Why do firms hold so much cash? A Tax-based explanation*

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Abstract

Cash held by firms is a significant part of the balance sheet, which has been justified in the existing empirical literature by transaction costs and precautionary motives. This paper raises the possibility that U.S. multinational firms hold cash in their foreign subsidiaries because of the tax costs associated with repatriating foreign income. While we find empirical support for both transaction costs and precautionary motives, we also find evidence consistent with taxes on repatriation driving firms to hold more cash. Cash holdings are increasing in foreign income, with a much stronger effect for firms with high implicit tax burdens for repatriated earnings.

Keywords: Cash, Taxes, Repatriation

1 Introduction

Cash is a significant asset for many corporations. At the end of fiscal 2003, cash represented almost 10% of the aggregate balance sheet of all Compustat firms. While this is a large percentage, for many firms, the absolute dollars held are also economically very significant. For example, in 2003 Microsoft held $49 billion in cash, Ford, $38 billion, General Motors, $32 billion, General Electric, $17 billion, and Intel, $16 billion.

Both the proportion of firms' assets held in cash and the cross-sectional variation in cash holdings have risen over the last several years. In 1984, the average firm had about nine percent of its assets in cash and the standard deviation in this fraction across firms was about 11%. By 2003, both the average and standard deviation had nearly doubled; the mean holdings grew to over 19%, with a standard deviation of almost 19%. These changes have not gone without public attention. From Kirk Kerkorian's proxy struggle with Chrysler in 1995,[1] to recent arguments over Microsoft's cash balance,[2] many investors are increasing their focus on this part of the balance sheet and questioning why such large balances are common or justified.

The earliest explanations offered by academic research were based on trade-offs motivated by transactions costs [for example, Miller and Orr (1966), Meltzer (1993), and Mulligan (1997)]. These theories suggest that firms hold cash to avoid the cost of being short liquid assets (and having to cut investment, dividends, or raise external funds). Opler, Pinkowitz, Stulz, and Williamson (1999) suggest that this precautionary incentive to hold cash is increased in environments with asymmetric information or agency costs that make it difficult for firms to raise external capital. In contrast, Dittmar, Mahrt-Smith, and Servaes (2003) suggest that cash holdings can be indicative of agency problems. They argue that managers left to their own devices will retain cash rather than distribute it, and as a result, firms in countries with poor shareholder protection hold more cash.[3]

[1] For example, see Kansas and Smith, (1995).

[2] For example, see Bary (2003).

[3] Previous studies have examined the impact of cash on a variety of corporate actions, including mergers and acquisitions [Harford (1999)], payout policy [Jensen (1986), Blanchard, Lopez-de-Silanes and Shleifer (1994), Almeida, Campello and Weisbach (2004)] and corporate performance [Mikkelson and Partch (2003)].

This paper examines the ability of tax incentives to explain cross-sectional variation in firms' cash holdings.[4] In particular, we consider the tax on repatriation of earnings of multinational corporations (MNCs). Under the current U.S. tax code, firms that want to distribute earnings from foreign subsidiaries to their U.S. parents (in order, for example, to pay a dividend, retire some of the parent's debt, or repurchase stock) must declare a dividend from the subsidiary to the parent. When this is done, the firm must pay taxes equal to the difference between what the U.S. taxes would have been on those earnings and the foreign taxes already paid. Our hypothesis is that to avoid these taxes firms sometimes hold these foreign earnings in cash rather than repatriate the earnings. Quite simply, in order to avoid taxes upon repatriation, firms with cash earned in foreign subsidiaries that is left over after they have taken advantage of their profitable investment opportunities retain the cash rather than paying it out to shareholders or paying down debt.

While this tax-based explanation was not considered in earlier academic studies, it has certainly captured the attention of policymakers. A recently enacted tax bill will temporarily reduce the tax rate on repatriated dividends to 5.25%. Originally dubbed the Homeland Investment Act, then the American Jobs Creation Act of 2004,[5] the public debate over this act centered around its effect on investment and job creation in the U.S. Proponents of the act argued that firms would bring more money back to the U.S., and this inflow of funds would spur investment and create jobs.[6]

There are, however, reasons to question whether the tax on repatriated earnings has any affect

[4]While the focus of our analysis is the impact of taxes on cash holdings, our study is also related to previous work that has separately examined the impact of both taxes and cash on corporate decision making. Taxes have been argued to have effects on many parts of the firm, including capital structure [Desai, Foley, and Hines (2004), Froot and Hines (1995), Graham (1996, 1999), Newberry (1998), Newberry and Dhaliwal (2001)], dividend payouts [Graham, Michaely and Roberts (2003)], hedging policy [Graham and Rogers (2001)], merger behavior [Hayn (1989)] and earnings management [Krull (2004)]. See Graham (2003) for a review of the role of corporate and personal taxes on the, financing, dividend and hedging decisions of the firm.

[5]The act allows U.S. MNCs to deduct 85% of cash dividends received from foreign subsidiaries, where the dividends are received in either the year preceeding or subsequent to the enactment of the American Jobs Creation Act. To be eligible, the dividend must (i) exceed the average dividend received over three out of the last five tax years, (ii) be reinvested in the U.S. for defined purposes, including, job creation, infrastructure development, research and development, and capital investment, and (iii) be less than $500 million, unless an amount greater than this is reported as permanently reinvested earnings in the prior year's financial statements. While weakening the firm's incentive to repatriate earnings under this act, these restrictions have no inference with respect to firms' cash balances in the years prior to the enactment of the American Jobs Creation Act.

[6]The legislated reduction in the tax rate on repatriated dividends siginificantly reduces the incentive for U.S. MNCs to hold cash. Our results comment on the economic significance of this tax incentive on firm's cash holdings, and hence the impact of the rate reduction. This tax incentive remains relevant to U.S. firms beyond the one-year horizon of the current legisation and more generally, to multinational corporations in any country where corporate tax is paid on repatriated earnings and a credit is allowed for foreign tax paid on these earnings.

on cash balances. First, even if the tax law leads firms to leave more assets in their overseas subsidiaries, they may increase investment rather than cash holdings.[7] Second, if firms target an overall cash balance, they will hold less cash in the U.S. or at the parent level, which will offset the additional cash they view as "trapped" overseas. Third, firms have various tax avoidance strategies at their disposal, such as having foreign subsidiaries purchase assets from a U.S. unit, thereby returning cash, *but not earnings*, to the U.S. These strategies also include having a MNC's foreign subsidiaries create and invest in U.S. special purpose vehicles. This can often be done in a way that enables the cash to be returned to the U.S. in a way that is not viewed by the IRS as repatriation (e.g., because the vehicle has no basis or book value for tax purposes). If these strategies are effective and not too costly, one would expect to find no relation between firms' cash holdings and their implicit tax burdens due to repatriation.

To address this issue, we study a large sample of firms over the 1984 to 2003 period and try to explain their cash balances (scaled by assets or sales) as a function of explanatory variables designed to capture both the transactions costs and precautionary explanations, as well as our tax-based explanation. While our results are consistent with the earlier findings, we also find that taxes have a significant effect on cash holdings. Specifically, cash holdings are significantly higher for those firms that are expected to pay higher taxes when they repatriate foreign earnings. These effects are economically significant. Using the estimated coefficients from our regressions, we predict a roughly dollar-for-dollar relation between increases in cash and increases in expected taxes due to dividend repatriation.

While the exact effects of the recently enacted tax act are certainly open to debate, a JP Morgan study [Swope, Kasman, and Mellman (2003, 2004)] argues that the act will lead to $425 billion in capital inflows. This figure is similar to our most aggressive estimate of the total amount of unexplained or abnormal cash held by firms with foreign income in 2003. A small sample of our firms have publicly announced their intent to repatriate earnings under the act; these announcing

[7] U.S. tax law contains provisions designed to encourage re-investment of earnings rather than holding cash. These provisions prevent U.S. MNCs from delaying the repatriation of earnings from "passive" investments, such as, interest and dividends received from investments in securities. This passive income is "deemed distributed," and therefore immediately taxable by the United States, even if not repatriated as dividend payments. Earnings reinvested in "active" business operations are not subject to these provisions.

firms seem to fit our explanation well. While this sample is too small to provide conclusive evidence, we find that the announcing firms have relatively large amounts of unexplained cash holdings, and many of the announcing firms are in the tail of our estimated excess cash distribution.

The remainder of the study is organized as follows. The next section discusses several explanations for why firms hold cash, including the tax-based motive we focus on here, as well as some of the related literatures on taxes and cash holdings. Section 2 describes our data, and Section 3 presents our results. Section 4 concludes.

2 Cash Holdings and Taxes

The earnings of foreign subsidiaries of U.S. MNCs are not subject to U.S. corporate taxes until they are repatriated to their U.S. parent through dividend payments.[8] The U.S. government taxes repatriations from a foreign subsidiary to the U.S. parent at a rate equal to the firm's U.S. corporate tax rate on domestic income, but allows a tax credit for foreign corporate taxes paid to prevent double taxation on income earned abroad. The application of this foreign tax credit is limited to the U.S. corporate tax liability on the foreign income.

To the extent that foreign tax payments made by a U.S. firm's subsidiary exceed the firm's U.S. corporate tax liability on that income, the firm has "excess" foreign tax credits, which cannot be used to offset U.S. taxes on U.S. sourced income. However, they can be cross-credited, meaning that excess credits accruing from one source of foreign income can be used to offset the U.S. corporate tax liability on foreign income from another source. This cross-crediting can take three forms: First, U.S. MNCs can cross-credit by simultaneously receiving dividends from subsidiaries in countries with differing tax rates, for example, high- and low-tax rate countries. When this occurs, the MNC's U.S. corporate tax liability is determined by the sum of worldwide foreign income, and its foreign tax credit by the sum of worldwide foreign corporate tax payments. Second, cross-crediting

[8]There is a distinction in the U.S. tax code between subsidiaries and branches. Branch income is taxed as if it is repatriated when earned, thus providing no incentive to hold cash in order to delay repatriation taxes. But, branches are a small fraction of U.S. multinationals, and to the extent that they are in our data, their presence works against finding a relation between cash holdings and repatriation taxes.

can occur between income types, for example, dividends and interest. The ability of MNCs to adjust the amount of foreign income received in non-dividend forms, such as interest on intra-firm loans and royalties, contributes to their control over whether or not they have net excess foreign tax credits at the firm level. Third, cross-crediting can occur over time using foreign tax credit carryforwards. Excess foreign tax credits can be carried forward five years and back two years, but they can only be used to the extent that foreign corporate taxes paid in those years are less than the respective U.S. corporate tax liabilities.

To illustrate this, consider the case of a U.S. MNC with two subsidiaries, subsidiary 1 in country A and subsidiary 2 in country B. The pretax income of the subsidiary 1 is x_1 and is subject to corporate tax in country A at the rate τ_c^A. If the dividend payout ratio is d, then the repatriated dividend is $dx_1\left(1-\tau_c^A\right)$.[9] Similarly, the repatriated dividend from subsidiary 2 is $dx_2\left(1-\tau_c^B\right)$. In addition, assume that the U.S. MNC receives interest payments int_1 from subsidiary 1. Allowing for the application of foreign tax credits, with worldwide income and cross crediting across income types the after-tax position of the U.S. MNC is:

$$\left[dx_1\left(1-\tau_c^A\right)+dx_2\left(1-\tau_c^B\right)+int_1\right]-\max\left[0,\left(dx_1+dx_2+int_1\right)\tau_c^{US}-\left(dx_1\tau_c^A+dx_2\tau_c^B\right)\right]. \quad (1)$$

where τ_c^{US} is the U.S. corporate tax rate. The first term represents the repatriated foreign income from all sources, and the second term is the additional U.S. corporate tax incurred on repatriation, payable if, and only if, the U.S. corporate tax rate exceeds the foreign corporate tax rate. This second term is determined by comparing U.S. corporate tax payable on the sum of repatriated worldwide foreign income from all sources, $\left(dx_1+dx_2+int_1\right)\tau_c^{US}$ to the worldwide foreign corporate tax paid on that income, $dx_1\tau_c^A+dx_2\tau_c^B$.

Ignoring cross-crediting over time, for any U.S. MNC in period t with i subsidiaries operating in n countries, we can express the tax on repatriation, $RepatTax_t$, as follows:

[9] This ignores any withholding taxes imposed in the foreign country.

$$RepatTax_t = \max\left(0, \sum_i \left(dx_{it} + nond_{it}\right)\tau_c^{US} - \sum_n \sum_i dx_{it}\tau_c^n\right), \tag{2}$$

where $nond_{it}$ represents foreign income from sources other than dividends, received from subsidiary i in period t. The equation above captures the ability to cross-credit across types of income and countries. Because firms cannot use credits for foreign taxes paid beyond their declared dividends to the parent, repatriation taxes are weakly positive. Thus, without the ability to use excess credits over time, firms would have no incentive to repatriate more tax credits (in the form of foreign taxes paid) than dividends. With cross-crediting over time, the repatriation decision becomes a dynamic problem that must account for available dividends and foreign tax credits from its various subsidiaries, its other sources of foreign income, as well as remaining carryforwards from prior years and expected future tax liabilities.

The above analysis indicates that MNCs with foreign corporate tax rates that exceed the U.S. corporate tax rate generally owe no U.S. taxes on dividend payments from foreign subsidiaries, and face no tax disincentive to repatriate earnings to the U.S. parent. However, MNCs with average foreign corporate tax rates that are below the U.S. corporate tax rate owe U.S. taxes on repatriations at a rate approximately equal to the difference between the firm's U.S. and average foreign corporate tax rates, and face a tax disincentive to repatriate earnings to the U.S. parent. The disincentive will increase as the difference between the U.S. and average foreign corporate tax rate increases.

Existing empirical evidence suggests that tax incentives do affect foreign subsidiaries' dividends to their U.S. parent.[10] Altshuler and Newlon (1993) find that in 1986, approximately 29.4% of all foreign subsidiaries paid a dividend to their U.S. parent. But, this rate was only 19% for subsidiaries from which a dividend payment would have resulted in the payment of U.S. corporate tax (i.e., the foreign corporate tax rate was below the U.S. corporate tax rate), versus 31.3% for subsidiaries whose dividend payment would not have resulted in the payment of U.S. corporate tax (i.e., the

[10]See Hines and Hubbard (1990), Altshuler and Newlon (1993), and Desai, Foley and Hines (2001).

foreign corporate tax rate exceeded the U.S. corporate tax rate). In addition, Desai, Foley, and Hines (2001) find that in a sample of U.S. MNCs, a one percent decrease in repatriation tax rates is associated with a one percent increase in dividend payments by foreign subsidiaries.

3 Data

We construct our sample using all firm-years on Compustat with at least $100 million in assets from 1984 through 2003 (in 1984 dollars). In order to be sure that the U.S. tax treatment on foreign income applies, we restrict our sample to firms that are incorporated in the U.S. Figure 1 shows the mean, median, and standard deviation of the ratio of cash plus short-term investments to total over our sample period. As discussed above, cash as a fraction of the firm's assets has risen over the last several years, from a mean (median) of 9.2% (5.2%) to 14.6% (6.5%). The cross-sectional variation in cash holdings has also increased, from a standard deviation of 10.7% to 18.8%.

[Figure 1 about here]

Following Opler et al. (1999), our primary dependent variable is the natural logarithm of the ratio of cash to net assets (defined as total assets minus cash), $Ln(Cash/NetAssets)$. Using net assets in the denominator facilitates interpretation of the results, since a shock to cash only affects the numerator. We use the logarithm in order to minimize the effects of outliers.[11]

Three facts are worth noting about this measure. First, we observe cash at the overall corporate level (i.e., we cannot observe cash at the foreign subsidiary level). Second, our focus is on cash rather than "permanently reinvested earnings" as disclosed in financial statement footnotes.[12] Third, while we scale cash by total assets, our results are robust to scaling instead by net sales.

[11] We obtain similar results using a Winsorized ratio of cash to net assets as an alternative control for outliers, or the natural log of one plus the ratio of cash to net assets, which would mitigate the effect of taking the log of ratios that are very close to zero.

[12] Krull (2004) finds evidence that firms use this latter measure to manage earnings, as well as evidence of the effects of foreign investment and tax incentives. Swope, Kasman, and Mellman (2003, 2004) also use this reinvested earnings number in order to arrive at their estimate of the expected effects of the Homeland Investment Act.

We construct two variables to measure the magnitude of the repatriation tax effect. Our first proxy for the repatriation effect is the ratio of pre-tax foreign income to total assets, $ForeignIncome/TA$. Firms with more foreign income, all else equal, are likely to hold more cash to avoid the repatriation of those earnings. However, there are other reasons why firms with more foreign income may hold more cash. First, a delay between when the cash from earnings is received and when it is used generates a mechanical positive relation between cash holdings and income. However, since this effect should hold for both foreign and domestic income, we can control for this possibility by including the ratio of domestic pre-tax income to total assets ($DomesticIncome/TA$) in our regression tests. If the effect of foreign income on cash is significantly greater than that of domestic income, then this would be evidence that the estimated relation is not just driven by this mechanical effect.[13] A second reason why foreign income may relate to cash holdings, even without taxes, is that firms with more foreign businesses may require more precautionary cash holdings. This will be the case if investment opportunities abroad are greater or more volatile than domestic opportunities, or alternatively, if raising capital for foreign operations is more difficult. To disentangle the empirical effects of the precautionary and tax motives for cash holdings, we construct our second proxy ($TaxBurden$), which is a direct measure of the taxes firms face if they choose to repatriate all of a given year's foreign income. We calculate this variable as,

$$TaxBurden = \frac{\max\left(USTaxRate \times ForeignPreTaxEarnings - ForeignTaxesPaid, 0\right)}{TotalAssets}. \qquad (3)$$

The first product inside the parentheses is an estimate of the taxes that the firm would incur if it repatriated all of its foreign earnings for the year, from which we subtract the foreign taxes paid as a proxy for the tax credits the firm could take against these repatriated earnings. Using the maximum of this difference and zero accounts for observations where the firm pays more taxes abroad than it would domestically, implying it would owe no additional tax upon repatriation. Each input for this variable is available from Compustat, except for an estimate of the firm's U.S. tax rate, for which we use the marginal tax rate after interest expense from John Graham [for a

[13] We also obtain similar results if we use the lagged values of income rather than the contemporaneous values.

discussion of his estimation, see Graham (1996)]. To test for the robustness of our results to this choice, we also conduct tests using several alternative measures of the firm's marginal tax rate.[14]

Our tests also include using several variables to control for the transaction costs and precautionary motives for holding cash. In response to the existence of transaction costs, firms set their optimal level of cash holdings by trading off the marginal costs and marginal benefits of holding cash. In this context, cash holdings reduce the likelihood of financial distress, acting as a buffer against unexpected losses. In addition, recognizing that external financial constraints would force the firm to forgo profitable investment opportunities, cash holdings allow the firm to accept positive net present value projects even when such constraints are binding.

Based on these arguments, the precautionary motive of holding cash predicts that firms that are able to easily access the capital markets will hold less cash. We expect that large firms will have greater access to capital markets, and therefore face lower costs of temporary shortages in liquid funds. In addition, levered firms have a demonstrated ability to raise debt capital, and should therefore hold less cash. As proxies for the firm's capacity to raise capital, we use the natural logarithm of total assets, $Ln(TotalAssets)$, as a proxy for firm size, and we construct the ratio of total debt to the sum of total debt and the market value of equity ($MktLeverage$). Note that these variables also acts as controls for other size- or leverage-related effects. We obtain similar results if instead of $MktLeverage$, we use (1) the ratio of short-term debt to short-term debt plus long-term debt, or (2) an indicator variable that takes the value of one if the firm has an investment grade rating from Standard and Poor's for its long-term debt, and zero otherwise.

We also expect that the benefits of holding cash are greater for firms that do not pay dividends. Firms that pay dividends have an additional source of flexibility (all else equal); cutting dividends provides an option for raising cash. To capture this, we construct an indicator variable that equals one if the firm pays a dividend in a given year and zero otherwise ($DividendPayment$).

[14]While we would like to use information about the degree to which firms operate in specific tax domiciles, we are unable to obtain these data. For example, firms that report geographic segments in the Compustat files typically present data for wide regions rather than countries, and tax paid is not separately disclosed by segment. As a result, we rely on foreign taxes paid at the firm level. But, as we discuss below, Fritz Foley finds results consistent with ours using data at the corporate affiliate or branch level.

To capture precautionary motives, we use measures of both firms' growth opportunities and the volatility of their sources of cash. Growth opportunities are likely to have an impact due to the fact that they are intangible assets. This intangibility implies greater information asymmetry, increasing the cost of raising external financing and making it more likely that external financial constraints are binding. Similarly, firms with more volatile cash flows are also more likely to face external financial constraints. These arguments predict that cash holdings should be increasing in growth opportunities and cash-flow volatility. As a first proxy for the former, we use the ratio of the book value of equity to the market value of equity (shares outstanding times price per share), labeled $BV(Equity)/MV(Equity)$.[15] Our second proxy for growth opportunities is the ratio of research and development expenses to total assets, $R\&D/TA$. Following Himmelberg, Hubbard, and Palia (1999), we set $R\&D/TotalAssets$ to zero if the numerator is missing in Compustat, and include an indicator variable for these missing observations ($R\&DMissing$) in order to control for any effects of this choice. To measure the volatility of cash inflows, we follow Opler et al. (1999) and calculate the standard deviation over the sample period of the firm's earnings before interest, taxes, and depreciation to total assets ($CashFlowStdDev$).[16] Consistent with these predictions, Opler et al. find that firms hold more cash when they are smaller, have higher R&D expenditures and greater growth opportunities.

In addition to these variables, we also expect a relation between cash holdings and investment expenditures. As firms accept profitable investment opportunities, cash holdings will be depleted, giving rise to a negative contemporaneous relation between investment and cash holdings. To measure investment, we include the ratio of capital expenditures to total assets, $CapEx/TA$. As an alternative to our conjecture that cash holdings decline with increased capital expenditure, it can be argued that to the extent increased investment expenditures are associated with greater growth opportunities and greater information asymmetry, cash holdings should be increasing in capital expenditures. We leave the sign on this control as an empirical question.

[15] Due to some outliers in the distribution of $BV(Equity)/MV(Equity)$, we Winsorize this variable at the one-percent level in each tail of the distribution. Even though most of our other independent variables are also calculated as ratios, upon inspection they are not subject to outlier problems. However, we obtain similar results if we Winsorize all of our independent variables.

[16] Opler et al. (1999) estimate both industry and firm-level cash flow standard deviation using the previous twenty years. Limitations on the duration of our sample prevent us from adopting the same approach, rather, we estimate a contemporaneous standard deviation over the full sample period. To obtain cross-sectional variation, we construct this at the firm level.

4 Results

Table 1, which presents the summary statistics, shows that for the pooled sample, cash represents 11.8% of assets on average (median of 4.9%). Cash as a portion of net assets has a much higher mean (28.6%), but a similar median (5.2%), suggestive of outliers in the distribution. Inspection of the minimum and maximum of this ratio confirm this problem, and support our use of the log of the ratio rather than its raw value. For example, the difference between the minimum and maximum ratio of cash to net assets is more than 180 times its standard deviation, while the difference in these extremes for the logged ratio is about 11 times its standard deviation.

Foreign income is on average 2.1% of assets, with a slightly lower median of 1.4%. For the average firm-year, R&D and capital expenditures represent 2.3% and 7.2% of assets, respectively, while debt represents an average of 28.6% of the market value of capital. Univariate tests (not tabulated) of differences in cash for firms with and without foreign income are consistent with our hypothesis. Average cash holdings for firms with foreign income are about one percent of assets greater compared to firms without foreign income, and we can reject the null of no difference across these groups at the 0.01 significance level using either t tests or non-parametric tests. Table 2 presents a correlation matrix for our data, and some additional univariate evidence of our hypothesis – cash is positively correlated with the estimated tax burden due to repatriation, and to a lesser extent, with foreign income. It also shows that none of our independent variables exhibit alarming degrees of (pairwise) multicollinearity.

[Table 1 about here]

[Table 2 about here]

We begin our multivariate empirical analysis by verifying the results of Opler et al. (1999) for our sample. For these regressions, and all of our subsequent regressions, we control for industry and time effects by including indicator variables for each industry (using two-digit SIC codes) and each year, and therefore, do not present intercept coefficients (coefficients on the indicators are not

reported). We calculate standard errors that are robust to clustering within firms over time. Also, for this and subsequent tables, we present results for both the full sample, and for our largest firms, where a large firm in year t is defined as having at least \$5 billion in sales for that year (in 1984 dollars).[17]

Table 3 presents the results of regressions of $Ln(Cash/NetAssets)$ on the non-tax variables described in the last section. Column one provides evidence from the full sample and column two provides evidence from a sample of large firms only. The results are largely consistent with those found previously, but slightly weaker for the large firms, which is consistent with precautionary motives playing a less significant role for large firms. An exception is our measure of investment, $CapEx/TA$, which is negatively related to cash (Opler et al. (1999) found a positive relation). This result is consistent with the idea that firms tend to deplete their cash reserves when they make large capital expenditures.

The remainder of the coefficients indicate that firms with greater growth opportunities (reflected in higher R&D or lower $BV(Equity)/MV(Equity)$) hold more assets in cash, consistent with those firms having a greater cost of a liquidity shortage. The coefficient on the leverage variable is significantly negative in both regressions, consistent with highly levered firms holding less cash due to their ability to tap the debt market if necessary. Firms with greater volatility of cash flows also hold more of their assets in cash. Consistent with transactions costs explanations, size is significantly negatively related to cash (for the full sample). Consistent with dividend payments providing an additional source of flexibility, dividend-paying firms hold significantly less cash.

[Table 3 about here]

As we turn our attention to the effect of repatriation taxes on cash, we restrict our further tests to the sample of firms with data available on foreign earnings and foreign taxes paid. Regressions using these firms are presented in Table 4. The first two columns detail the results of the same

[17]Other than the alternative definition of the volatility of cash flows, our regressions differ from those of Opler et al. (1999) in one other respect. Opler et al. include the ratio of cash flow to net assets, while we instead include measures of domestic and foreign income in later regressions.

regressions shown in Table 3, but impose the requirement that each observation has non-missing values for $ForeignIncome/TA$ and $TaxBurden$. In columns three and four we augment these regressions with these two variables that measure the degree to which firms face incentives to hold cash due to foreign earnings, plus our control for domestic income. As in Table 3, odd-numbered columns provide evidence from the full sample and even-numbered columns provide evidence from a sample of large firms only.

[Table 4 about here]

The results for the non-tax variables in all four columns are similar to those in Table 3. The overall pattern is very similar, with the notable exception of $Ln(TotalAssets)$, which has a significantly positive coefficient for the large-firm sample compared to the insignificant coefficient for large firms in Table 3. Explanatory power is higher for the large firm sample, with a slight improvement in the R^2 for both regressions that use only the non-tax variables (0.34 to 0.35 and 0.44 to 0.47, respectively).

As shown in columns three and four, the results indicate that firms that earn more foreign income hold more cash. The coefficients on $ForeignIncome/TA$ in these two columns are positive and statistically significant at the ten- and five-percent levels, respectively. Therefore, all else equal, the more a firm earns overseas, the more cash they hold as a fraction of assets. Interestingly, the effect of foreign income is *not* just an income effect – that is, it is not the case that the increase in cash is driven by just an increase in profits. This can be seen by the economically small and statistically insignificant coefficients on $DomesticIncome/TA$, which are dwarfed by their foreign-income counterparts (differences that are statistically significant at the ten-percent level for both regressions). Taken together, these results are consistent with foreign income leading to an increase in cash holdings, perhaps due to precautionary motives.

The coefficients on $TaxBurden$, which provide the most direct test of the tax effect, are consistent with the hypothesis that repatriation taxes affect cash holdings. These coefficients are both significantly positive (at the one- and five-percent levels, respectively). Furthermore, the coefficients

on $TaxBurden$ are much more economically significant (four to seventeen times larger) than those on $ForeignIncome/TA$. To understand this, consider a positive shock to foreign income of one percent of assets for two firms that have completely sheltered their foreign income from tax, and one faces a 0% domestic tax rate on repatriated earnings and the other faces a 35% domestic tax rate (holding all else equal). For both firms, this shock would increase $ForeignIncome/TA$ by 0.01, while for the latter firm, $TaxBurden$ would also increase by 0.0035. From their respective coefficients, the increase in $Ln(Cash/NetAssets)$ would be 0.01 for the first firm ($= 0.01 \times 1.024$), but for the latter firm, the effect would about seven times as large, at 0.072 ($= 0.01 + 0.0035 \times 17.779$).

Thus, while foreign income per se does appear to be positively associated with cash holdings, the most significant effects are found in firms that would owe significant taxes if they repatriated their foreign earnings. For these firms, the greater the implied taxes upon repatriation, the greater their cash holdings. This is inconsistent with the null hypotheses of no tax effect, which would be the case if firms fully adjust domestic cash to compensate for "trapped cash" overseas, or if the various tax avoidance strategies result in no net effect on firm-level cash.

4.1 Economic significance

To more fully address the economic significance of these results we estimate the significance of repatriation on cash by calculating the expected change in cash due to a $1 million increase in a firm's $TaxBurden$. (Note that since our specification is non-linear in cash one cannot merely use the coefficients to obtain an implied change in cash.) We use the coefficient on $TaxBurden$ and each firm's total assets to calculate this expected change. For the full sample, the median increase in cash for a $1 million increase in a firm's $TaxBurden$ is $1.19 million, while for large firms, the median effect is $0.71 million. Thus, in the middle of the distribution, there is roughly a dollar-for-dollar correspondence between increases in implied repatriation taxes and increases in cash held at the corporate level. This is qualitatively similar to the predicted one-for-one (percentage) change in dividends due to (percentage) changes in tax rates documented by Desai et al. (2001).

A second interesting issue in terms of economic significance is the expected effect of the American

Jobs Creation Act's one-year reduction in repatriation taxes. To estimate an upper bound on the effect of foreign income on taxes we use the residuals from the models that ignore foreign income and taxes in column one of Table 4 as an estimate of abnormal or unexplained cash. We convert these residuals into dollar estimates, and then sum across the 587 firms with positive foreign income in fiscal 2003. This total is $361 billion; thus, if one were willing to assume that all of this unexplained cash for firms with foreign income is due to repatriation taxes, then one arrives at estimated effects that are about 85% of the size reported in Swope, Kasman, and Mellman (2003, 2004). Note, however, that this presumes that only assets currently held in cash will be repatriated; if firms liquidate some other, non-cash assets in order to take advantage of this repatriation window, the effects of the Act could be much larger.[18]

As another way to relate our results to the effects of this Act we conducted a search for firms that have publicly announced their intent to repatriate cash. We found 31 announcing firms, of which we have full data for 16. For these 16 firms, we compute their cash holdings that are unexplained by the precautionary and transactions costs motives, i.e., we convert the residuals from column one of Table 4 for these firms in 2003 into dollars. Consistent with our hypothesis, we find that the announcing firms have relatively large amounts of unexplained cash holdings. The average unexplained cash holdings for the announcing firms is $726 million. In addition, four of the sixteen announcing firms are in at least the 99^{th} percentile of cash holdings, with another four firms between the 75^{th} and 99^{th} percentiles. The fact that many of the announcing firms are in the tail of our estimated distribution is consistent with their excess cash being due to repatriation concerns.

4.2 Robustness

In this section, we address some concerns that arise from reviewing the results presented in Tables 3 and 4. The first set of these tests of robustness are not tabulated. First, our results may be influenced by scaling both dependent and independent variables by assets. Specifically, increases in the reporting of total assets over the sample period can result in decreases in both dependent

[18]Swope et al. (2003, 2004) based their estimated effects on the amounts firms declared as permanently reinvested abroad (rather than cash), combined with a survey.

and independent variables, inducing a spurious relation between the variables. To ensure that our results are not driven by the choice of deflator, we scale cash by sales and get very similar results. Second, in order to further ensure that we are not picking up a mechanical, contemporaneous income-cash effect, we also estimate our regressions using lagged foreign and domestic income and obtain similar results. Further, we find that our results are robust with respect to specifications that exclude financial firms.

Another set of concerns centers around the estimation of our $TaxBurden$ variable. In Table 5, we present the results of two alternative specifications, where we vary the measure of the size of the repatriation effect.

[Table 5 about here]

The first concern we address is that the significance of our $TaxBurden$ measure is driven by the low taxes paid by foreign subsidiaries rather than by the tax burden that arises if foreign earnings are repatriated. For example, perhaps low tax rates in a foreign country (which would lead to a higher $TaxBurden$) lead to increased holdings of cash due to higher after-tax interest income that can be earned in these countries. Or, more generally, lower foreign taxes implies higher after-tax income, and more cash available to retain. Existing empirical evidence [Grubert and Mutti (1991), Harris, Morck, Slemrod and Yeung (1993) and Hines and Rice (1994)] finds that U.S. MNCs report higher income in countries with low corporate tax rates. To test for this alternative explanation, in column one of Table 5, we break $TaxBurden$ into two components: $ImpliedUSTaxPaid$ and $ForeignTaxPaid$. $ImpliedUSTaxPaid$ equals the first portion of $TaxBurden$ in equation (5), the product of the U.S. tax rate and foreign pre-tax earnings (scaled by total assets). $ForeignTaxPaid$ is the second part of $TaxBurden$, the ratio of taxes paid on foreign income to total assets. In order to capture the observations for which these variables are relevant, we multiply both of these by an indicator for a positive $TaxBurden$.

If these alternative explanations of our results were true, we would expect that the relation between $TaxBurden$ and cash holdings would be driven by a negative relation between cash and

$ForeignTaxPaid$ rather than a positive relation between cash and $ImpliedUSTaxPaid$. But, as the results in column one show, the coefficient on $ImpliedUSTaxPaid$ is significantly positive while the coefficient on $ForeignTaxPaid$ is significantly negative. This is inconsistent with these alternative explanations that would attribute the relation between $TaxBurden$ and cash holdings solely to income earned in low-tax countries (i.e., those observations where, holding foreign income constant, a firm has lower foreign taxes paid). It is instead consistent with the effects of $TaxBurden$ on cash holdings being due to interactions between foreign income, the firm's U.S. tax rate, and the presence of a positive $TaxBurden$.

The second column of Table 5 explores an alternative measure of firms' U.S. marginal tax rates. In this regression, we use $AlternativeTaxBurden$, which is calculated using equation (3) with a different proxy for the U.S. tax rate. Here, we use the highest statutory corporate tax rate for each year in place of the Graham rate, however for firms that have positive net operating loss carryforwards, we assume a marginal tax rate of zero. Thus, in lieu of the Graham rate, firms receive one of two possible rates: the highest statutory rate for that year (for firms without loss carryforwards), or zero (for loss carryforward firms). As the results in column two show, we obtain very similar results using this alternative variable, in terms of both the magnitude of the coefficient and its statistical significance. This implies that our results are not an artifact of Graham's methodology.

[Table 6 about here]

In Table 6, we explore the sources of variation in the tax burden-cash relation. First, we examine whether our results are driven by cross-sectional or time-series variation (or both). Specifically, we estimate both fixed effects and between-firm regressions in columns one and two, respectively. Both the fixed effects in column one and the averages used in column two are at the firm level. By sweeping out individual firm effects, the fixed effects regression isolates the time-series effects. In contrast, the between-firm model in column two uses firm-level averages for all dependent and independent variables, thereby isolating the cross-sectional effects.

As shown in columns one and two, the tax burden variable is significant only in the between effects models, and comparing the coefficients on our tax burden variable shows that the cross-sectional variation appears to be a much stronger driver of our results than time-series variation. The coefficient is about 41.1 in the between-firm regression, versus about 2.4 for the fixed effects model. The lack of significance for the fixed effects regression could be driven by a lack of within-firm, time-series variation in cash holdings and/or firms' tax burdens. To gauge this, we first calculated the standard deviation of $Ln(Cash/NetAssets)$ and $TaxBurden$ within each firm over time, and then calculated the average standard deviation of both variables across firms. These are 0.770 and 0.002, respectively. In comparison, we alternatively calculated the cross-sectional standard deviation for both variables for each year, and then the average standard deviation across years. These averages are 1.669 and 0.005, consistent with there being much greater cross-sectional variation in our key variables compared to their within-firm, time-series variation.

The third and fourth columns in Table 6 examine whether our results are stronger in more recent years. Based on the evidence that both average cash holdings and the variation in cash holdings rose significantly after 1994 (see Figure 1), one might expect that our results are stronger for the most recent subperiod. To test for this, we split our sample into the 1984-1994 period and the 1995-2003 period. From the results in column three, one can see that the coefficient on foreign income is positive and significant in the earlier part of the sample, while the coefficient on the tax burden variable is insignificant. This is consistent with a precautionary motive for holding cash for firms with greater foreign income, but a weak direct repatriation tax motive. In contrast, as the results in column four show, for the most recent period, the coefficient on foreign income is insignificant, consistent with reduced precautionary motives due to foreign income in the last few years. But, in this later period, the coefficient on the tax burden variable is large (about three times as large as the early-period estimate), and statistically significant at the one-percent level, consistent with a tax motive for cash holdings that has been increasing over time.

This increase in the importance of holding cash to avoid paying repatriation taxes is consistent with broader evidence on increased use of tax shelter strategies during the 1990s [Bankman (2004) and Desai (2003)]. Perhaps as firms have become more aggressive in their employment of tax sheltering

strategies starting in the 1990s, they have also become more willing to hold cash in order to avoid repatriation taxes. In addition, the Omnibus Budget Reconciliation Act of 1993 contained several provisions that tightened the tax treatment of multinational firms, which may have increased their hesitancy to pay even more taxes if they repatriated income.

In column five, we examine if our documented effect is stronger depending on whether the firm is facing financial constraints. Specifically, we estimate our regression using the subsamples of firms that we expect to be the least constrained and most constrained (while excluding firms in the middle). As a proxy for our least constrained group, we use firms that have an investment grade bond rating from S&P during our sample. As a proxy for the most constrained group, we use firms that have above-median market leverage, but have no debt rating in our sample.[19] We construct an indicator variable for the most constrained group, *Constrained*, which enters the regression both alone, and via an interaction with *TaxBurden*. We expect that constrained firms will be able to retain less cash (implying a negative sign on *Constrained*), and that the repatriation tax effect on cash will be weaker for the constrained firms, as they cannot afford the luxury of retaining more cash (implying a negative sign on the interaction term). The results in column five are consistent with these predictions; the most constrained firms hold significantly less cash than their least constrained counterparts, and the effect of the repatriation tax variable is significantly weaker for these firms.

As a whole, the results in Table 6 imply that tax motives are a significant factor in explaining the cross-sectional variation in firms' cash holdings. And, these effects are much stronger since 1994, the period over which firms' average cash holdings and the variation in their cash holdings have shown dramatic increases. In addition, as predicted, our effects are much weaker for firms expected to face financial constraints, who find it too costly to retain cash in order to avoid taxes. We are unable to use firms' estimated repatriation tax burdens to explain within-firm variation in cash holding over time, but this seems likely to be due to low power driven by a lack of time series variation in our key variables.

[19] We explored several different definitions of constraints. Almeida, Campello, and Weisbach (2004) investigate definitions of constraints based on size, dividend policy, and leverage, and find that all three serve as similar proxies. Because we investigated size effects separately, and large multinational firms do not exhibit as much variation in dividend policy as a broader sample of firms, we focused on leverage and debt ratings. But, we obtain qualitatively similar results using all three measures or various means of dividing the sample based on debt market access, consistent with the least constrained firms having stronger repatriation effects on cash than the most constrained firms.

4.3 Supporting Evidence

While our data is limited to the extent that Compustat only reports cash at the firm level (rather than at the affiliate level for multinationals),[20] the Bureau of Economic Analysis (BEA) does have data on affiliate-level cash holdings. In a discussion of this paper, Fritz Foley (who has access to the BEA data) reported results that are very consistent with ours, but that are based on affiliate-level cash and tax treatment. Specifically, he regressed the natural logarithm of the ratio of affiliate cash to affiliate assets on the income tax rate in the affiliate's host country, plus parent and year fixed effects. He found a significant negative relation between affiliate cash and the tax rate of the affiliate's host country, consistent with firms holding more cash in low-tax locations. In addition, he found no significant relation between cash and host country taxes for branches, which should not face the same repatriation tax incentives. Thus, Foley finds evidence that within firm, cross-affiliate variation in cash holdings is associated with tax incentives at the host country level, which nicely complements our evidence that cross-firm variation in cash holdings is associated with tax incentives at the firm level.

5 Conclusions

This study explores how taxes on the repatriation of earnings affects the cash balances of firms. This issue is particularly timely for two reasons. First, cash as an asset on the balance sheet has grown rapidly over the last several years, causing many in the investment community to question firms' cash policies. Second, the growth in foreign earnings of U.S. firms combined with current tax policy has led to the enactment of the American Jobs Creation Act of 2004. This Act temporarily lowers the tax on repatriated earnings, and it has been argued that its adoption will spur domestic investment and job growth.

We find strong evidence consistent with taxes on foreign earnings affecting cash balances. Specifically, we find an economically and statistically significant relation between a proxy for the taxes

[20] In the context of this discussion, an affiliate refers to a business located in foreign country which is owned or controlled by a U.S. firm.

firms would pay if they repatriated their foreign earnings and their cash held. This effect is independent of, and much larger economically than the direct effect of foreign income on cash balances, which might arise because of a precautionary motive for cash holdings.

In order to further investigate economic significance, we use three estimates. First, the typical firm exhibits approximately a dollar-for-dollar correspondence between implicit taxes upon repatriation and cash held. Second, if one is willing to assume that all unexplained cash held by firms with foreign earnings (as of the end of fiscal 2003) is due to repatriation issues, then the size of the unexplained cash is around $361 billion, which is roughly consistent with the predicted investment by one private-sector study that analyzed the Jobs Creation Act [Swope, Kasman, and Mellman (2003, 2004)]. Third, examination of the firms that have publicly announced their intent to repatriate substantial amounts of cash reveals that these firms are disproportionately among the top firms in our sample in terms of excess cash that is unexplained by non-tax variables.

These findings leave for future research the question of the impact of this tax provision on the remainder of the firm's balance sheet. For example, it may be that firms – in addition to holding more cash – invest more in foreign subsidiaries than they otherwise would in order to avoid paying taxes on repatriated earnings.[21] If this is the case, then the amount repatriated in response to the temporary tax change will reflect changes in investment as well as cash holdings, and will thus be somewhat larger than the amount we estimate.

[21] Harris, Morck, Slemrod, and Yeung (1993) find that repatriation tax encourages income shifting between foreign subsidiaries of U.S. MNCs.

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Table 1: Summary Statistics

This table presents summary statistics for our sample, which consists of all firm-years on Compustat from 1984 through 2003, with a minimum size of $100 million in assets (in 1984 dollars). The table presents the mean, median, standard deviation, minimum, maximum, and number of observations for each variable. Cash includes cash and short-term investments, as per Compustat. We scale this by total assets (TA), and by net assets (defined as total assets minus cash), and also present the latter ratio in logged form. $R\&D/TA$ and $CapEx/TA$ are the ratios of research and development and capital expenditures to total assets, respectively, where missing values of R&D expenses have been set to zero (we control for this in subsequent tables by using an indicator variable for missing observations). $MktLeverage$ is the ratio of total debt to the sum of total debt and the market value of equity . $CashFlowStdDev$ is defined as the standard deviation over the sample period of the firm's earnings before interest, taxes, and depreciation to total assets. $Dividends/TA$ is the ratio of annual dividends paid to total assets, while $Ln(TotalAssets)$ is the natural logarithm of total assets. $BV(Equity)/MV(Equity)$ is the ratio of the book value of common equity to the market value of common equity (shares outstanding times price per share), as of the calendar year-end, and is Winsorized at the 1% level (per tail). $DomesticIncome/TA$ and $ForeignIncome/TA$ are ratios of domestic pre-tax income and foreign pre-tax income to total assets, respectively. $TaxBurden$ is defined as the maximum of zero, and the the implied U.S. taxes on foreign (pre-tax) earnings (using the Graham tax rate), less foreign taxes paid, scaled by total assets.

Variable	Mean	Median	Std Dev	Min	Max	N
$Cash/TotalAssets$	0.118	0.049	0.164	0.000	0.999	44,671
$Cash/NetAssets$	0.286	0.052	4.191	0.000	785.129	44,671
$Ln(Cash/NetAssets)$	-2.959	-2.960	1.799	-13.020	6.666	44,671
$R\&D/TA$	0.023	0.000	0.054	0.000	2.052	44,671
$CapEx/TA$	0.072	0.052	0.077	0.000	1.519	44,671
$MktLeverage$	0.286	0.233	0.254	0.000	1.000	44,671
$CashFlowStdDev$	0.052	0.040	0.047	0.000	1,074	44,671
$Dividends/TA$	0.014	0.003	0.042	0.000	2.987	44,671
$TotalAssets$	3,501.2	471.9	21,489.6	100.0	1,264,032.0	44,671
$Ln(TotalAssets)$	6.495	6.157	1.465	4.606	14.050	44,671
$BV(Equity)/MV(Equity)$	0.618	0.535	0.818	-3.600	4.360	44,671
$DomesticIncome/TA$	0.035	0.043	0.229	-22.436	7.658	16,683
$ForeignIncome/TA$	0.021	0.014	0.043	-1.178	0.349	16,420
$TaxBurden$	0.002	0.000	0.005	0.000	0.060	12,671

Table 2: Correlation Matrix

This table presents the correlation matrix for our sample, which consists of all firm-years on Compustat from 1984 through 2003, with a minimum size of $100 million in assets (in 1984 dollars). Pearson correlations for each pair of independent variables are presented. *DividendPayment* is a dummy variable that takes a value of one if the firm paid a dividend in the year and zero otherwise. Other variables are as defined in Table 1.

Variables		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
$Cash/TotalAssets$	[1]	1.00											
$Ln(Cash/NetAssets)$	[2]	0.83	1.00										
$R\&D/TA$	[3]	0.43	0.37	1.00									
$CapEx/TA$	[4]	-0.11	-0.09	-0.05	1.00								
$MktLeverage$	[5]	-0.37	-0.37	-0.28	0.01	1.00							
$CashFlowStdDev$	[6]	0.28	0.25	0.29	0.07	-0.15	1.00						
$DividendPayment$	[7]	-0.28	-0.19	-0.21	-0.01	0.00	-0.23	1.00					
$Ln(TotalAssets)$	[8]	-0.20	-0.19	-0.12	-0.05	0.11	0.20	0.34	1.00				
$BV(Equity)/MV(Equity)$	[9]	-0.10	-0.10	-0.08	-0.06	0.16	-0.08	0.04	-0.05	1.00			
$DomesticIncome/TA$	[10]	0.00	0.00	-0.08	0.03	-0.18	-0.09	0.11	0.02	0.04	1.00		
$ForeignIncome/TA$	[11]	0.03	0.07	0.03	0.02	-0.23	-0.09	0.10	0.09	-0.06	0.11	1.00	
$TaxBurden$	[12]	0.14	0.14	0.09	0.05	-0.14	0.08	-0.05	0.01	-0.04	0.02	0.37	1.00

Table 3: Cash as a Function of Transactions Costs and Precautionary Measures

This table presents regressions of our measure of cash on proxies for both transactions costs and precautionary motives for holding cash. The dependent variable in both regressions is the natural logarithm of the ratio of cash to net assets (total assets minus cash). $R\&DMissing$ is an indicator variable which takes the value of one if Compustat reports research and development expense as missing. Other variables are as defined in Tables 1 and 2. Column (1) reports the regression for the sample of all firms, while column (2) reports the results for firms with at least \$5 billion in sales for the given year (in 1984 dollars). t statistics are in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. Standard errors are robust to clustering within firms over time, and all regressions include dummy variables for industry (two- digit SIC codes) and year (coefficients not reported). The table also reports the number of firm-year observations, the number of separate firms, and the R^2 for each regression.

Dependent variable: $Ln(Cash/NetAssets)$		
Sample:	All Firms	Large Firms
Independent variable:	(1)	(2)
$R\&D/TA$	6.089	9.624
	$(10.94)^{***}$	$(4.83)^{***}$
$R\&DMissing$	-0.121	0.042
	$(-2.57)^{***}$	(0.35)
$CapEx/TA$	-1.565	-2.475
	$(-6.90)^{***}$	$(-2.85)^{***}$
$MktLeverage$	-1.712	-1.068
	$(-25.47)^{***}$	$(-4.70)^{***}$
$CashFlowStdDev$	3.450	11.928
	$(7.37)^{***}$	$(4.78)^{***}$
$DividendPayment$	-0.387	-0.672
	$(-10.77)^{***}$	$(-5.56)^{***}$
$Ln(TotalAssets)$	-0.103	0.051
	$(-8.13)^{***}$	(0.98)
$BV(Equity)/MV(Equity)$	-0.075	-0.039
	$(-5.29)^{***}$	(-0.68)
Number of observations	45,284	3,949
Number of firms	5,831	471
R^2	0.34	0.44

Table 4: Cash as a Function of Transactions Costs, Precautionary Measures, Foreign Income and Tax Rates

This table presents regressions of our measure of cash on proxies for both transactions costs and precautionary motives for holding cash, plus domestic and foreign income, and our estimate of each firm's annual tax burden due to repatriation taxes. Specifically, $TaxBurden$ is defined as the maximum of zero, and the the implied U.S. taxes on foreign (pre-tax) earnings (using the Graham tax rate), less foreign taxes paid, scaled by total assets. Other variables are as defined in Tables 1 through 3. The dependent variable in all four regressions is the natural logarithm of the ratio of cash to net assets (total assets minus cash). Columns (1) and (3) report the regressions for the sample of all firms, while columns (2) and (4) report the results for firms with at least \$5 billion in sales for the given year (in 1984 dollars). In columns (1) and (2), we repeat the regressions in Table 3 using only the proxies for transactions costs and precautionary motives, but using the sample of firms for which we have data available to calculate foreign and domestic income, and $TaxBurden$. t statistics are in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. Standard errors are robust to clustering within firms over time, and all regressions include dummy variables for industry (two-digit SIC code) and year (coefficients not reported). The table also reports the number of firm-year observations, the number of separate firms, and the R^2 for each regression.

Dependent variable: $Ln(Cash/NetAssets)$				
Sample:	All Firms	Large Firms	All Firms	Large Firms
Independent variable:	(1)	(2)	(3)	(4)
$R\&D/TA$	5.971	10.822	6.022	9.576
	$(10.84)^{***}$	$(5.12)^{***}$	$(10.94)^{***}$	$(4.62)^{***}$
$R\&DMissing$	0.070	0.324	0.067	0.274
	(1.01)	$(1.93)^{*}$	(0.98)	$(1.79)^{*}$
$CapEx/TA$	-2.558	-3.681	-2.628	-3.808
	$(-4.96)^{***}$	$(-2.42)^{**}$	$(-5.02)^{***}$	$(-2.61)^{***}$
$MktLeverage$	-1.840	-1.245	-1.718	-0.857
	$(-16.44)^{***}$	$(-4.39)^{***}$	$(-14.91)^{***}$	$(-2.94)^{***}$
$CashFlowStdDev$	3.668	9.781	3.609	8.631
	$(5.82)^{***}$	$(2.80)^{***}$	$(5.84)^{***}$	$(2.98)^{***}$
$DividendPayment$	-0.377	-0.678	-0.364	-0.654
	$(-6.65)^{***}$	$(-3.61)^{***}$	$(-6.44)^{***}$	$(-3.59)^{***}$
$Ln(TotalAssets)$	-0.068	0.171	-0.076	0.153
	$(-3.34)^{***}$	$(2.53)^{**}$	$(-3.80)^{***}$	$(2.36)^{**}$
$BV(Equity)/MV(Equity)$	-0.084	0.055	-0.080	0.100
	$(-2.98)^{***}$	(0.53)	$(-2.84)^{***}$	(0.95)
$DomesticIncome/TA$			0.087	0.831
			(1.22)	(1.15)
$ForeignIncome/TA$			1.024	4.369
			$(1.94)^{*}$	$(2.49)^{**}$
$TaxBurden$			17.779	17.919
			$(4.53)^{***}$	$(2.03)^{**}$
Number of Observations	12,788	1,688	12,788	1,688
Number of firms	1,969	236	1,969	236
R^2	0.35	0.47	0.36	0.49

Table 5: Robustness of Tax Burden-Cash Relation: Alternative Tax Measures

This table presents regressions of our measure of cash holdings (the natural logarithm of the ratio of cash to net assets) on alternative measures of the annual tax burden due to repatriation taxes and proxies for other explanations of cash holdings. $ImpliedUSTaxPaid$ is the implied U.S. taxes on foreign earnings (using the Graham tax rate), times an indicator for $TaxBurden > 0$. $ForeignTaxPaid$ is the foreign taxes paid by the firm, times an indicator for $TaxBurden > 0$. $AlternativeTaxBurden$ is identical to $TaxBurden$, but uses the annual maximum statutory U.S. corporate tax rate in place of the Graham tax rate, except for firms with positive tax loss carryforwards, for which we assume a corporate tax rate of zero. t statistics are in parentheses. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. Standard errors are robust to clustering within firms over time. All regressions include (unreported) dummy variables for industry (two-digit SIC code), year, and missing R&D expenses. Also presented are the number of firm-year observations, the number of separate firms, and the R^2 for each regression.

Dependent variable: $Ln(Cash/NetAssets)$		
Independent variable:	(1)	(2)
$R\&D/TA$	6.010	6.006
	$(10.92)^{***}$	$(10.92)^{***}$
$CapEx/TA$	-2.631	-2.620
	$(-5.03)^{***}$	$(-5.01)^{***}$
$MktLeverage$	-1.708	-1.730
	$(-14.85)^{***}$	$(-15.01)^{***}$
$CashFlowStdDev$	3.613	3.571
	$(5.84)^{***}$	$(5.81)^{***}$
$DividendPayment$	-0.367	-0.363
	$(-6.49)^{***}$	$(-6.42)^{***}$
$Ln(TotalAssets)$	-0.076	-0.075
	$(-3.84)^{***}$	$(-3.77)^{***}$
$BV(Equity)/MV(Equity)$	-0.079	-0.081
	$(-2.79)^{***}$	$(-2.84)^{***}$
$DomesticIncome/TA$	0.087	0.088
	(1.21)	(1.21)
$ForeignIncome/TA$	0.754	0.906
	(1.40)	$(1.69)^{*}$
$ImpliedUSTaxPaid$	16.194	
	$(4.08)^{***}$	
$ForeignTaxPaid$	-10.734	
	$(-2.16)^{**}$	
$AlternativeTaxBurden$		17.286
		$(4.67)^{***}$
Number of observations	12,788	12,788
Number of firms	1,969	1,969
R^2	0.36	0.36

Table 6: Sources of Variation in Tax Burden-Cash Relation

The dependent variable in both regressions is the natural logarithm of the ratio of cash to total assets. Other variables are as defined in previous tables. Regression (1) reports a fixed effects model, where the fixed effects are at the firm level. Regression (2) reports the between-firm regression, i.e., a cross-sectional regression using the averages within each firm of the dependent and explanatory variables. t statistics are in parentheses. Regressions (3) and (4) present the results for the subsamples split around 1994. In regression (5), the sample consists of firms that are expected to be the least and most constrained, i.e., firms that either have an investment grade debt rating (least constrained), or have above-median market leverage but no debt rating (most constrained). *Constrained* is an indicator variable that takes the value of one for firms in this latter group. One, two, and three asterisks denote significance at the 0.10, 0.05, and 0.01 levels, respectively. Regression (1) includes dummy variables for year, and regression (2) includes dummy variables for industry, and regressions (3), (4), and (5) include both year and industry dummy variables (coefficients not reported). The table also reports the number of firm-year observations, the number of separate firms, and the R^2 for each regression.

Specification:	Fixed Effects	Between Regression	1984-1994	1995-2003	Constrained vs. Unconstrained
Dependent variable:			$Ln(Cash/NetAssets)$		
Independent variable:	(1)	(2)	(3)	(4)	(5)
$R\&D/TA$	-2.427	6.750	5.018	6.672	6.935
	$(-5.54)^{***}$	$(10.50)^{***}$	$(5.53)^{***}$	$(10.76)^{***}$	$(7.09)^{***}$
$R\&DMissing$	-0.031	-0.055	0.120	0.049	0.090
	(-0.49)	(-0.71)	(1.26)	(0.57)	(1.10)
$CapEx/TA$	-2.752	-1.984	3.287	-1.724	-1.964
	$(-12.06)^{***}$	$(-3.83)^{***}$	$(-6.52)^{***}$	$(-2.47)^{**}$	$(-3.09)^{***}$
$MktLeverage$	-0.880	-1.994	-1.394	-1.813	-0.492
	$(-12.61)^{***}$	$(-13.99)^{***}$	$(-8.07)^{***}$	$(-13.33)^{***}$	$(-2.96)^{***}$
$CashFlowStdDev$		1.846	3.314	3.500	3.665
		$(3.55)^{***}$	$(2.83)^{***}$	$(5.16)^{***}$	$(3.59)^{***}$
$DividendPayment$	-0.020	-0.366	-0.342	-0.383	-0.239
	(-0.56)	$(-5.42)^{***}$	$(-4.29)^{***}$	$(-5.70)^{***}$	$(-3.25)^{***}$
$Ln(TotalAssets)$	-0.180	-0.084	-0.084	-0.072	-0.019
	$(-7.80)^{***}$	$(-3.89)^{***}$	$(-3.17)^{***}$	$(-3.22)^{***}$	(-0.77)
$BV(Eq)/MV(Eq)$	-0.093	-0.046	-0.108	-0.058	-0.039
	$(-5.85)^{***}$	(-1.07)	$(-2.37)^{**}$	$(-1.77)^{*}$	(-1.46)
$DomesticInc/TA$	0.071	0.120	0.781	0.050	-0.008
	$(1.99)^{**}$	(0.73)	$(2.53)^{**}$	(0.88)	(-0.34)
$ForeignInc/TA$	1.581	-2.270	3.728	-0.285	0.626
	$(5.88)^{***}$	$(-2.65)^{***}$	$(5.51)^{***}$	(-0.57)	(0.74)
$TaxBurden$	2.374	41.052	8.509	23.869	37.476
	(1.05)	$(4.65)^{***}$	(1.58)	$(5.12)^{***}$	$(3.44)^{***}$
$Constrained$					-0.223
					$(-2.36)^{**}$
$Constrained \times TaxBurden$					-27.591
					$(-2.18)^{**}$
Number of obs.	12,788	12,788	5,825	6,963	6,176
Number of firms	1,969	1,969	1,023	1,608	1,263
R^2	0.09	0.33	0.30	0.43	0.23