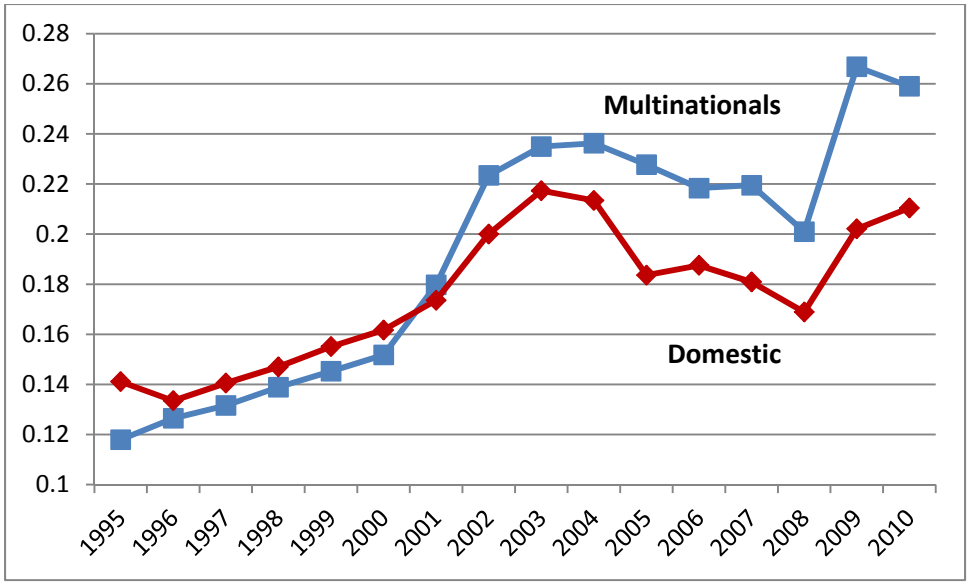



**Figure 1B**
**Evolution of Cash-to-Sales Ratio**




**Figures 1A and 1B.** Evolution of cash holdings: domestic and multinational companies. Firms are classified as domestic in those firm years in which they report foreign income as either zero or missing. All other firm years are classified as the firm having foreign operations (i.e. as the firm being a multinational). Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables.

**Figure 2**
**Cash Holdings: Low Cash ETR vs. High Cash ETR**

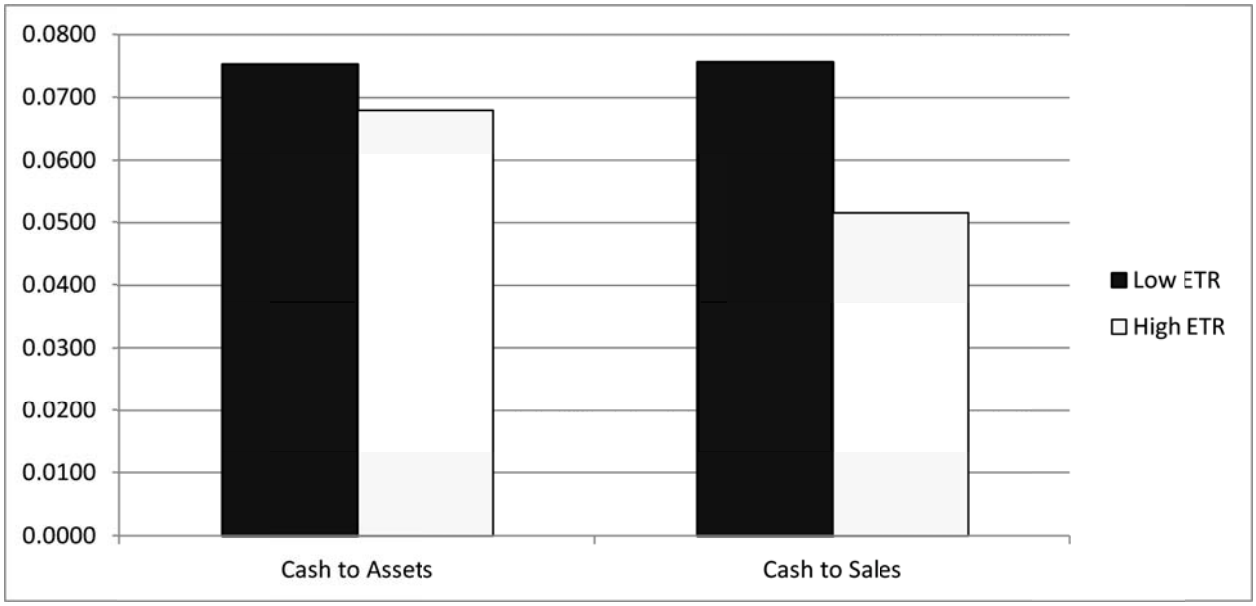



**Figure 2.** This figure presents average cash holdings of low *5-year CASHETR* firms versus high *5-year CASHETR* firms. The *5-year CASHETR* is the long-run cash effective tax rate, computed as the sum of cash taxes paid over the previous five years divided by the sum of a firm's pre-tax income over the same five year period. We winsorize the values at zero and one. Firms are classified into either low *5-year CASHETR* or high *5-year CASHETR* based on whether they are below or above the sample median *5-year CASHETR*. Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables. The data used for this graph include the years 1995 – 2011.

**Figure 3**
**Cash Holdings: High UTB vs. Low UTB**

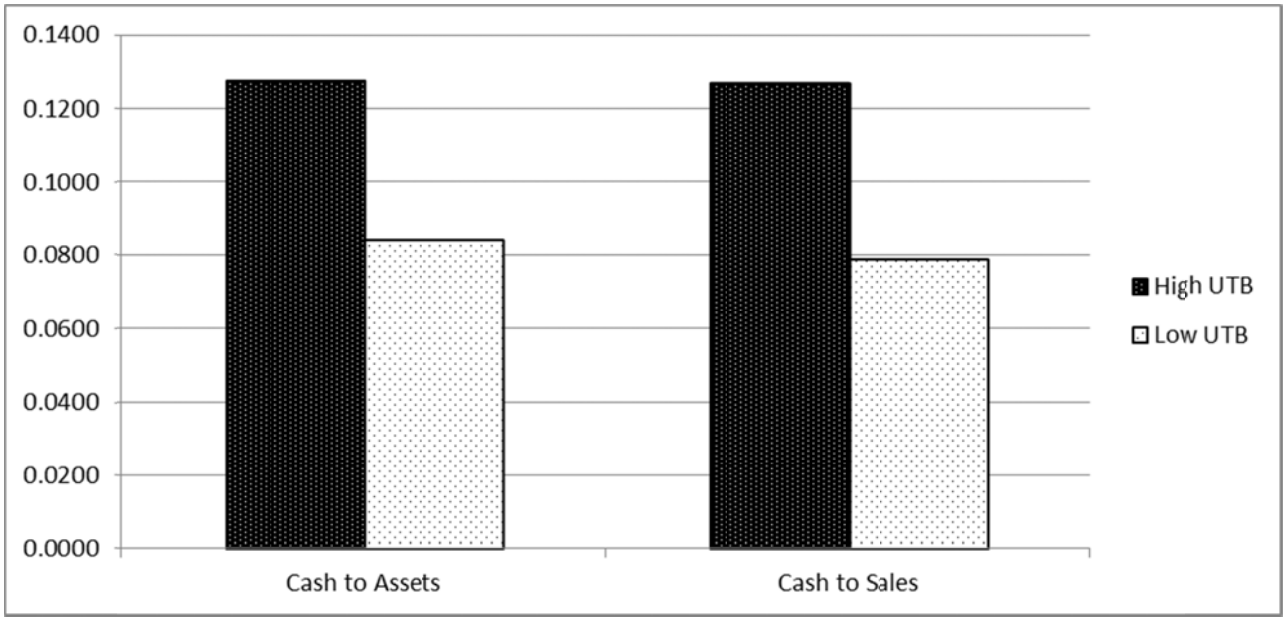



**Figure 3**. This figure presents average cash holdings of high *UTB* firms versus low *UTB* firms. *UTB* is measured as the reserve for unrecognized tax benefits scaled by total assets. For firm years with missing *UTB* and fiscal years starting in 2007, we set *UTB* equal to zero. Firms are classified into either high *UTB* or low *UTB* based on whether they are below or above the sample median *UTB*. Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables. The data used for this graph include the years 2007 – 2011.

## Table 1
## Sample

*Panel A: Sample Selection*

| | **N (firm-years)** |
|---|---|
| Firm years with non-missing tax information over five consecutive years | 64,057 |
| Excluding financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999) | (13,092) |
| Excluding firm years with non-positive pretax income over five years | (16,622) |
| Excluding firm years with missing cash holdings and data to calculate control variables | (5,456) |
| **Final Sample** | **28,887** |

*Panel B: Sample Distribution*

| | **Firm year observations** | | |
|---|---|---|---|
| **Fiscal Year** | *Full Sample* | *Multinationals* | *Domestic* |
| 1995 | 1,670 | 536 | 1,134 |
| 1996 | 1,862 | 592 | 1,270 |
| 1997 | 1,944 | 640 | 1,304 |
| 1998 | 1,907 | 612 | 1,295 |
| 1999 | 1,951 | 637 | 1,314 |
| 2000 | 1,866 | 616 | 1,250 |
| 2001 | 1,742 | 616 | 1,126 |
| 2002 | 1,699 | 622 | 1,077 |
| 2003 | 1,664 | 665 | 999 |
| 2004 | 1,660 | 697 | 963 |
| 2005 | 1,621 | 727 | 894 |
| 2006 | 1,666 | 766 | 900 |
| 2007 | 1,658 | 841 | 817 |
| 2008 | 1,552 | 821 | 731 |
| 2009 | 1,513 | 810 | 703 |
| 2010 | 1,470 | 834 | 636 |
| 2011 | 1,442 | 830 | 612 |
| **Total** | **28,887** | **11,862** | **17,025** |

**Table 1.** Sample selection and distribution. Firms are classified as domestic in those firm years in which they report foreign income as either zero or missing. All other firm years are classified as the firm having foreign operations (i.e. as the firm being a multinational). Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables.

**Table 2**
**Descriptive Statistics**

*Panel A: Full Sample*

| Variable | N | Mean | Median | Std Dev | 25th Pctl | 75th Pctl |
|---|---|---|---|---|---|---|
| *Cash-to-assets* | 28,887 | 0.137 | 0.072 | 0.160 | 0.021 | 0.199 |
| *Cash-to-sales* | 28,887 | 0.173 | 0.062 | 0.291 | 0.017 | 0.189 |
| *Five-year Cash ETR* | 28,887 | 0.332 | 0.309 | 0.225 | 0.198 | 0.398 |
| *UTB* | 7,637 | 0.007 | 0.002 | 0.012 | 0.000 | 0.010 |
| *Repatriation Tax Cost* | 28,887 | 0.002 | 0.000 | 0.005 | 0.000 | 0.000 |
| *Leverage* | 28,887 | 0.212 | 0.191 | 0.184 | 0.040 | 0.330 |
| *Cash Flow Volatility* | 28,887 | 0.065 | 0.041 | 0.072 | 0.021 | 0.079 |
| *Market-to-Book* | 28,887 | 1.771 | 1.432 | 1.133 | 1.087 | 2.037 |
| *Size* | 28,887 | 5.969 | 5.968 | 1.945 | 4.618 | 7.288 |
| *Dividends* | 28,887 | 0.407 | 0.000 | 0.491 | 0.000 | 1.000 |
| *CAPEX* | 28,887 | 0.058 | 0.040 | 0.058 | 0.021 | 0.073 |
| *Acquisitions* | 28,887 | 0.028 | 0.000 | 0.065 | 0.000 | 0.021 |
| *R&D* | 28,887 | 0.023 | 0.000 | 0.043 | 0.000 | 0.027 |
| *Cash Flow* | 28,887 | 0.089 | 0.086 | 0.067 | 0.053 | 0.124 |

**Table 2 (continued)**
**Descriptive Statistics**

*Panel B – Multinational Companies*

| Variable | N | Mean | Median | Std Dev | 25th Pctl | 75th Pctl |
|---|---|---|---|---|---|---|
| *Cash-to-assets* | 11,862 | 0.147 | 0.088 | 0.156 | 0.032 | 0.211 |
| *Cash-to-sales* | 11,862 | 0.189 | 0.082 | 0.274 | 0.028 | 0.223 |
| *Five-year Cash ETR* | 11,862 | 0.340 | 0.301 | 0.221 | 0.209 | 0.395 |
| *UTB* | 4,137 | 0.010 | 0.006 | 0.014 | 0.000 | 0.014 |
| *Repatriation Tax Cost* | 11,862 | 0.004 | 0.000 | 0.008 | 0.000 | 0.004 |
| *Leverage* | 11,862 | 0.204 | 0.191 | 0.168 | 0.052 | 0.310 |
| *Cash Flow Volatility* | 11,862 | 0.059 | 0.037 | 0.068 | 0.019 | 0.070 |
| *Market to Book* | 11,862 | 1.889 | 1.538 | 1.159 | 1.186 | 2.173 |
| *Size* | 11,862 | 6.825 | 6.786 | 1.737 | 5.661 | 7.955 |
| *Dividends* | 11,862 | 0.479 | 0.000 | 0.500 | 0.000 | 1.000 |
| *CAPEX* | 11,862 | 0.049 | 0.036 | 0.044 | 0.021 | 0.061 |
| *Acquisitions* | 11,862 | 0.032 | 0.002 | 0.066 | 0.000 | 0.031 |
| *R&D* | 11,862 | 0.034 | 0.013 | 0.048 | 0.000 | 0.050 |
| *Cash Flow* | 11,862 | 0.091 | 0.088 | 0.060 | 0.058 | 0.122 |

*Panel C: Domestic Only Companies*

| Variable | N | Mean | Median | Std Dev | 25th Pctl | 75th Pctl |
|---|---|---|---|---|---|---|
| *Cash-to-assets* | 17,025 | 0.131 | 0.058 | 0.162 | 0.016 | 0.187 |
| *Cash-to-sales* | 17,025 | 0.163 | 0.049 | 0.302 | 0.012 | 0.167 |
| *Cash ETR* | 17,025 | 0.327 | 0.314 | 0.227 | 0.187 | 0.399 |
| *UTB* | 3,500 | 0.004 | 0.000 | 0.009 | 0.000 | 0.004 |
| *Repatriation Tax Cost* | 17,025 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| *Leverage* | 17,025 | 0.218 | 0.191 | 0.194 | 0.031 | 0.347 |
| *Cash Flow Volatility* | 17,025 | 0.069 | 0.044 | 0.075 | 0.023 | 0.085 |
| *Market to Book* | 17,025 | 1.688 | 1.357 | 1.106 | 1.030 | 1.932 |
| *Size* | 17,025 | 5.374 | 5.371 | 1.859 | 4.086 | 6.616 |
| *Dividends* | 17,025 | 0.356 | 0.000 | 0.479 | 0.000 | 1.000 |
| *CAPEX* | 17,025 | 0.064 | 0.043 | 0.065 | 0.021 | 0.083 |
| *Acquisitions* | 17,025 | 0.026 | 0.000 | 0.065 | 0.000 | 0.012 |
| *R&D* | 17,025 | 0.016 | 0.000 | 0.038 | 0.000 | 0.007 |
| *Cash Flow* | 17,025 | 0.087 | 0.084 | 0.072 | 0.049 | 0.125 |

## Table 2 (continued)

**Table 2.** The table reports descriptive statistics for the full sample, multinationals, and domestic firms respectively. Firms are classified as domestic in those firm years in which they report foreign income as either zero or missing. All other firm years are classified as the firm having foreign operations (i.e. as the firm being a multinational). Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables. *Cash-to-Assets* corresponds to the ratio of cash and marketable securities to the book value of total assets. *Cash-to-Sales* corresponds to the ratio of cash and marketable securities to sales. *Five-year Cash ETR* is the long-run cash effective tax rate, computed as the sum of income tax paid over the previous five years divided by the sum of a firm's pre-tax income. We winsorize the values at zero and one. *Tax repatriation costs* are computed by subtracting foreign taxes paid from the product of a firm's foreign pretax income and the US statutory tax rate. *Leverage* is measured as long-term debt plus debt in current liabilities divided by book assets. *UTB* is measured as the reserve for unrecognized tax benefits scaled by total assets. For firm years with missing *UTB* and fiscal years starting in 2007, we set *UTB* equal to zero. To calculate *Market-to-book ratio* we use the book value of total assets minus the book value of equity plus the market value of equity as the numerator of the ratio and the book value of assets as the denominator. *Firm size* is calculated as the natural logarithm of total assets. *Capital expenditures* is measured as the ratio of capital expenditures to book assets. We measure *Volatility of cash flows* by calculating the standard deviation of annual changes of EBITDA over a four-year lagged period, scaled by average non-cash assets in the four-year lagged period. The *Dividend payout dummy* is equal to one in years in which a firm pays a common dividend. Otherwise, the dummy equals to zero. *Research and Development* is measured as research and development expenses scaled by total assets, and R&D is set equal to zero when R&D is missing. *Acquisitions* is calculated as acquisition expenses during the current year over the book value of assets. *Cash Flow* is measured as earnings after interest, dividends, and taxes but before depreciation divided by book assets. All variables are winsorized at the 1% and 99% level.

## Table 3
## Pearson Correlations – Full Sample

| | | *A* | *B* | *C* | *D* | *E* | *F* | *G* | *H* | *I* | *J* | *K* | *L* | *M* | *N* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cash-to-assets** | ***A*** | 1.000 | 0.799 | -0.052 | 0.158 | 0.159 | -0.461 | 0.483 | 0.315 | -0.181 | -0.136 | -0.177 | -0.136 | 0.394 | -0.002 |
| | | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | 0.779 |
| **Cash-to-sales** | ***B*** | | 1.000 | -0.089 | 0.129 | 0.125 | -0.290 | 0.378 | 0.197 | -0.078 | -0.130 | -0.137 | -0.075 | 0.305 | -0.140 |
| | | | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 |
| **Five-year Cash ETR** | ***C*** | | | 1.000 | 0.007 | -0.090 | 0.014 | 0.056 | -0.138 | -0.078 | -0.022 | -0.117 | -0.026 | -0.007 | -0.159 |
| | | | | | 0.548 | <.0001 | 0.015 | <.0001 | <.0001 | <.0001 | 0.000 | <.0001 | <.0001 | 0.261 | <.0001 |
| **UTB** | ***D*** | | | | 1.000 | 0.308 | -0.029 | 0.028 | 0.126 | 0.226 | 0.041 | -0.104 | -0.018 | 0.212 | 0.054 |
| | | | | | | <.0001 | 0.010 | 0.014 | <.0001 | <.0001 | 0.000 | <.0001 | 0.114 | <.0001 | <.0001 |
| **Repatriation Tax Cost** | ***E*** | | | | | 1.000 | -0.075 | 0.043 | 0.170 | 0.193 | 0.009 | -0.038 | -0.009 | 0.172 | 0.145 |
| | | | | | | | <.0001 | <.0001 | <.0001 | <.0001 | 0.133 | <.0001 | 0.109 | <.0001 | <.0001 |
| **Leverage** | ***F*** | | | | | | 1.000 | -0.267 | -0.220 | 0.235 | 0.021 | 0.077 | 0.170 | -0.281 | -0.138 |
| | | | | | | | | <.0001 | <.0001 | <.0001 | 0.000 | <.0001 | <.0001 | <.0001 | <.0001 |
| **Cash Flow Volatility** | ***G*** | | | | | | | 1.000 | 0.150 | -0.331 | -0.205 | -0.024 | -0.085 | 0.298 | -0.049 |
| | | | | | | | | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 |
| **Market to Book** | ***H*** | | | | | | | | 1.000 | 0.075 | 0.027 | 0.063 | 0.006 | 0.276 | 0.392 |
| | | | | | | | | | | <.0001 | <.0001 | <.0001 | 0.294 | <.0001 | <.0001 |
| **Size** | ***I*** | | | | | | | | | 1.000 | 0.321 | 0.027 | 0.105 | -0.096 | 0.060 |
| | | | | | | | | | | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 |
| **Dividends** | ***J*** | | | | | | | | | | 1.000 | -0.008 | -0.008 | -0.144 | -0.054 |
| | | | | | | | | | | | | 0.172 | 0.170 | <.0001 | <.0001 |
| **CAPEX** | ***K*** | | | | | | | | | | | 1.000 | -0.106 | -0.110 | 0.289 |
| | | | | | | | | | | | | | <.0001 | <.0001 | <.0001 |
| **Acquisitions** | ***L*** | | | | | | | | | | | | 1.000 | -0.003 | 0.002 |
| | | | | | | | | | | | | | | 0.636 | 0.699 |
| **R&D** | ***M*** | | | | | | | | | | | | | 1.000 | 0.041 |
| | | | | | | | | | | | | | | | <.0001 |
| **Cash Flow** | ***N*** | | | | | | | | | | | | | | 1.000 |

## Table 3 (Continued)

**Table 3.** The table reports Pearson correlation coefficients for the variables used in the analysis. Firms are classified as domestic in those firm years in which they report foreign income as either zero or missing. All other firm years are classified as the firm having foreign operations (i.e. as the firm being a multinational). Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables. *Cash-to-Assets* corresponds to the ratio of cash and marketable securities to the book value of total assets. *Cash-to-Sales* corresponds to the ratio of cash and marketable securities to sales. *5-year CASHETR* is the long-run cash effective tax rate, computed as the sum of cash taxes paid over the previous five years divided by the sum of a firm's pre-tax income over the same five year period. We winsorize the values at zero and one. *Tax repatriation costs* are computed by subtracting foreign taxes paid from the product of a firm's foreign pretax income and the U.S. statutory tax rate. *Leverage* is measured as long-term debt plus debt in current liabilities divided by book assets. *UTB* is measured as the reserve for unrecognized tax benefits scaled by total assets. For firm years with missing *UTB* and fiscal years starting in 2007, we set *UTB* equal to zero. To calculate *Market-to-book ratio* we use the book value of total assets minus the book value of equity plus the market value of equity as the numerator of the ratio and the book value of assets as the denominator. *Firm size* is calculated as the natural logarithm of total assets. *Capital expenditures* is measured as the ratio of capital expenditures to book assets. We measure *Volatility of cash flows* by calculating the standard deviation of annual changes of EBITDA over a four-year lagged period, scaled by average non-cash assets in the four-year lagged period. The *Dividend payout dummy* is equal to one in years in which a firm pays a common dividend. Otherwise, the dummy equals to zero. *Research and Development* is measured as research and development expenses scaled by total assets, and R&D is set equal to zero when R&D is missing. *Acquisitions* is calculated as acquisition expenses during the current year over the book value of assets. *Cash Flow* is measured as earnings after interest, dividends, and taxes but before depreciation divided by book assets. All variables are winsorized at the 1% and 99% level.

## Table 4
## The Incremental Effect of Tax Risk on Cash Holdings

*Panel A: The Effect of Tax Risk on Cash Holdings – Tax Risk proxied by the Five-year CASHETR*

| | *Dependent Variable = Cash-to-Assets* | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| | *Full Sample* | *Multinationals* | *Domestic* |
| **Tax Risk (5-year CASHETR)** | **-0.043*** ** | **-0.040*** ** | **-0.045*** ** |
| | (-8.16) | (-7.91) | (-9.96) |
| Tax Repatriation Costs | 1.837*** | 1.685*** | |
| | (11.75) | (10.05) | |
| Leverage | -0.234*** | -0.212*** | -0.241*** |
| | (-50.1) | (-30.03) | (-39.95) |
| Volatility Cash Flows | 0.678*** | 0.706*** | 0.665*** |
| | (43.54) | (30.06) | (32.63) |
| Market-to-Book | 0.024*** | 0.028*** | 0.022*** |
| | (26.33) | (19.42) | (18.15) |
| Size | -0.001** | -0.001 | -0.001** |
| | (-3.45) | (-1.4) | (-2.81) |
| Dividend Dummy | -0.009*** | -0.018*** | -0.002 |
| | (-5.56) | (-7.93) | (-1.33) |
| Capex | -0.362*** | -0.451*** | -0.340*** |
| | (-25.18) | (-16.58) | (-20.08) |
| Acquisitions | -0.196*** | -0.186*** | -0.202*** |
| | (-23.79) | (-14.83) | (-18.58) |
| Cash Flow | -0.207*** | -0.226*** | -0.196*** |
| | (-13.36) | (-8.71) | (-10.23) |
| R&D Spending | 0.417*** | 0.437*** | 0.387*** |
| | (15.58) | (12.81) | (9.29) |
| Intercept | 0.178*** | 0.147*** | 0.204*** |
| | (14.38) | (11.96) | (9.34) |
| *Firms* | 4,886 | 2,086 | 3,473 |
| *N* | 28,887 | 11,862 | 17,025 |
| *Fixed Effects* | Industry and Year | Industry and Year | Industry and Year |
| *Clustering* | By firm and year | By firm and year | By firm and year |
| *R-Squared* | 0.481 | 0.554 | 0.439 |

**Table 4 (continued)**
**The Incremental Effect of Tax Risk on Cash Holdings**

*Panel B: The Effect of Tax Risk on Cash Holdings – Tax Risk is proxied by the Level of Uncertain Tax Benefits*

| | *Dependent Variable = Cash-to-Assets* | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| | *Full Sample* | *Multinationals* | *Domestic* |
| **Tax Risk (UTB)** | **0.483*** ** | **0.481*** ** | **0.594** ** |
| | (3.90) | (3.00) | (2.17) |
| Tax Repatriation Costs | 1.533*** | 1.491*** | |
| | (6.26) | (5.66) | |
| Leverage | -0.208*** | -0.203*** | -0.210*** |
| | (-23.71) | (-17.03) | (-16.46) |
| Volatility Cash Flows | 0.646*** | 0.695*** | 0.621*** |
| | (24.79) | (18.59) | (17.12) |
| Market-to-Book | 0.030*** | 0.032*** | 0.028*** |
| | (15.28) | (11.9) | (9.62) |
| Size | -0.001 | -0.000 | -0.002 |
| | (-1.48) | (0.03) | (-1.41) |
| Dividend Dummy | -0.012*** | -0.015*** | -0.009** |
| | (-4.27) | (-4.10) | (-1.92) |
| Capex | -0.379*** | -0.449*** | -0.362*** |
| | (-12.72) | (-9.04) | (-9.48) |
| Acquisitions | -0.251*** | -0.251*** | -0.241*** |
| | (-12.95) | (-9.94) | (-7.92) |
| Cash Flow | -0.160*** | -0.175*** | -0.155*** |
| | (-5.73) | (-4.04) | (-4.31) |
| R&D Spending | 0.540*** | 0.534*** | 0.528*** |
| | (10.57) | (9.42) | (5.34) |
| Intercept | 0.139*** | 0.071*** | 0.219*** |
| | (5.92) | (4.00) | (4.86) |
| *Firms* | 2,256 | 1,207 | 1,154 |
| *N* | 7,637 | 4,137 | 3,500 |
| *Fixed Effects* | Industry and Year | Industry and Year | Industry and Year |
| *Clustering* | By firm and year | By firm and year | By firm and year |
| *R-Squared* | 0.489 | 0.538 | 0.460 |

## Table 4 (Continued)

**Table 4.The Effect of Tax Risk on Cash Holdings**. The table presents regression results of a model predicting cash holdings. Firms are classified as domestic in those firm years in which they report foreign income as either zero or missing. All other firm years are classified as the firm having foreign operations (i.e. as the firm being a multinational). Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables. *Cash to Assets* corresponds to the ratio of cash and marketable securities to the book value of total assets. *Tax Risk* is measured by the *5-year CASHETR* in Panel A. The *5-year CASHETR* is the long-run cash effective tax rate, computed as the sum of income tax paid over the previous five years divided by the sum of a firm's pre-tax income. We winsorize the values at zero and one. *Tax repatriation costs* are computed by subtracting foreign taxes paid from the product of a firm's foreign pretax income and the US statutory tax rate. *Leverage* is measured as long-term debt plus debt in current liabilities divided by book assets. *UTB* is measured as the reserve for unrecognized tax benefits scaled by total assets. For firm years with missing *UTB* and fiscal years starting in 2007, we set *UTB* equal to zero. To calculate *Market-to-book ratio* we use the book value of total assets minus the book value of equity plus the market value of equity as the numerator of the ratio and the book value of assets as the denominator. *Firm size* is calculated as the natural logarithm of total assets. *Capital expenditures* is measured as the ratio of capital expenditures to book assets. We measure *Volatility of cash flows* by calculating the standard deviation of annual changes of EBITDA over a four-year lagged period, scaled by average non-cash assets in the four-year lagged period. The *Dividend payout dummy* is equal to one in years in which a firm pays a common dividend. Otherwise, the dummy equals to zero. *Research and Development* is measured as research and development expenses scaled by total assets, and R&D is set equal to zero when R&D is missing. *Acquisitions* is calculated as acquisition expenses during the current year over the book value of assets. *Cash Flow* is measured as earnings after interest, dividends, and taxes but before depreciation divided by book assets. All variables are winsorized at the 1% and 99% levels. t-statistics are presented in parenthesis below the coefficients and are clustered by firm and year.***, **, and * denote significance at the 1%, 5%, and 10% levels, one-tailed, respectively.

## Table 5
## Robustness Tests: Alternative Cash Definitions

*Panel A: The Effect of Tax Risk on Cash Holdings – Tax Risk proxied by the Five-year Cash ETR*

| | ***Dependent Variable*** | | | |
|---|---|---|---|---|
| | ***log (Cash-to-Sales)*** | ***Cash-to-Net Assets*** | ***log (1+Cash-to-Net Assets)*** | ***log (Cash-to-Net Assets)*** |
| **Tax Risk (5-year CASHETR)** | **-0.397*** ** | **-0.138*** ** | **-0.074*** ** | **-0.135*** ** |
| | (-10.04) | (-15.09) | (-14.29) | (-3.58) |
| *Firms* | 4,886 | 4,886 | 4,886 | 4,886 |
| *N* | 28,887 | 28,887 | 28,887 | 28,887 |
| *Controls* | Yes | Yes | Yes | Yes |
| *Fixed Effects* | Industry and Year | Industry and Year | Industry and Year | Industry and Year |
| *Clustering* | By firm and year | By firm and year | By firm and year | By firm and year |
| *R-Squared* | 0.378 | 0.402 | 0.454 | 0.413 |

**Table 5 (continued)**
**Robustness Tests: Alternative Cash Definitions**

*Panel B: The Effect of Tax Risk on Cash Holdings – Tax Risk is proxied by the Level of Uncertain Tax Benefits*

| | ***Dependent Variable*** | | | |
|---|---|---|---|---|
| | ***log (Cash-to-Sales)*** | ***Cash-to-Net Assets*** | ***log (1+Cash-to-Net Assets)*** | ***log (Cash-to-Net Assets)*** |
| **Tax Risk (UTB)** | **3.191*** ** | **0.736** ** | **0.595*** ** | **5.97*** ** |
| | (3.00) | (2.07) | (3.06) | (5.34) |
| *Firms* | 2,256 | 2,256 | 2,256 | 2,256 |
| *N* | 7,637 | 7,637 | 7,637 | 7,637 |
| *Controls* | Yes | Yes | Yes | Yes |
| *Fixed Effects* | Industry and Year | Industry and Year | Industry and Year | Industry and Year |
| *Clustering* | By firm and year | By firm and year | By firm and year | By firm and year |
| *R-Squared* | 0.360 | 0.425 | 0.469 | 0.404 |

## Table 5 (Continued)

**Table 5. Alternative cash definitions.** The table presents regression results of a model predicting cash holdings. Firms are classified as domestic in those firm years in which they report foreign income as either zero or missing. All other firm years are classified as the firm having foreign operations (i.e. as the firm being a multinational). Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables. *Log (cash to sales)* is defined as the natural logarithm of cash and marketable securities to sales. *Cash to net assets* is defined as the ratio of cash and marketable securities to the book value of assets minus cash. *Log (1+ cash to net assets)* is defined as the natural logarithm of one plus the ratio cash and marketable securities to the book value of assets minus cash. *Log (cash to net assets)* is defined as the natural logarithm of the ratio cash and marketable securities to the book value of assets minus cash. *5-year CASHETR* is the long-run cash effective tax rate, computed as the sum of cash taxes paid over the previous five years divided by the sum of a firm's pre-tax income. We winsorize the values at zero and one. *Tax repatriation costs* are computed by subtracting foreign taxes paid from the product of a firm's foreign pretax income and the US statutory tax rate. *Leverage* is measured as long-term debt plus debt in current liabilities divided by book assets. *UTB* is measured as the reserve for unrecognized tax benefits scaled by total assets. For firm years with missing *UTB* and fiscal years starting in 2007, we set *UTB* equal to zero. To calculate *Market-to-book ratio* we use the book value of total assets minus the book value of equity plus the market value of equity as the numerator of the ratio and the book value of assets as the denominator. *Firm size* is calculated as the natural logarithm of total assets. *Capital expenditures* is measured as the ratio of capital expenditures to book assets. We measure *Volatility of cash flows* by calculating the standard deviation of annual changes of EBITDA over a four-year lagged period, scaled by average non-cash assets in the four-year lagged period. The *Dividend payout dummy* is equal to one in years in which a firm pays a common dividend. Otherwise, the dummy equals to zero. *Research and Development* is measured as research and development expenses scaled by total assets, and R&D is set equal to zero when R&D is missing. *Acquisitions* is calculated as acquisition expenses during the current year over the book value of assets. *Cash Flow* is measured as earnings after interest, dividends, and taxes but before depreciation divided by book assets. All variables are winsorized at the 1% and 99% levels. t-statistics are presented in parenthesis below the coefficients and are clustered by firm and year.***, **, and * denote significance at the 1%, 5%, and 10% levels, one-tailed, respectively.

## Table 6
## Robustness Tests: Changes Specification

*Changes in 5-year CASHETR*

*Dependent Variable = Change (Cash-to-Total Assets)*

| | *Full Sample* | *Multinationals* | *Domestic* |
|---|---|---|---|
| **Change Tax Risk (5-year CASHETR)** | **-0.008**** | **-0.008** | **-0.010**** |
| | (-1.88) | (-1.15) | (-1.66) |
| Lagged Cash-to-Assets Ratio | -0.131*** | -0.154*** | -0.118*** |
| | (-26.19) | (-19.49) | (-18.45) |
| Lagged Change Cash-to-Assets | -0.043*** | -0.021 | -0.055*** |
| | (-426) | (-1.47) | (-4.05) |
| Tax Repatriation Costs | 0.517*** | 0.622*** | |
| | (4.90) | (5.35) | |
| Change Leverage | -0.067*** | -0.024** | -0.082*** |
| | (-9.40) | (-1.68) | (-8.81) |
| Change Market-to-Book | 0.000*** | 0.007*** | 0.000*** |
| | (7.68) | (5.28) | (7.48) |
| Change Size | 0.026*** | 0.021*** | 0.030*** |
| | (6.47) | (3.37) | (5.75) |
| Change Dividend Dummy | 0.002 | 0.008* | -0.002 |
| | (0.82) | (2.05) | (-0.49) |
| Change Capex | -0.254*** | -0.313*** | -0.236*** |
| | (-17.62) | (-9.94) | (-14.28) |
| Change Acquisitions | -0.150*** | -0.160*** | -0.145*** |
| | (-19.87) | (-14.56) | (-13.95) |
| Change R&D | -0.509*** | -0.488*** | -0.506*** |
| | (-8.59) | (-6.44) | (-5.65) |
| Cash Flow Volatility | 0.168*** | 0.183*** | 0.162*** |
| | (15.08) | (10.75) | (10.78) |
| Change Cash Flow | 0.008 | -0.020 | 0.017 |
| | (0.57) | (-0.91) | (0.95) |
| Intercept | 0.001 | 0.003 | -0.002 |
| | (0.09) | (0.45) | (-0.18) |
| *Firms* | 3,346 | 1,541 | 2,231 |
| *N* | 18,758 | 8,307 | 10,451 |
| *Fixed Effects* | Industry and Year | Industry and Year | Industry and Year |
| *Clustering* | By firm and year | By firm and year | By firm and year |
| *R-Squared* | 0.194 | 0.224 | 0.183 |

## Table 6 (Continued)

**Table 6. Changes in cash holdings and tax risk.** The table presents regression results of a model predicting cash holdings after the adoption of FIN 48. Firms are classified as domestic in those firm-years in which they report foreign income as either zero or missing. All other firm years are classified as the firm having foreign operations (i.e. as the firm being a multinational). Following previous research, we exclude financial firms (SIC code 6000-6999) and utilities (SIC code 4900-4999). We exclude firms with non-positive pretax income over 5 years, missing cash holdings, and missing values for all control variables. The dependent variable is the first difference in the ratio of cash to total assets. *Change 5-year CASHETR* is the first difference in the long-run cash effective tax rate, computed as the sum of cash taxes paid over the previous five years divided by the sum of a firm's pre-tax income. *Tax Cost of Repatriating Earnings* is computed by first subtracting foreign taxes paid from the product of a firm's foreign pre-tax income and the U.S. statutory tax rates. *Change in Log of Assets* is the first difference in the natural logarithm of total firm assets. *Dividend Dummy* is a dummy equal to one if the firm pays cash dividends and zero otherwise, and the change in this variable is its first difference. Change in *Market-to-book ratio* is the first difference in the ratio of the market value of common equity to the book value of common equity, measured as of year-end. We measure *Volatility of cash flows* by calculating the standard deviation of annual changes of EBITDA over a four-year lagged period, scaled by average non-cash assets in the four-year lagged period. *Change in R&D* Expenditures is the first difference in the ratio of research and development expenditures to total assets. *Change in Leverage* is the first difference in the ratio of long- and short-term debt to total assets. *Change in Acquisitions* is the first difference in the ratio of acquisition expenses over the book value of assets. *Change* C*ash Flow* is measured as the change in cash flows computed as earnings after interest, dividends, and taxes but before depreciation divided by book assets. Each specification includes industry and year fixed effects. Standard errors that correct for clustering of errors by firm and year are presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, one-tailed, respectively.