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UNDERSTANDING PRECAUTIONARY CASH AT HOME AND ABROAD

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ABSTRACT

Has the need for precautionary savings driven the dramatic increase in U.S. corporate cash? We show that the run-up in cash is concentrated in foreign subsidiaries of multinational corporations. Precautionary motives explain variation in the level of cash held domestically, but not the level or growth of foreign cash. Multinational firms' foreign cash balances are instead explained by low foreign tax rates and the ability to transfer profits within the firm through among related subsidiaries. The firms with the greatest incentive and ability to transfer income to low tax jurisdictions do, causing cash to accumulate in their foreign subsidiaries.

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A well-known fact from both the academic literature and the business press is that US corporations hold a large amount of cash and marketable securities on their balance sheets. These cash balances have continued to grow dramatically. Between 1994 and 2014, the amount of cash increased by a factor of three and is now over $3T according to numbers from the Flow of Funds (see Figure 1). This amount has led policy makers and commentators to express concern as to why firms are building such large stockpiles despite both an economy in recovery and a low interest rate environment that should induce greater investment. It raises the academic question of why firms hold cash and why this "need" has grown so much.

The explanation that has drawn the most attention in the academic literature is the precautionary savings motive. It predicts that firms will hold more cash if future projects arrive unexpectedly, they cannot defer those projects without a loss of value, and most importantly they may be unable to fund those projects from internal cash flow or external financing. Empirically, this hypothesis has been successfully documented in panel regressions. Firms with poorer access to the capital markets (e.g., small, no bond rating, and more intangible assets) and firms which have not demonstrated they have excess cash flow (e.g., firms which do not pay dividends) do hold more cash (Opler et al., 1999; Bates et al., 2009). Firms with more uncertain investment opportunities also hold more cash (Martin and Santomero, 1997; Boyle and Guthrie, 2003), as do firms with more financing risk (Harford, Klasa, and Maxwell, 2014).

These results do not necessarily explain the dramatic increase in cash. For the precautionary savings story to explain the increase in cash shown in Figure 1, it must be that firms are getting riskier, capital markets are becoming less liquid, or both. Bates, Kahle, and Stulz (2009) have focused on the role of increasing investment uncertainty to explain this phenomenon; they

argue that improvements in information and financial technology should have led to smaller cash balances.

There may be more to the story. First, much of the increase in cash has been concentrated in arguably the least constrained firms: large, profitable firms with rated debt (Opler et al., 1999; Bates et al., 2009; Duchin et al., 2017). Second, the increase in total cash levels both prior to and following the 2008 recession looks very similar. If we standardize cash by GDP, the increase in cash occurs entirely before 2008 (see Figure 1). Since 2008, corporate cash balances have grown at the same rate as the economy. If the explanation were entirely about risk, the rise in cash holdings would have been larger post-crisis, not pre-crisis.

It is clear that the precautionary savings motive is an important partial explanation for why some firms hold more cash than others. To fully account for the increase, however, we may need to look at other factors. The structure of US corporate income taxes is one likely candidate. Income earned in the United States is immediately taxed and available for investment or for returning to investors. Income earned in foreign subsidiaries is immediately taxed in the foreign country and can be invested in that country with no additional taxes being paid. However, if foreign income is repatriated to the United States to be invested or paid to shareholders, an additional tax is due (the difference between the US tax and the foreign tax rate, if positive).

This asymmetry has two implications. First, it creates an incentive for firms to leave cash in the foreign subsidiary and thus increase their total cash holdings. Second, the value of a dollar of precautionary savings depends upon where it is held. Cash held in the United States is a more valuable source of precautionary savings since it can be invested domestically or in foreign subsidiaries. Cash held in the foreign subsidiary can be invested abroad with no immediate tax consequences, but there is a tax cost if it is repatriated and invested in the United States. Firms

may find that the incremental repatriation tax exceeds the positive net present value (NPV) of the investment and therefore may optimally forgo the investment if only foreign funds are available. If this is the case, foreign cash (precautionary savings) is an imperfect substitute for domestic cash. This raises the empirical question of how important precautionary motives are in explaining foreign cash holdings.

The asymmetry introduced by the tax code means our research should focus not only on how much cash a firm holds but also on where they hold it. Location matters. The objective of this paper is to document the separate determinants for stockpiling domestic and foreign cash, as the factors motivating each decision are likely distinct. This objective is not possible using publicly available data sources. While some firms have voluntarily disclosed their foreign cash position (Harford et al., 2017), this selectively released data is limited in both scope and length. Therefore, researchers have not yet been able to separately estimate the domestic versus foreign cash positions.[1] The Bureau of Economic Analysis (BEA) conducts a mandatory survey of US multinational companies that generates the data needed to address this shortcoming.[2] From this survey, we are able to measure the quantities of cash and marketable securities that firms hold in each foreign subsidiary. Combining this with the disclosure of their total cash and marketable securities position (from Compustat), we are able to calculate how much cash is held domestically.

Our empirical strategy proceeds in several steps. We first regress the total cash position of each firm on variables that have previously been shown to explain cross-sectional variation in corporate cash positions (Opler et al., 1999; Bates et al., 2009). The aggregate cash position is explained by a variety of firm characteristics associated with precautionary motives, such as

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[1] A prominent exception is Foley et al. (2007) which also uses data from the Bureau of Economic Analysis. After we discuss our findings, we will discuss how and why our results differ from Foley et al. (2007).

[2] The survey is conducted by the BEA for the purpose of producing publicly available aggregate statistics on the activities of U.S. multinational enterprises.

growth opportunities and leverage. We find that total cash is also inversely related to the Faulkender and Smith (2016) effective tax rate (an average of the US and foreign tax rates which firms face given the location of their foreign operations). Firms with lower average tax rates hold more cash.

Having verified that the results for total cash using our sample match the prior literature, we then turn to separate analyses of domestic and foreign cash. Similar to the time series for the total cash level, we begin by plotting aggregate cash over our sample period: 1998 to 2008 (see Figure 2). Cash is divided into three components: the level of cash held by purely domestic US firms, the level of domestic cash held by US multinationals, and the level of foreign cash held by US multinationals. The trends of the three series are quite different. In aggregate, domestic cash increased between 50 and 60 percent (in real terms) while foreign cash rose by 410 percent. The vast difference between these growth rates suggests that distinct factors explain the variation in these levels, and we seek to identify those factors.

Precautionary motives, we find, are the main drivers of firms' domestic cash levels. The variables used in the prior literature to measure capital constraints and risk, and which have predicted total cash, also predict domestic cash. Interestingly, variables that measure capital market access and need for external financing (e.g. proxies for precautionary motives) are not relevant for explaining foreign cash.

Taxes are the predominant predictor of multinational corporations' foreign cash holdings. Consistent with Foley et al. (2007), reductions in the effective tax rate (the average of the firm's domestic and foreign tax rates) lead to statistically and economically large increases in foreign cash. The effective tax has essentially no effect on a firm's domestic cash. Our estimates of the magnitude of the tax effect are much larger than previously documented, likely resulting from the

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greater differential between US and foreign tax rates that has occurred since the beginning of our sample. Additionally, we document that this tax sensitivity arises almost entirely from firms engaged in significant R&D that facilitates transference of income from high-tax to low-tax jurisdictions.

The rest of this paper is organized as follows. Section 1 describes our data and empirical strategy. Section 2 presents our empirical results, and then the channel of transfer pricing (internal or related sales) is explored in Section 3. The final section concludes.

I.   Empirical Strategy and Data

A.   Empirical Design

Our objective is to better understand the recent growth of firms' cash balances. In particular, we investigate the relative importance of accessibility to external capital (precautionary savings) versus international tax considerations. To distinguish between these factors, we estimate the factors that explain a firm's level of domestic cash and those that explain its level of foreign cash. This estimation allows us to test whether the motivations that drive firms to stockpile cash are the same for both domestic and foreign cash.

Our approach is first to run a horse race between the two predominant explanations. We estimate the total cash holdings of firms (as a percentage of their book assets) as a function of standard determinants of cash similar to Bates, Kahle, and Stulz (2009). Specifically, we control for firm size (as measured by the natural log of sales); for whether the firm has a bond rating; and for its asset tangibility (the ratio of PP&E to book assets), profitability (return on assets), R&D to sales, advertising to sales, market to book ratio, book leverage, and capital expenditure to assets. After reconciling our estimates with those that have been previously documented for total cash,

we move to separately estimating this specification for the cash that is held in the United States and for the cash that is held abroad. The domestic cash specification is estimated both for all firms and for only those that have international operations (multinational corporations or MNCs).

Since precautionary savings are motivated by concerns about financial constraints, our examination includes additional factors that the academic literature has identified as measuring the extent to which firms may be currently financially constrained or concerned about becoming constrained in the future. Following Faulkender and Petersen (2012), we measure the likelihood that firms' internally generated cash may have been insufficient to fully fund their investment opportunities. Specifically, we calculate the fraction of the previous three years in which the firm's earnings before interest, taxes, depreciation and amortization (EBITDA, which is after advertising and R&D) less than capital expenditures (i.e. if EBITDA always exceeds the firm's capital expenditure this variable is zero). The higher this percentage, the more likely it is that firms have investment opportunities that have been foregone. Arguably, firms with sufficient operating cash flow to fund investment should not be capital constrained. Anticipating such investment needs, these firms are more likely to build precautionary savings reserves when capital markets are accessible.

We follow the recent literature and include two distinct measures of risk in our precautionary savings specifications. Following Bates et al., we include the industry cash flow risk. For each two-digit SIC group, we calculate a ten-year moving average of the standard deviation of the cash flow to assets ratio. This measure captures historical evidence of cash flow volatility. We also include a forward-looking measure of risk that affects the need for precautionary cash. We capture changing product market threats using the product market fluidity measure from Hoberg, Phillips, and Prabhala (2014), which is found to affect cash balances. The

fluidity measure uses text analysis of product descriptions from both a firm and its rivals to measure the dynamics of a firm's product market competition. Higher overlapping word use indicates a greater threat and, thus, fluidity may function as a forward-looking measure of risk (details are available on the author's website).

Moving to the tax motivations of cash holdings, we follow Faulkender and Smith (2016) and use an international blended tax rate. The measure is a weighted average of the marginal statutory tax rate based on the firm's earnings before interest and taxes (EBIT). The weights are the percentage of EBIT generated in each affiliate in the corresponding fiscal year in the specified tax jurisdiction of that affiliate (e.g., subsidiary).[3] Thus, if 50% of EBIT in 2006 was generated in the United States, 30% in the Irish foreign affiliate, and the remaining 20% in the German affiliate, the estimated 2006 tax rate for this firm is:

$$\tau_{\text{Firm,2006}} = 50\% \tau_{\text{US,2006}} + 30\% \tau_{\text{Ireland,2006}} + 20\% \tau_{\text{Germany,2006}} \tag{1}$$

This blended tax rate represents our estimate of the tax rate confronting firms prior to deducting interest expense or incorporating interest income. As this weighted average rate increases, we would expect the firm to hold less foreign cash because the realized deferral benefits are lower. Stated differently, firms that generate the greatest amount of earnings in low tax jurisdictions are the ones that would benefit most from deferring repatriation of those earnings and thus stockpiling the earnings in cash and marketable securities. Finding a negative relationship between a firm's worldwide average tax rate and its cash holdings would provide evidence consistent with this hypothesis.

The next issue is to determine which kinds of firms are best able to manage their operations in a way that mitigates taxes and thus results in trapped foreign cash. Anecdotally, there is evidence

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[3] If EBIT is negative in a subsidiary, the weight is set to zero for that subsidiary

that the effect is particularly pronounced in firms that have high levels of intellectual property and are thus able to utilize transfer pricing and royalty payments to move earnings from high tax to low tax jurisdictions. We therefore would expect that the firms that have significant sales from one subsidiary to another, relative to external sales, are those most able to engage in this type of international tax planning. We construct a measure (related sales) equal to the percentage of the firm's total revenue accounted for by sales of its foreign subsidiaries to either the parent company or to other foreign subsidiaries. We hypothesize that the tax effect should be greatest among those firms that are particularly adept at using related sales to move income across various tax jurisdictions.

B.   Data Sources

The challenge to this empirical approach is the lack of publicly available data regarding the international operations of firms. The information disclosed in firms' 10-Ks is entirely too coarse to understand where firms are operating, the tax jurisdiction to which they are subject, and the amount of cash and marketable securities they hold in these various locations. Fortunately, the Bureau of Economic Analysis (BEA) conducts an annual survey of US multinationals that contains numerous balance sheet and income statement items for each foreign affiliate of a US-based multinational firm. The US multinationals are required by law to complete the survey. We use the BEA multinational-affiliate data to measure the portion of a firm's total cash which is held domestically or in one of its international affiliates.

Specifically we employ data from the BEA's benchmark (BE-10) and annual surveys (BE-11) of US multinational companies, which include information on the assets and profitability of the foreign affiliates of multinational firms.[4] Since we are interested in the cash allocations of firms

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[4] The benchmark (BE-10) survey, conducted every five years (e.g. 1999 and 2004), has more comprehensive coverage of the accounting data for the smaller foreign subsidiaries than the annual (BE-11) survey, which is conducted in

as well as variation in the foreign tax rates multinational firms confront, our firm-year observations are limited to the years during which the necessary data was gathered. This data is available from 1998 to 2008 (after 2008, foreign cash balances are no longer collected). Using this data, we are able to measure the amount of cash and estimate the marketable securities held in their foreign subsidiaries. The annual survey (BE-11) explicitly includes the amount of cash in each foreign subsidiary as well as inventory and "other current assets." To estimate the marketable securities which are contained in other assets, we subtract an estimate of the subsidiary's accounts receivable from other assets assuming the accounts receivable to sales ratio is the same across the firm. Our estimate of the cash and marketable securities is thus:[5]

$$\text{Cash} + \left[\text{Other current assets} - \left(\frac{\text{Accounts Receivable}_{\text{firm}}}{\text{Sales}_{\text{firm}}} \right) \text{Sales}_{\text{Subsidiary}} \right] \tag{2}$$

This approach assumes the rest of "other current assets", beyond accounts receivable, are marketable securities. The difference between the total cash position of the firm and the sum of the cash in its foreign affiliates is our estimate of the firm's domestic cash position each year.[6] When these results are replicated using only cash, opposed to our estimate of cash and marketable securities from equation (2), they remain essentially unchanged.

We also use the BEA data to construct our estimate of the effective tax rate (equation 1). Following Faulkender and Smith (2016), we use tax code information for foreign jurisdictions

provided by Comtax for the years 2006 to 2008. For the period 1998 to 2005, we utilize data from the KPMG Corporate and Indirect Tax Survey. For all other control variables, we use the Compustat data that is provided by Standard and Poor's, based upon annual 10-K filings. These include firm size (the natural logarithm of sales), profitability (EBIT over book assets), asset tangibility (the ratio of PP&E to book assets), growth opportunities (measured by the ratio of R&D to sales and the market to book ratio), and whether the firm has a bond rating any month during the fiscal year. All measures are winsorized at the 1st and 99th percentiles.

C.   Summary Statistics: Location and Magnitude of Cash Holdings

We know firms have significant cash holdings. Based on the Federal Reserve's Flow of Funds, the total cash and marketable securities on the balance sheet of US firms has risen from under $1 trillion in 1998 to over $3 trillion by 2014 (see Figure 1). Relative to GDP, cash has risen almost 50% over our sample period. This persistent rise in cash levels is difficult to reconcile with a purely precautionary motive. For the rise in cash to be solely due to precautionary motivations, the risk which the average publicly traded firm faces would need to have risen consistently over the last two decades. The increase in risk prior to the financial crisis (2008) would have to be similar to the rise after the financial crisis in order to explain Figure 1.[7]

For the average firm, most of their cash is held domestically (see Table 1 – full sample). This fact arises for two reasons. First, a large fraction of the firms in Compustat do not have foreign operations, and thus their foreign cash is zero. When we examine multinational firms, the amount of cash held abroad is larger but it is still only 42% of total for the average firm (0.089/0.211, see Table 1 – multinationals sample). A second reason is the correlation between firm size and the presence of foreign operations. Multinational firms are significantly larger (see Table 1). This

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[7] Since cash relative to GDP levels off in the latter half of this sample period, a risk story would need to argue in there was increasing risk prior to the 2008 crisis, but not since.

means that the fraction of cash held abroad is even larger when we weight the data by firm size or when we look at cash opposed to cash relative to assets for each firm (Table 1). Although the average firm holds 42% of its cash abroad (weighting firms equally), 64% of the cash of MNCs is held abroad over our sample period (weighting each dollar equally). This ratio rises to 74% in the final year of our sample. This implies that the cash holdings are concentrated in a subset of MNCs, an issue we return to below.[8]

Multinational and domestic firms differ by more than size. Compared to domestic firms, firms with foreign operations are more profitable, more likely to pay dividends, and more likely to have access to the bond market (e.g., a bond rating), while also having less volatile cash flows, lower market to book ratios, and invest less in R&D and capital equipment. These firm characteristics are normally associated with greater capital market access, not less. The average MNC does not appear to be a capital-constrained firm, yet these firms hold a majority of the cash. Before turning to explanations of firms' cash holdings, it is useful to examine where most of the cash is held (i.e., in which industries and in which countries).

1.   **Location of Cash: Geography**

Low tax rates in some foreign jurisdictions create an incentive to earn income and thus to stockpile cash in these countries. However, firms also earn income and may thus stockpile cash in a country for strictly economic reasons (e.g., this country is where the business and investments are located). Our data allows us to identify the specific countries in which the foreign subsidiaries

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[8] Although our results are similar to Foley et al. (2007), the magnitudes differ significantly. The level of cash to net assets is much larger in our sample. Total cash is larger by a factor of almost four (22.5% in Table 1 versus 5.7% in their Table 1) and foreign cash of MNCs is larger by almost a factor of nine (8.9% in our Table 1 versus 0.7% mean, 1.0% median in their sample). The dependent variable in their paper is the natural log of cash to assets (or foreign cash to assets). Thus, to make the numbers comparable we took the exponent of their mean or median (e.g. exp(-2.8687=5.7%). The reason the magnitudes are different, is that cash levels, especially foreign cash levels, have risen significantly between their sample period (1982-1999 for foreign cash) and ours (1998-2008). We will return to a discussion of the difference in results in Section II-B.

are located and cash is held. In Table 2, we report the percentage of total foreign cash held in the top fifteen countries in 1998 and the fraction of total foreign sales originating from subsidiaries located in these countries. The percent of cash and sales in the remaining countries is also reported. The countries are sorted by the fraction of foreign cash in the country. Among the countries with high cash balances in 1998, we see several large economies (e.g., the United Kingdom, Germany, France, Canada, and Japan) where we would expect US multinationals to conduct significant business and thus generate sales and possibly hold cash. The fraction of foreign cash and the fraction of foreign sales are relatively similar across countries in 1998. For example, subsidiaries located in the United Kingdom held 14.6% of total foreign cash (the highest fraction) and generated 14.8% of all foreign sales in 1998. Subsidiaries in the top six countries, sorted by foreign cash, held 52% of the foreign cash and generated 42% of the foreign sales.

The allocation of foreign cash changes significantly by 2008 (see Table 2). Only one large economy, the United Kingdom, remains in the top six. The other five countries (Ireland, Bermuda, the Netherlands, Belgium, and Luxembourg) are smaller economies, which have top corporate tax rates well below the US rate of 35% at the federal level (with the exception of Belgium).[9] It is also apparent that the correlation between sales and cash had weakened by 2008. Although these countries are the location of most of the foreign cash (subsidiaries in the top six countries now hold 55% of the cash), they generate only 25% of the foreign sales. Some of the countries are particularly noteworthy. Irish subsidiaries hold 13.1% of the cash, but generate only 4.0% of the sales in 2008; subsidiaries in the Luxembourg hold 5.5% of the cash, but generate only 0.5% of

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[9] The corporate tax rates we use in our analysis are marginal statutory corporate tax rates that subsidiaries would face on their next dollar of income. If firms have negotiated (face) lower tax rates due to tax holidays, then we will underestimate the incentive to move income to such low tax jurisdictions.

foreign sales in 2008. This is inconsistent with a precautionary motive, as cash has moved to countries with smaller operations (fewer sales).

Part of the shift between 1998 and 2008 was caused by firms increasing their stockpile of cash in countries that had low tax rates even in 1998. In addition, foreign corporate tax rates had fallen relative to US rates. The average top corporate tax rate across the fifteen countries listed in Table 2 - Panel A (highest foreign cash holdings in 1998) dropped from 38.7% to 29.0% between 1998 and 2008 (see Figure 3).[10] During this period, the US corporate tax rate did not change. The decline in foreign tax rates is consistent across this sample of countries. For example, between 1998 and 2008, the effective tax rate dropped from 32% to 12.5% in Ireland, from 35% to 24.3% in the Netherlands, and even Germany's tax rate drops from 56.6% to 30.9% (see Table 2).[11] The growing difference between US tax rates and foreign tax rates, combined with firms' greater ability to shift income across countries and greater awareness of the benefits, may have led to growth of cash—specifically foreign cash—we see in Figure 2.

2.   Location of Cash: Industry

Foreign cash holdings specifically, and total cash holdings more generally, are concentrated in a small set of industries. When we rank industries by the fraction of total foreign cash held by firms in that industry, we find that 70% of foreign cash is held by firms in the top five industries. The top nine industries hold nearly 86% (see Table 3).[12] Each of the remaining 53 two-digit SIC industries each hold less than 2% of the total foreign cash. The five industries with the most cash are: Chemical and Allied Products (e.g. pharmaceutical firms), Petroleum and Coal

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[10] The drop in tax rates among the six countries (ranked by cash) in Table 2 is greater (38.3% to 15.7%) due to the shift of cash to low tax jurisdictions.

[11] These tax rates are taken from the OECD web site and represent the top corporate tax rate.
    http://stats.oecd.org//Index.aspx?QueryId=58204
    http://www.oecd.org/tax/tax-policy/tax-database.htm#C_CorporateCaptial

[12] To maintain the confidentiality of the individual respondents and abide by BEA disclosure rules, finer cuts of the data are not feasible.

Products (e.g. oil and gas exploration and development firms), Industrial Machinery and Equipment (e.g. computer equipment firms), Transportation Equipment (e.g. auto, rail, and truck manufacturing firms), and Business Services (e.g. software and computer service firms).

The top nine industries (as ranked by percent of foreign cash) are distinct along other dimensions as well. First, they hold most of the total cash (71% of total cash versus 85.9% of foreign cash). Not surprisingly, they generate more of their income in foreign operations. On average, the top nine industries generate 29.3% of their income in foreign subsidiaries versus 13.4% for the remaining industries. The top nine industries face lower average foreign tax rates, but the difference is small (26.4% versus 29.6%). The small difference in the source of income (foreign versus domestic) and in foreign tax rates hides significant variation within industry, which we will use in the analysis below. Lower foreign tax rates become more common in the latter half of our sample period (see Figure 3).

II.   Determinants of Cash Holdings and Location

A.   Precautionary Motives

Our first set of regressions examines total cash and marketable securities as a function of those firm characteristics that, in the prior literature, have been shown to explain the cash position of firms. As we investigate the determinants of firms' cash holdings, we will examine variation across firms with and without foreign operations. Among the firms with foreign operations, we can examine the determinants of their domestic and foreign cash holdings. Consistent with prior work such as Bates, Kahle, and Stulz (2009), when looking at the total cash held by a firm, we find evidence of a precautionary motive for stockpiling cash. Firms that are larger, have greater asset tangibility (PPE/book assets), pay dividends, conduct less R&D, have lower capital expenditure,

have lower market to book ratios, and have higher leverage ratios all hold less cash. Traditionally, these results have been interpreted as consistent with the precautionary savings motivation because these characteristics are associated with firms that are less likely to be capital rationed (have less difficulty accessing the public capital markets) and would therefore derive less benefit from stockpiling cash. The results are broadly consistent whether we examine all firms (see Table 4, column I) or only multinational firms (firms with foreign profits: see Table 4, column II).[13] In addition, the coefficient on our estimated tax rate variable is negative and statistically significant, consistent with Foley et al. (2007), implying that those firms confronting lower average tax rates hold more cash. Remember, however, that variation in our estimated tax rate comes entirely from the portion of the firm's earnings that is realized overseas and the tax rate in the countries in which those earnings are generated. Although this coefficient is consistent with foreign taxes influencing the total amount of cash a firm holds, as we will discuss below, the story is richer.

Having established that the results are consistent with the previous literature, we now can examine whether the determinants of cash holdings are the same for both domestic and foreign cash holdings. In the remaining columns of Table 4, we run the regressions for domestic and foreign cash separately. The first thing to note is that many of the variables that are related to precautionary motives are relevant only for explaining the domestic cash. The precautionary savings motivations are a significant determinant of the observed variation in the domestic cash of firms whether we look at all firms (Table 4, column III) or only multinational firms (column IV).

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[13] The standard errors are clustered by firm. We also estimate White standard errors, standard errors clustered by year, and standard errors clustered by firm and year (Petersen, 2009). Consistent with a firm effect, the T-statistics fall (the standard errors rise) when we cluster by firm relative to White standard errors. For example, the T-statistic on R&D falls from 73.6 to 45.3 and the T-statistic on the effective tax rate falls from 18.5 to 10.0 (column I). Clustering by year produces T-statistics that are slightly larger than when we cluster by firm and smaller than when we use White standard errors (e.g. the T-statistic on the effective tax rate is 11.2 when standard errors are clustered by year). Clustering by both firm and year produces T-statistics that are slightly smaller than clustering by only firm. The largest change occurs for the effective tax rate, where the T-statistic falls from 10.0 to 8.1. This pattern of results is consistent across the following tables and is available from the authors.

Firms that are larger, have greater asset tangibility (PPE/book assets), pay dividends, conduct less R&D, have lower capital expenditure, have lower market to book ratios, and have higher leverage ratios all hold less domestic cash.[14] The economic effects are also large. For example, increasing R&D by one standard deviation (0.597 from Table 1, column 2) leads to an 8.1 percentage point increase in cash to assets (0.136 * 0.597 = 0.081) for all firms (Table 4, column III). This ratio is large compared to the average domestic cash to asset ratio of 21% (Table 1). These results are consistent with the types of firms most likely to be rationed holding more domestic cash in order to mitigate potential underinvestment that may result from such rationing.

Interestingly, these precautionary savings motivations do not explain variation in foreign cash holdings. We see that many of the firm characteristics that explained domestic cash (column IV), which are often interpreted as associated with precautionary savings motivations, have little predictive power in explaining a firm's foreign cash positions (Table 4, column V). The coefficients either shrink, lose statistical significance, or in one case (firm size) flip signs. Firms with more tangible assets hold less foreign cash, although the coefficient is 77% smaller. Growth proxies (the R&D-to-sales ratio and the market to book ratio) have estimated coefficients that are appreciably smaller economically and no longer statistically different from zero (even though the standard errors are the same or smaller). In addition, the coefficients on variables explaining capital rationing—like whether the firm pays dividends and what its leverage ratio is—have shrunk in magnitude and are no longer statistically significant. Even if we look only at those MNCs whose percent of income from foreign sources is above the median, the precautionary savings variables have little explanatory power (see Table 4, column VI). The coefficient on R&D is still small and statistically insignificant, although firms with a bond rating now hold more cash, not less. We

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[14] If we do not include the firm's leverage, the results are even stronger (e.g., the coefficients are larger in magnitude). Results are available from the authors.

return to the role of R&D in generating foreign cash stockpiles below. Precautionary motives are an important determinant of a firm's domestic cash holdings (whether a firm is MNC or not), but not of a firm's foreign cash holdings. Our precautionary savings covariates are measured at the firm level in these regressions, not at the level of foreign subsidiaries. While this is partially due to the fact that many of the variables do not exist at the individual subsidiary level (the market value of the firm and whether the firm has a bond rating are only available for the entire firm), it is also because the precautionary savings motivation is largely about accessibility of external capital. Frictions in raising such external funds are theoretically the result of firm-level characteristics, not subsidiary-specific characteristics. We can measure some variables at the foreign subsidiary level, and we return to this issue in the subsidiary level regressions below.

B. Tax Rate Effects

When we examined total cash holdings, we found that the tax rate was negatively correlated with firms' cash holdings. Firms with higher tax rates hold less cash. When we examine domestic and foreign cash, we again find very different results. Higher tax rates are associated with slightly higher, not lower, domestic cash levels whether we examine the entire sample (column III) or only multinationals (column IV). The coefficient switches signs, drops appreciably in magnitude, and is no longer statistically different from zero when we examine domestic cash.[15] The effect of taxes which we found for total cash is driven completely by the foreign cash holding of MNCs. MNCs with lower effective tax rates hold more cash abroad, as is expected given the cross-sectional variation in the cost of repatriating foreign earnings. The coefficient estimate in column V implies

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[15] In the All Firms sample (column I and III), we also include a dummy variable which is equal to one if the firm is domestic (has no foreign operations) and zero otherwise. The results imply that MNCs have slightly more total cash (1.6% of BVA in column I), significantly less domestic cash (5.7% of BVA in column III), and by construction more foreign cash holding all other variables constant. The unconditional averages in Table 1 show broadly similar results. MNCs average domestic cash level is significantly lower, but their total cash is similar to the average firm.

that lowering the effective tax rate from 35% to 30% (approximately the standard deviation from Table 1) will increase the cash to assets ratio by 3.8 percentage points.[16]

The sensitivity of firm's foreign cash to foreign tax rates is much larger in our sample than in Foley et al. (2007) despite both papers using the BEA data. A one standard deviation decrease in their tax variable leads to a 12% increase in the foreign cash to assets ratio in their sample.[17] We find that a one standard deviation decrease in our tax variable leads to a 42% increase (3.8/8.9), or over three time larger. Why would the sensitivity to the foreign tax rate be so much higher in our sample? We think the answer is the different sample periods. Foley et al. (2007) use the BEA benchmark survey from 1982, 1989, 1994, and 1999 to measure foreign cash. We use both the benchmark survey and the annual survey from the BEA to measure foreign cash, but our sample runs from 1998 to 2008. The two samples have little overlap. At the beginning of our sample and during the Foley sample, the average foreign tax rate and the US corporate tax rate are equal (see Figure 3). The average foreign tax rate (country tax rate) in the Foley sample is 35% (see their Table 1). Foreign tax rates are equal to the US tax rate at the beginning of the sample, but fall significantly over the course of our sample. When average foreign tax rates are equal to US tax rates, the tax reasons for earning income in foreign subsidiaries are minimal, and thus less cash gets trapped abroad. MNCs held just over half of their cash abroad at the beginning of our sample,

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[16] Is the rise in cash over our sample period due to changes in the independent variables or due to a systematic rise in cash (unrelated to change in the explanatory variables)? The time dummies, which are included in Table 4, can help answer this question. For the regressions based on the full sample (columns I and III), the time dummies imply an increase in the cash to asset ratio of about 2.3% which is not attributable to changes in the explanatory variables. This is slightly larger than the increase we see in the raw data (2.0% for total cash and 0.7% for domestic cash). Thus the rise in domestic cash is not coming from a change in firm characteristics as we measure them. The time dummies in the foreign cash regression (column V) show variability over the sample period (ranging from -0.6% to 1.5%) but there is no systematic increase. The average foreign cash to assets ratio rises by 5.3 percentage points over our sample period (from 6.8% to 12.0%). Thus, the rise in the level of foreign cash is driven by changes in the independent variables.

[17] They calculate this number on page 597. The coefficient on their tax variable (Effective Repatriation Tax Rate) in their Table 5 – column I is 8.0158. Multiplying this by the standard deviation of this variable (0.0149) from Table 1 generates a percentage change in the foreign cash to asset ratio of 12% (0.0149*8.0815). Their dependent variable is the Ln(foreign cash/asset) and so is already expressed as a percentage change.

but foreign cash grew much faster during our sample period (see Figure 2). Over time, as foreign tax rates have come down, the incentive to move income abroad has increased, as has firms' awareness of how to do this. The enactment of the 'check-the-box' regulation facilitated the ability of firms to shift income overseas. This occurred in 1997, near the end of the Foley sample and just before the beginning of ours. Together, the incentive and ability to transfer price has made the role of foreign taxes more important over time, as we document.

C.   Capital Constraints

To the extent that the precautionary savings motivation explains cash holdings, these findings should be particularly acute for the firms most likely to confront capital constraints. To test this idea, we add Faulkender and Petersen's (2012) measure that captures whether firms' investment expenditures exceed their internally generated funds. If firms' operations are sufficient to fund all of their investment opportunities, then they need not rely on either external capital or an internal stockpile. However, if investment expenditures may exceed their internally generated funds, firms are likely to stockpile cash when capital markets are accessible and then hold this cash and marketable securities should they need it to fund investment in the future. We add this variable to our baseline specification and examine the results for domestic versus foreign cash in Table 5.

Firms that are more likely to be capital constrained hold higher domestic cash levels. The estimated coefficient suggests that the domestic cash to assets ratio is 13.1 percentage points higher for those firms that invested more than their realized operating cash flow in each of the last three years relative to a firm whose investment never exceeded its internally generated cash flow (Table 5, column I). Firms which are more constrained also hold more foreign cash, but the coefficient is 82% smaller (0.024/0.131-1: see column II). Unlike the results in Table 4, this measure of credit

constraints suggests that foreign cash is partially a source of precautionary savings, but precautionary savings is a much more powerful factor in explaining domestic than foreign cash.

D.   Measures of Risk

Precautionary savings are more valuable to firms whose cash flows are riskier. Should firms' operations be negatively shocked, not only will their internal capital generating capacity be impaired, they would likely also face larger costs of external funds. If firms need cash, either to overcome a temporary shock to their operations or to fund valuable investment that will allow them to adapt to the shock, then having a large cash stockpile is more valuable.

In Table 5, we examine two different measures of risk – industry cash flow volatility and product market fluidity – and again estimate how these measures correlate with domestic versus foreign cash positions. Following Bates et al., we incorporate the standard deviation of the firm's cash flow, measured over the previous five fiscal years, into our regressions. Higher cash flow risk is positively associated with the firm's domestic cash position (Table 5, column III). The effect is statistically significant but the magnitude is small. Increasing cash flow risk from the 25th to the 75th percentile increases the cash to asset ratio by only 1.7 percentage points. Cash flow risk has an even smaller, and statistically insignificant, effect on multinational firms' foreign cash (column IV). We examine the product market fluidity of each firm as a more forward-looking measure of investment uncertainty in columns V and VI. This variable measures the competitive product market threat to the firm and has previously been shown to affect cash holdings (Hoberg, Phillips, and Prabhala, 2014). Product market fluidity risk is positively associated with the domestic cash position of firms, consistent with the precautionary motivation (increasing product market fluidity from the 25th to the 75th percentile raises the case to asset ratio by 5.5 percentage points). Its estimated association with foreign cash is actually negative, and the coefficient is 67% smaller in

magnitude, indicating that greater product market competition is correlated with slightly lower foreign cash holdings. Although total cash is higher (the sum of the coefficients in columns V and VI is positive), more than 100% of the increase is in domestic cash.

Even after controlling for risk and capital constraints, firms with lower effective tax rates hold significantly more foreign cash. The magnitude of the effect is essentially unchanged (compare Table 4, column V to Table 5). Firms hold more domestic cash but the effect is smaller and not always statistically significant.

These results confirm that domestic cash and foreign cash are not substitutes for each other. The motivations that drive each are distinct. Given the potentially significant tax costs firms face upon repatriating foreign cash, it makes sense that the precautionary savings motivations that have been previously documented to explain firms' cash positions would predict domestic cash. Foreign cash is an imperfect store of precautionary savings due to the asymmetry of international taxation. What is surprising is that firms' foreign cash holdings appear to be minimally (if at all) related to precautionary motives. Thus, researchers need to be careful about assigning a precautionary saving explanation to the aggregate cash position of non-financial firms. That explanation appears to apply only to the domestic portion of a firm's cash. Examining why the rise in cash balances is mainly foreign is a question we revisit below along with the underlying causes.

III.   **Moving Cash Abroad**

A.   **The Mechanics of Transfer Pricing**

If the precautionary savings motivation, which has long been the dominant explanation for why non-financial firms stockpile cash, does not explain the significant run-up in the foreign cash position of firms, an alternative explanation is needed. Low foreign taxes appear to be a dominant

factor. The lower the effective tax rate of the firm, the higher its total cash position (Table 4 – column I); however, the effect is driven entirely by foreign cash holdings. Domestic cash holdings do not rise as the foreign tax rate falls below the US tax rate (see Table 4, column IV), and the dramatic rise in cash is concentrated in the foreign cash of MNCs (see Figure 2).

Our results raise the following question: If firms are able to lower their corporate income tax by owning a foreign subsidiary in a low tax jurisdiction and generating their earnings for tax purposes with that subsidiary, why don't all firms do this? Holding cash abroad may reduce financial flexibility (domestic cash is a better store of precautionary savings), but it can have significant tax benefits. To explain why not all (multinational) firms are sitting on large foreign cash positions, we need to examine the sources of variation in the foreign cash position among MNCs. 86% of foreign cash is held by firms in only nine industries (Table 3). Those that are able to generate larger foreign earnings, particularly in low tax jurisdictions, are the ones that have a comparative advantage at reducing their tax obligations, and the collateral effect is that cash stockpiles are built in these countries.

Transfer pricing may be an important element in the movement of earnings to low tax jurisdiction subsidiaries (Grubert and Mutti, 1991). Starbucks, for example, was investigated by European Commission regulators for whether "Dutch authorities allowed Starbucks to use unfair methods to shrink its taxable income, including paying a royalty to a partnership in Britain, Alki, for a recipe for coffee-roasting" (Kanter, 2014). Underpinning transfer pricing is the nature of the intellectual property of the firm. Not only is it easier to transfer intellectual property to low tax jurisdictions than to transfer physical capital, it is also easier to avoid charges of tax avoidance when income arises from more difficult to value assets such as patents and technology (Grubert, 2003; Levin and McCain, 2013). Thus, firms with more unique assets would be more successful

at lowering their effective tax rates and transferring income to low tax jurisdictions. Given the structure of the US tax code, this would generate larger foreign cash stockpiles.

To identify transfer-pricing opportunities within a firm, we examine the portion of a firm's sales that it deems "related" or "affiliated" (related sales). In the BEA data, firms report the portion of a subsidiary's revenue arising from sales to the other subsidiaries of the firm or to its parent. We sum the sales across all foreign subsidiaries of the firms and express this amount as a percentage of the firm's total revenue. We hypothesize that, if transfer pricing is the mechanism that facilitates the movement of earnings to low tax jurisdictions, then the firms that have high levels of related sales and low effective tax rates are the ones that will end up with the most trapped cash abroad. The analysis is presented in Table 6.

Looking at the firms' total cash positions, we find results consistent with our hypothesis. Not only do firms confronting lower effective tax rates have higher cash positions, but firms with more related party sales also have higher cash balances. The coefficient on the cross product of related party sales and the effective tax rate is negative, but not statistically different from zero. This pattern holds for both the full sample and the subsample of multinationals (Table 6, columns I and II). Neither the effective tax rate nor related party sales are useful in predicting domestic cash, even among multinationals (Table 6, columns III and IV).

The role of foreign tax rates and related party sales is most apparent when we examine MNCs' foreign cash holdings. Foreign cash is most prevalent in firms with subsidiaries in low tax rate foreign jurisdictions that have significant related party sales. The coefficient on the effective tax rate is negative, the coefficient on related party sales is positive, and both are statistically different from zero (Table 6, column V).[18] The coefficient on the cross product (tax rate multiplied

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[18] The standard errors are clustered by firm. If we cluster by firm and time, the standard errors on the related sales and the cross product change very slightly (e.g. the standard error on related sales falls from 0.119 to 0.110). The standard

by related sales) is negative (but not statistically different from zero). While low tax rates themselves are important in explaining large foreign cash positions, this effect is enhanced by low tax-rate firms' abilities to move revenue across the firm. A firm's tax rate is low only in some (or all) of its foreign subsidiaries. Thus, firms who have greater ability to move income to low tax jurisdictions (through related party sales) have the greatest opportunity to lower their taxes and are also the ones with the greatest foreign cash balances.

These results still do not sufficiently explain why all firms are not engaging in such related party sales to lower their corporate income tax liability. There must be some restriction on firms' ability to place subsidiaries in low tax jurisdictions and/or use related party sales to lower taxes. In much of the anecdotal evidence about transfer pricing, one common thread is that intangible assets are relatively easier to reallocate to low tax jurisdiction countries than economic value arising from outcomes of physical capital (manufacturing, mining, timber, etc.). To further explore this channel, we divide the sample into those firms engaged in significant intellectual property development, as measured by disclosing material (non-zero and non-missing) amounts of R&D spending and those firms that either spend zero on R&D or whose spending is insufficient to merit reporting (see Table 6, columns VI and VII).

The dual role of low foreign tax rates and the use of related party sales does not affect foreign cash holdings of firms without significant R&D expenditure. Among these firms, lower tax rates do lead to higher foreign cash balances, but related sales have no effect (the coefficient is positive but small and statistically indistinguishable from zero). The effect of related sales on foreign cash holdings appears only among firms with R&D expenditures (column VII). When related sales are zero, the effect of taxes on foreign cash holdings is the same for both sets of firms

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error on the tax rate (which has both cross sectional and time series variation) rises from 0.070 to 0.122, but the coefficient is still statistically significant (t-statistic=4.5).

(compare the coefficient on the tax variable in columns VI and VII). Not only do increases in related sales increase foreign cash holdings directly for firms with R&D expenditure, but they also increase the effect of lower foreign taxes on foreign cash holdings (the coefficient on the cross product is negative, economically large, and statistically significant). For example, lowering the effective tax rate from 35% to 30% and increasing related sales from 0% to 16.7% (the inter-quartile range) increases the cash to net book assets by 5.1 percentage points.[19] This is large relative to the mean level of foreign cash from Table 1 (8.9%).[20]

The rise in foreign cash of MNCs has been much greater than the rise of domestic cash (in either domestic firms or MNCs) over our sample period (see Figure 2). Our empirical results document the role of intellectual property and transfer pricing to move earnings from high tax jurisdictions to low tax jurisdictions, resulting in significant amounts of trapped cash. To see the role of each in the rise of cash, we graph the total foreign cash held by MNCs that report positive R&D and those that do not in Figure 4. In Figure 5, we graph the total foreign cash held by firms that report either zero or positive related sales.[21] At the beginning of our sample period, MNCs with positive R&D held more foreign cash than firms with no R&D (Figure 4), and MNCs with

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[19] Only 65% of the MNC firm-years (column V) report non-zero related sales. Among this group, which is concentrated in the sample with positive R&D (column VII), the interquartile range of related sales is 26.3% (0.7% to 27.0%). Increasing related sales by this amount (and lowering the effective tax rate from 35% to 30%) increases the cash to assets ratio by 6.7 percentage points. For the MNCs without significant R&D (column VI) lowering just the tax rate from 35% to 30% in column VI raises the cash to net book asset ratio by only 2.5 percentage points. This group has little related sales.

[20] Our results on the effect of R&D on foreign cash are different than Foley et al. (2007). They find a positive and statistically significant effect of R&D on foreign cash. As can be seen in Table 6 (column V and VIII), we find the coefficient on R&D is zero. It is not that R&D does not affect foreign cash, but the results are more subtle. The effect is zero if the firm has zero related sales. It is the combination of positive R&D and positive related sales that predict high levels of foreign cash. Thus in the foreign cash regressions, R&D measures the feasibility of using transfer pricing (related sales) to move income between high and low tax jurisdictions.

[21] In both Figure 4 and 5, there is a blip in foreign cash in both 1999 and 2004. It appears in both sets of firms, although less apparent in the firms with zero R&D or zero related sales. These are the two years when the benchmark survey was conducted. In the other years, we estimate marketable securities (which we then add to cash) by subtracting off an estimate of accounts receivable from other current assets. These results suggest that the accounts receivable number we subtract is too large, and thus we are underestimating foreign cash in the non-benchmark years. In the regressions, this mismeasurement will be absorbed by the time dummies and so will not affect our estimates.

positive related sales held more foreign cash than firms without; however, the differences are small. Over the next decade, there had been a dramatic rise in foreign cash among MNCs that have positive R&D and positive related sales.[22] Among firms that have no R&D or related sales, we see no increase in foreign cash.[23]

The regressions run this far have been in levels. The regressions are specified this way since the precautionary savings explanation is a story about levels. Firms with more limited access to the capital markets, and which therefore face greater risk, maintain a higher average level of cash. The tax explanation is a story about both levels and changes. First, as tax rates have fallen in many foreign countries relative to the United States (see Figure 3), the incentive to earn income in foreign subsidiaries has risen as well and as a result, cash builds up in the firm's foreign subsidiaries (Dobridge and Landefeld, 2017). This is a story about the level of foreign cash. However, even if the difference between US and foreign tax rates does not change, the level of foreign cash may still rise. When the foreign tax rate is less than the US tax rate, firms have an incentive to earn income in low tax foreign jurisdictions each and every year and thus add to their stockpile of foreign cash, even if tax rates do not change.

As a test of this alternative specification, we reran the regression from column VII using the change in foreign cash divided by assets as the dependent variable (see Table 6 – column VIII). Although the coefficients are smaller, the implications are the same. MNCs which face lower foreign tax rates and have higher related sales accumulate foreign cash at a faster rate, and the two

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[22] Pinkowitz, Stulz, and Williamson (2016) compare the cash holdings of US and foreign MNCs to determine if firm characteristics or country characteristics explain differences in cash holdings across countries. They also present evidence that non-R&D firms and R&D firms are not comparable in terms of how much cash they hold. They show that US MNCs and foreign MNCs hold similar amounts of cash once the high R&D US MNCs are excluded.

[23] We can also split the sample based on measures of precautionary savings to see if the rise in foreign cash is more pronounced in firms with stronger precautionary demand for cash. When we split the sample based on firms' market fluidity (see Table 5), we see no difference in the rise in foreign cash. MNCs with above median value of the market fluidity risk measure see their foreign cash rise by 5.5x versus 5.2x for firms with values of market fluidity below the median.

coefficients are statistically significant (the cross product is not). Lowering the effective tax rate from 35% to 30% and increasing related sales from 0% to 16.7% (the inter-quartile range) increases the dependent variable by 0.7 percentage points (versus 5.1 in column VII). The magnitudes are not directly comparable. This is the increase in foreign cash that would occur each year in response to the lower tax rate and the higher related sales.[24]

B.   Sources of Variation in Effective Tax Rates.

Two factors contribute to this dramatic rise in cash holdings and thus the growing concentration of the cash in firms with intangible assets (positive R&D) and significant inter-company sales (positive related sales). First, the average foreign tax rate was similar to the US corporate tax rate at the beginning of the sample but has since diverged (Figure 3). This has changed the incentive to defer repatriations. Relatedly, the ability to defer repatriation also has changed. In 1997, just before the start of our sample, the U.S. Treasury enacted 'check-the-box' regulations intended to simplify tax policy by allowing firms to self-identify subsidiaries for tax purposes (Albertus, 2016). What followed was the proliferation of hybrid entities where a subsidiary could be considered a 'disregarded entity' by US tax laws but treated as a corporation in the foreign jurisdiction. Normally, financial payments between a parent firm and its foreign subsidiary would have tax implications, as the US tax code does not defer taxation of 'passive income' or 'Subpart F income'. Check-the-box regulations allowed firms to treat such payments as internal transfers and not subject to US taxation, while allowing the subsidiary to deduct those payments as expenses, thus minimize foreign taxes.

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[24] We also ran the regression in changes for domestic cash. The coefficient on the precautionary savings variables are smaller in magnitude and less statistically significant. This is consistent with the precautionary story explaining levels not changes.

There are two distinct sources of variation in our tax variable: the average foreign tax rate and the fraction of income which is earned abroad. As the foreign tax rates have fallen, and possibly firms have adjusted to the new regime, the mean fraction of income earned abroad has risen 38% to 53% over our sample period (see Figure 6). To more fully understand the importance of each of these sources of variation, we bifurcate the effective tax rate variable into its two components: the foreign tax rates and what fraction of the firm's income (EBIT) is earned in the foreign jurisdictions. Decreasing the foreign tax rate (the average tax rate the firm faces on income across its foreign subsidiaries) increases the amount of foreign cash which MNCs hold, but this decrease has no statistically significant effect on domestic cash (see Table 7). We also see that income is sticky; cash tends to be held where it is earned. The more income that is earned in the US, the more domestic cash the firm has (Table 7, column I). The more income earned in foreign subsidiaries, the more foreign cash the firm holds (column II). Foreign income is significantly stickier than domestic income; the coefficient on US income is almost three times larger in the foreign cash regressions (0.042 versus -0.129). This difference is evidence of the asymmetry introduced by the tax code. The increase in foreign cash appears to be due to both the reduction in foreign tax rates and the movement of income abroad.

C.   Subsidiary Level Regressions

The analysis thus far has treated the firm's foreign subsidiaries as a single entity. In reality, firms have foreign subsidiaries in many different countries with potentially very different tax rates, and our data allows us to observe the cash and operating activity in each of the firm's subsidiaries. Not only do firms have a tax incentive to move income out of the United States and into foreign subsidiaries with low tax rates, but they also have an incentive to move income out of foreign subsidiaries with high tax rates and into foreign subsidiaries with lower tax rates. Firms invest in

and earn income in countries where business opportunities exist. That is why we found the fraction of cash and the fraction of sales generated in foreign countries were similar in 1998 (see Table 2). Once foreign tax rates had diverged from US tax rates (Figure 3), we see the cash has gravitated to countries with low tax rates even when only a small fraction of the sales are generated in those countries (see Table 2).

Given our data on the cash levels in each of the firm's foreign subsidiaries, we are able to run the regressions from Table 6 using subsidiary level instead of firm level observations.[25] Thus if a firm has subsidiaries in three countries in 2008, we have three observations on the firm in 2008.[26] The dependent variable is the subsidiaries' cash divided by the firm's net book value of assets.[27] The lower the tax rate in a country, the more cash is held by the subsidiary in that country (see Table 8, column I). This is true even if we include firm dummies (column II), firm-year dummies (column III), or country dummies (column IV).[28] When we include a separate dummy variable for each firm-year combination, the tax coefficient is estimated from variation in the tax rate across different subsidiaries for a given firm and year. We included related sales and the

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[25] The dataset has limited information about the financials of each subsidiary. We included the PPE to asset ratio, size (log of sales), and the R&D/sales ratio all measured at the subsidiary level in Table 8. These are measures of precautionary savings used in the literature and in the prior regressions (see Table 4). The coefficients on PPE and size are positive, not negative as implied by the precautionary savings explanation. The coefficient on R&D is positive and statistically significant, but the magnitude is a fraction of what we found for domestic cash in Table 6 (i.e. 0.005 in Table 8, column VII versus 0.203 in Table 6, column IV). The coefficient on R&D was negative and not statistically significant in the foreign cash regression (Table 6, column V). R&D could be a measure of precautionary savings or of the ability to use transfer pricing to move income across countries. As we found with the firm level regressions in Table 6, R&D or intangible assets enable transfer pricing, but it is low tax rates and high related sales that lead to higher foreign cash levels, not R&D alone.

[26] This is why the observation count rises by a factor of almost 9 from 13,113 in Table 6, column V to 116,281 in Table 8.

[27] We are interested in the firm's decision of how much cash a firm has and where to hold it. Thus we, continue to use the firm's asset value in the denominator instead of the subsidiaries asset value. We do this so that the coefficients are comparable across tables. In addition, some of the subsidiaries have low asset values and sales (see Table 2). Thus if we use subsidiary assets we would get very large values for the dependent variable not because the subsidiary holds a lot of cash but because it has few tangible assets.

[28] The coefficients do not change across the columns as different sets of dummy variables are included. The only exception is column VIII. When we include country dummies, lower tax rates lead to higher cash in a subsidiary only if related sales is positive.

interaction of related sales and the tax rate in the last four columns of Table 8 (this replicates the results from Table 6, V-VII). As we saw before, subsidiaries with more related sales have higher cash balances. Subsidiaries with lower tax rates have higher cash balances, and the effect of the tax rate is increasing in their related sales. Although the signs of the coefficients are the same, the magnitudes are smaller than we find in Table 6. Thus lowering the foreign tax rate, relative to the US tax rates leads to significantly more cash being held abroad. Lowering the tax rate in one subsidiary relative to another increases cash in the low tax subsidiary but by a smaller amount.[29] This suggests that incentive to shift income out of the United States (due to lower foreign taxes) is greater than the incentive to shift income among the foreign subsidiaries in which the firm operates.

IV.   Conclusion

US firms have increased significantly the amount of cash on their balance sheets, and theory suggests why this can be value increasing. In the absence of market frictions, firms will pay out excess cash flow and then raise capital in the future when and if they need it. In the presence of market frictions, outside equity and debt capital may be too expensive or unavailable. In this environment, firms can create value by stock-piling cash and using it in the future when capital is unavailable or too expensive. Prior empirical work has focused on and documented that precautionary motives can explain a significant portion of the variability in firms' cash balances.

The challenge with interpreting these results is the fact that each firm's cash is not in one universally accessible account. Due to the structure of the US tax code, cash held in a US firm's

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[29] The coefficients in Table 8 are directly comparable to Table 6. Since each observation is a single subsidiary, the dependent variable is the cash in a single subsidiary in Table 8 and the sum of cash across all foreign subsidiaries in Table 6. Based on the coefficients in Table 8, column VII, lowering the effective tax rate by one standard deviation (10 percentage points) and increasing related sales by one standard deviation (0.261) increases the subsidiary cash to net book assets by 0.4 percentage points, which is large relative to the mean of the dependent variable (subsidiary cash/firm assets of 1.1%).

foreign subsidiaries is not readily accessible, nor is it a perfect substitute for cash held in the US. Firms must pay an incremental tax to access cash held in foreign subsidiaries located in low tax jurisdiction. As a large and increasing fraction of the cash held by US corporations is held abroad, it is important to understand the unique motivations that drive the decision to hold cash domestically or in their foreign subsidiaries. The imperfect substitutability is not symmetric. Excess cash held in the parent can be used to fund foreign investments without paying an incremental cost, while cash held in the foreign subsidiary can only be used to fund foreign investments without paying the tax cost.

Due to the imperfect substitutability of these different cash accounts, along with the asymmetry in the substitutability, domestic cash is more valuable than foreign cash as a form of precautionary savings. As our results demonstrate, such imperfect substitutability leads to significantly different factors explaining the observed variation in domestic relative to foreign cash. Many of the firm characteristics previously documented to explain corporate cash that are associated with precautionary motives only explain the observed variation in the domestic cash component on corporate balance sheets. These same characteristics do a relatively poor job explaining the variation in foreign cash balances.

Instead, the primary factor explaining the observed variation in foreign cash holdings appears to be tax considerations. Lower foreign tax rates are associated with higher foreign cash positions, consistent with low tax rate jurisdictions being associated with higher effective repatriation tax rates. Firms optimally respond by deferring repatriation, leading to higher cash and marketable securities balances during the deferral period. Our results are more precise. We find that the rise in cash is driven predominantly by an increase in the foreign cash of MNCs. This cash is concentrated in a small number of low tax countries and a well-defined set of firms. Most of the

rise in foreign cash is concentrated in firms which make investments in intangible assets through R&D expenditure and who have greater related sales.

Our results indicate that at least two important considerations are at work in explaining the rising level of corporate liquidity: precautionary savings and taxes. Caution is therefore required when interpreting the policy implications of recently high levels of observed cash positions.

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Table 1: Summary Statistics

Variable	Full Sample		Multinationals	
	Mean	Standard Deviation	Mean	Standard Deviation
Foreign Cash to Assets	0.015	0.248	0.089	0.147
Domestic Cash to Assets	0.210	0.245	0.122	0.179
Total Cash to Assets	0.225	0.249	0.211	0.206
Effective Tax Rate	0.347	0.022	0.330	0.051
Ln(Sales)	4.788	2.505	6.656	1.982
Firm Has Bond Rating	0.209	0.406	0.453	0.498
PPE to Assets	0.276	0.247	0.250	0.193
Return on Assets	-0.018	0.322	0.104	0.152
Firm Pays Dividends	0.325	0.468	0.480	0.500
R&D to Sales	0.199	0.597	0.073	0.245
Market to Book	3.179	3.151	2.275	2.128
Book Leverage	0.380	0.502	0.372	0.384
Capital Expenditure/Assets	0.066	0.093	0.049	0.053
St Dev(Cash Flow)	0.155	0.240	0.086	0.844

Notes:

This table contains the means and standard deviations of the foreign, domestic, and total cash to book assets ratio as well as the control variables used in the analysis. The statistics are provided for both the full sample over the panel's sample period (78,336 firm-year observations) as well as for only those in the BEA multinational (MNC) survey (13,153 firm-year observations). Data definitions can be found in the text.

Table 2: Distribution of Cash and Sales across Subsidiary Countries

	1998				2008		
Country	Foreign Cash %	Foreign Sales %	Corporate Tax Rate	Country	Foreign Cash %	Foreign Sales %	Corporate Tax Rate
United Kingdom	14.6%	14.8%	27.3%	Ireland	13.1%	4.0%	12.5%
Netherlands	10.4%	5.8%	35.0%	United Kingdom	11.1%	12.7%	26.1%
Ireland	9.0%	2.0%	32.0%	Bermuda	9.9%	1.1%	0.0%
Germany	6.9%	10.6%	56.6%	Netherlands	9.9%	4.7%	24.3%
Belgium	5.8%	2.5%	37.2%	Belgium	5.6%	2.4%	31.1%
France	5.4%	6.0%	41.7%	Luxembourg	5.5%	0.4%	0.0%
Switzerland	5.1%	2.9%	27.8%	Canada	5.0%	10.0%	30.9%
Canada	4.3%	11.1%	44.6%	Germany	4.6%	7.0%	30.9%
Bermuda	4.2%	0.6%	0.0%	Switzerland	4.1%	4.5%	7.8%
Italy	3.5%	3.1%	33.0%	France	2.9%	3.9%	34.4%
Singapore	2.9%	3.2%	26.0%	Australia	2.5%	2.9%	30.0%
Japan	2.6%	7.8%	51.6%	Japan	2.2%	5.4%	43.0%
Australia	2.1%	2.8%	36.0%	Singapore	1.9%	4.9%	18.0%
Brazil	2.0%	3.6%	25.0%	Italy	1.7%	2.6%	27.5%
Spain	1.9%	2.1%	35.0%	China	1.6%	3.5%	25.0%
Other Countries	19.3%	21.0%		Other Countries	18.3%	30.2%	
Top 6 Countries	52.0%	42.0%	38.3%	Top 6 Countries	55.0%	25%	15.7%

Notes:

This table contains the fraction of total foreign cash held by subsidiaries in each country and the fraction of total foreign sales originating from subsidiaries in each country. The numbers are reported for 1998 (the beginning of our sample) and 2008 (the end of our sample). The top 15 countries (sorted by cash) are reported in each year along with the fraction of cash and sales in the subsidiaries from the remaining countries. The table also reports the statistics for the top six countries in each year. For example, foreign subsidiaries of US firms located in the United Kingdom held 14.6% of the cash in 1998 and generated 14.8% of foreign sales in 1998. The table also reports the top corporate statutory tax rate for each country in 1998 and 2008 as per Faulkender and Smith (2016).

Table 3: Location of Cash by Industry

	Industry Names (SIC codes)	Foreign Cash	Total Cash	Foreign Income	Foreign Tax Rate
Top 5	Chemical & Allied Products (28) Petroleum & Coal Products (29) Industrial Machinery & Equipment (35) Transportation Equipment (37), and Business Services (73)	69.8%	47.7%	33.1%	26.2%
Top 9	Above five industries plus Not Classified (e.g. conglomerates 99) Food & Kindred Products (20) Electrical Equip & Components (36) Controlling Instruments (38)	85.9%	71.0%	31.5%	26.1%
	All Other Industries	14.1%	29.0%	13.3%	29.0%

Notes:

The table contains the location of cash and earnings by industry (two-digit SIC). The first row contains the numbers for the five industries with the most foreign cash. The second row contains the numbers for the nine industries with the most foreign cash. The remaining industries are reported in the final row. These remaining 53 industries each hold less than 2% of the total foreign cash during our sample period (1998-2008). The foreign cash (total cash) column reports the percent of foreign (total) cash that is held by firms in listed industries. Domestic income is the average fraction of income that is earned in foreign subsidiaries by firms in the listed industries. The foreign tax rate is the average of the marginal statutory corporate tax paid by foreign subsidiaries of firms in the listed industries.

Table 4: Baseline Cash Regressions

	I	II	III	IV	V	VI
	Total Cash	Total Cash	Domestic Cash	Domestic Cash	Foreign Cash	Foreign Cash
	All Firms	MNC	All Firms	MNC	MNC	High Foreign Income MNC
Effective Tax Rate	-0.720*	-0.701*	0.085	0.060	-0.761*	-0.463*
	(0.072)	(0.074)	(0.047)	(0.048)	(0.076)	(0.074)
Ln(Firm Sales)	-0.016*	-0.006[1]	-0.017*	-0.012*	0.006[1]	0.010*
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)
Has Bond Rating	0.010[1]	0.003	0.007	-0.005	0.008	0.022[5]
	(0.004)	(0.008)	(0.003)	(0.007)	(0.006)	(0.011)
PPE to Book Assets	-0.319*	-0.270*	-0.311*	-0.198*	-0.072*	-0.117*
	(0.006)	(0.017)	(0.006)	(0.013)	(0.014)	(0.022)
Return on Assets	0.027*	-0.077[1]	0.032*	-0.009	-0.068[5]	0.029
	(0.006)	(0.029)	(0.005)	(0.023)	(0.032)	(0.028)
Firm Pays Dividends	-0.013*	-0.028*	-0.015*	-0.035*	0.007	0.013
	(0.003)	(0.006)	(0.003)	(0.005)	(0.005)	(0.009)
R&D to Sales	0.136*	0.202*	0.136*	0.202*	0.001	0.012
	(0.003)	(0.016)	(0.003)	(0.018)	(0.011)	(0.011)
Market to Book	0.004*	0.009*	0.004*	0.009*	-0.000	-0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Book Leverage	-0.097*	-0.104*	-0.096*	-0.103*	-0.001	-0.007
	(0.003)	(0.009)	(0.003)	(0.008)	(0.006)	(0.008)
Capital Exp/Sales	0.082*	0.217*	0.075*	0.149*	0.068	0.131[5]
	(0.011)	(0.042)	(0.011)	(0.035)	(0.036)	(0.053)
Domestic Firm (1 if yes)	-0.016*		0.057*			
	(0.004)		(0.004)			
Observations	78,103	13,113	78,103	13,113	13,113	6,556
R^2	0.392	0.305	0.412	0.336	0.094	0.093

Notes:

The table contains regressions of the ratio of the firm's cash to book assets on a set of firm characteristics. Cash is defined as total cash (columns I and II), domestic cash (columns III and IV), and foreign cash (columns V and VI) divided by net assets. The entire sample is included in the regression in columns I and III. Only multinational firms (MNC) are included in the sample in columns II, IV, V, and VI. The sample in Column VI includes only MNCs whose foreign source income percentage is above the median. Each regression contains year dummies. Standard errors are clustered by firm. Statistical significance at the 0.1, 1, or 5% levels is reported as superscripts *, 1, and 5, respectively.

Table 5: Capital Constraints and Additional Risk

	I	II	III	IV	V	VI
	Domestic Cash	Foreign Cash	Domestic Cash	Foreign Cash	Domestic Cash	Foreign Cash
Effective Tax Rate	0.102[5]	-0.764[*]	0.057	-0.772[*]	0.118[1]	-0.768[*]
	(0.047)	(0.077)	(0.049)	(0.078)	(0.048)	(0.079)
Years Constrained (%)	0.131[*]	0.024[5]				
	(0.012)	(0.011)				
StDev(Cash Flow)			0.132[*]	0.039		
			(0.036)	(0.026)		
Product Market Fluidity					0.012[*]	-0.004[*]
					(0.001)	(0.001)
Ln(Firm Sales)	-0.007[*]	0.008[*]	-0.010[*]	0.007[1]	-0.016[*]	0.010[*]
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Has Bond Rating	-0.007	0.009	-0.006	0.008	-0.005	0.006
	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
PPE to Book Assets	-0.214[*]	-0.086[*]	-0.178[*]	-0.077[*]	-0.164[*]	-0.067[*]
	(0.015)	(0.015)	(0.014)	(0.015)	(0.014)	(0.016)
Return on Assets	0.131[*]	-0.066	0.028	-0.084[5]	-0.021	-0.109[*]
	(0.023)	(0.039)	(0.024)	(0.034)	(0.025)	(0.030)
Firm Pays Dividends	-0.030[*]	0.010	-0.034[*]	0.009	-0.021[*]	0.002
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
R&D to Sales	0.215[*]	-0.005	0.224[*]	-0.004	0.153[*]	0.003
	(0.021)	(0.013)	(0.021)	(0.013)	(0.020)	(0.011)
Market to Book	0.012[*]	0.001	0.011[*]	0.001	0.023[*]	0.008[*]
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Book Leverage	-0.098[*]	-0.003	-0.098[*]	-0.002	-0.100[*]	0.006
	(0.008)	(0.006)	(0.008)	(0.006)	(0.010)	(0.007)
Capital Exp/Sales	-0.024	0.041	0.144[*]	0.059	0.033	0.026
	(0.044)	(0.050)	(0.042)	(0.040)	(0.043)	(0.040)
Observations	12,339	12,339	12,375	12,375	11,625	11,625
R^2	0.364	0.107	0.342	0.102	0.409	0.122

Notes:

The table contains regressions of the ratio of the firm's cash to book assets on a set of firm characteristics as in Table 4. The sample includes only MNCs. Cash is defined as domestic cash in columns I, III, and V and foreign cash in columns II, IV, and VI. In the first two columns, we include a measure of capital constraints: the percent of years the firm is financially constrained. This is the percent of years over the last three during which each firm's internal cash flow (EBITDA – taxes – capital expenditure) was insufficient to finance their investment. In columns III-VI, we add two measures of cash flow risk. The first measure is the standard deviation of cash flow for the firm for the preceding five years. The second measure is product market fluidity as measured by Hoberg, Phillips, and Prabhala (2014). Each regression contains year dummies. Standard errors are clustered by firm. Statistical significance at the 0.1, 1, or 5% levels is reported as superscripts *, 1, and 5, respectively.

Table 6: Related Sales Cash Regressions

	I	II	III	IV	V	VI	VII	VIII
	Total Cash	Total Cash	Domestic Cash	Domestic Cash	Foreign Cash	Foreign Cash	Foreign Cash	Foreign Cash (Δ)
	All Firms	MNC	All Firms	MNC	MNC	MNC R&D=0	MNC R&D>0	MNC R&D>0
Related Sales	0.225^5	0.211^5	-0.048	-0.066	0.277^5	0.005	0.423^1	0.077^5
	(0.101)	(0.099)	(0.059)	(0.055)	(0.119)	(0.109)	(0.148)	(0.037)
Effective Tax Rate	-0.539^*	-0.534^*	0.048	0.012	-0.545^*	-0.503^*	-0.484^*	-0.059^5
	(0.074)	(0.076)	(0.063)	(0.064)	(0.070)	(0.097)	(0.088)	(0.029)
Related Sales x Tax Rate	-0.362	-0.315	0.100	0.163	-0.478	0.098	-0.872^5	-0.176
	(0.300)	(0.292)	(0.177)	(0.166)	(0.343)	(0.308)	(0.433)	(0.113)
Ln(Firm Sales)	-0.016^*	-0.009^*	-0.017^*	-0.012^*	0.003	-0.006^1	0.009^1	0.002^5
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.001)
Has Bond Rating	0.009^5	0.003	0.007	-0.005	0.008	0.002	0.012	0.001
	(0.004)	(0.008)	(0.004)	(0.007)	(0.006)	(0.006)	(0.009)	(0.003)
PPE to Book Assets	-0.319^*	-0.266^*	-0.312^*	-0.199^*	-0.067^*	-0.052^*	-0.066^5	0.002
	(0.006)	(0.016)	(0.006)	(0.014)	(0.014)	(0.012)	(0.029)	(0.009)
Return on Assets	0.028^*	-0.081^1	0.031^*	-0.008	-0.072^5	-0.002	-0.124^1	-0.070^*
	(0.006)	(0.029)	(0.005)	(0.023)	(0.032)	(0.027)	(0.043)	(0.014)
Firm Pays Dividends	-0.014^*	-0.027^*	-0.015^*	-0.035^*	0.008	-0.004	0.016^5	0.000
	(0.003)	(0.006)	(0.003)	(0.005)	(0.005)	(0.006)	(0.008)	(0.002)
R&D to Sales	0.136^*	0.199^*	0.136^*	0.203^*	-0.004		-0.016	-0.009^5
	(0.003)	(0.016)	(0.003)	(0.017)	(0.011)		(0.014)	(0.005)
Market to Book	0.004^*	0.009^*	0.004^*	0.009^*	0.001	-0.001	-0.001	0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Book Leverage	-0.097^*	-0.105^*	-0.096^*	-0.103^*	-0.002	0.000	-0.003	0.002
	(0.003)	(0.009)	(0.003)	(0.008)	(0.006)	(0.006)	(0.008)	(0.004)
Capital Exp/Sales	0.082^*	0.222^*	0.076^*	0.148^*	0.074^5	-0.003	0.135	0.032
	(0.011)	(0.042)	(0.011)	(0.034)	(0.034)	(0.034)	(0.090)	(0.033)
Domestic (1 if yes)	-0.007		0.055^*					
	(0.004)		(0.004)					
Observations	78,103	13,113	78,103	13,113	13,113	5,091	8,022	7,107
R^2	0.393	0.317	0.412	0.336	0.122	0.072	0.165	0.058

Notes:

The table contains regressions of the ratio of the firm's cash to book assets on a set of firm characteristics for multinational firms. Cash is defined as total cash (columns I and II), domestic cash (columns III and IV), foreign cash (V-VII) or change in foreign cash (VIII). Related sales is defined as the percent of the firm's total sales that are sales made by its subsidiaries to other subsidiaries or to the parent. The entire sample is included in the regression in column I & III. Only multinational firms (MNC) are included in the sample in the other columns. Column VI contains only firm-years with zero reported R&D while column VII and VIII only contains firm-years with strictly positive reported R&D. Each regression contains year dummies. Standard errors are clustered by firm. Statistical significance at the 0.1, 1, or 5% levels is reported as superscripts *, 1, and 5, respectively.

Table 7: Tax Variable Decomposition

	I	II
	Domestic Cash	Foreign Cash
	MNC	MNC
US Income (%)	0.042*	-0.129*
	(0.006)	(0.008)
Foreign Tax Rate	-0.050	-0.144*
	(0.026)	(0.024)
Ln(Firm Sales)	-0.011*	0.008*
	(0.002)	(0.002)
Has Bond Rating	-0.005	0.007
	(0.007)	(0.006)
PPE to Book Assets	-0.192*	-0.085*
	(0.015)	(0.014)
Return on Assets	-0.018	-0.024
	(0.028)	(0.040)
Firm Pays Dividends	-0.035*	0.011[5]
	(0.006)	(0.005)
R&D to Sales	0.257*	0.018
	(0.029)	(0.016)
Market to Book	0.009*	0.001
	(0.001)	(0.001)
Book Leverage	-0.106*	-0.004
	(0.009)	(0.006)
Capital Exp/Sales	0.199*	0.053
	(0.046)	(0.037)
Observations	12,371	12,371
R^2	0.344	0.158

Notes:

The table contains regressions of the ratio of the firm's domestic or foreign cash to book assets on a set of firm characteristics. Only multinational firms (MNC) are included in the sample. US Income is the percentage of the firm's earnings that were generated in the United States. Foreign Tax Rate is the subsidiary earnings weighted tax rate for the foreign subsidiaries in which the company operates. Each regression contains year dummies. Standard errors are clustered by firm. Statistical significance at the 0.1, 1, or 5% levels is reported as superscripts *, 1, and 5, respectively.

Table 8: Subsidiary Level Regressions

	I	II	III	IV	V	VI	VII	VIII
Foreign Tax Rate	-0.027*	-0.032*	-0.031*	-0.014*	-0.014*	-0.022*	-0.021*	-0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)
Related Sales					0.027*	0.023*	0.023*	0.022*
					(0.005)	(0.004)	(0.004)	(0.004)
Related Sales x Tax					-0.077*	-0.057*	-0.057*	-0.062*
					(0.013)	(0.011)	(0.011)	(0.012)
Subsidiary PPE	0.276*	0.199*	0.219*	0.264*	0.276*	0.198*	0.217*	0.264*
	(0.018)	(0.016)	(0.018)	(0.018)	(0.018)	(0.016)	(0.018)	(0.018)
Subsidiary Ln(Sales)	0.002*	0.003*	0.003*	0.001*	0.001*	0.003*	0.003*	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Subsidiary R&D	0.005*	0.006*	0.006*	0.004*	0.004*	0.006*	0.005*	0.003*
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm Dummies	No	Yes	No	No	No	Yes	No	No
Firm-Year Dummies	No	No	Yes	No	No	No	Yes	No
Country Dummies	No	No	No	Yes	No	No	No	Yes
Observations	116,272	116,272	116,272	116,271	116,272	116,272	116,272	116,271
R^2	0.117	0.302	0.409	0.153	0.122	0.306	0.413	0.155

Notes:

The table contains regressions of the ratio of a subsidiary's cash to book assets on the tax rate in the subsidiary, the percent of the subsidiaries sales which are made to the parent or other subsidiaries of the parent (related sales) and the cross product. The subsidiary's property, plant, and equipment (PPE) to book value of assets, size (Ln[sales]), and R&D/Sales are included as additional explanatory variables. Each observation represents a MNC's subsidiary in a given year. Thus, a firm that has three subsidiaries will have three observations per year. Standard errors are clustered by firm. Statistical significance at the 0.1, 1, or 5% levels is reported as superscripts *, 1, and 5, respectively.

Figure 1: Aggregate Corporate Cash – Flow of Funds
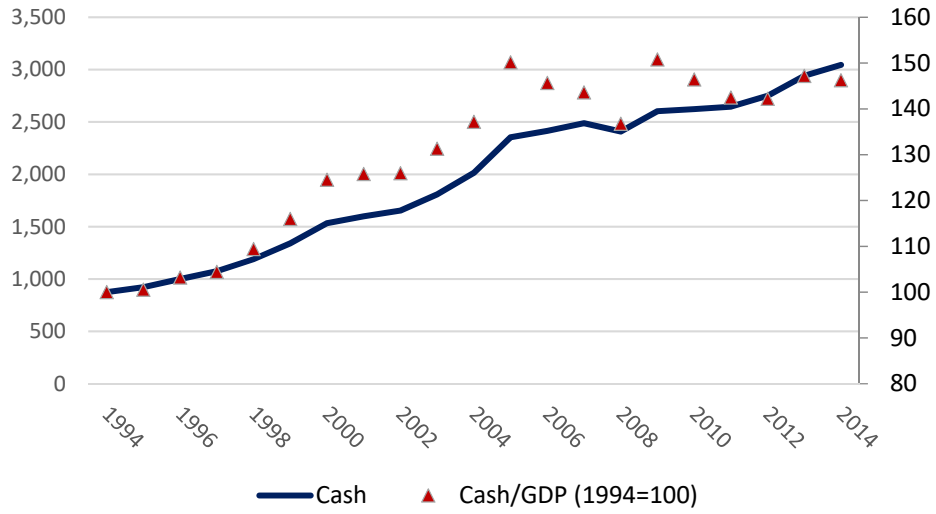
Notes:

The data is from the Federal Reserve Flow of Funds, Table L. 102 Nonfinancial Business (December 15, 2015). We summed rows 2 through 11. This includes checking and savings accounts of non-financial businesses as well as investment in debt securities (e.g. commercial paper, government bonds, and loans). The data is from 1998 to 2014.

Figure 2: Domestic and Foreign Cash
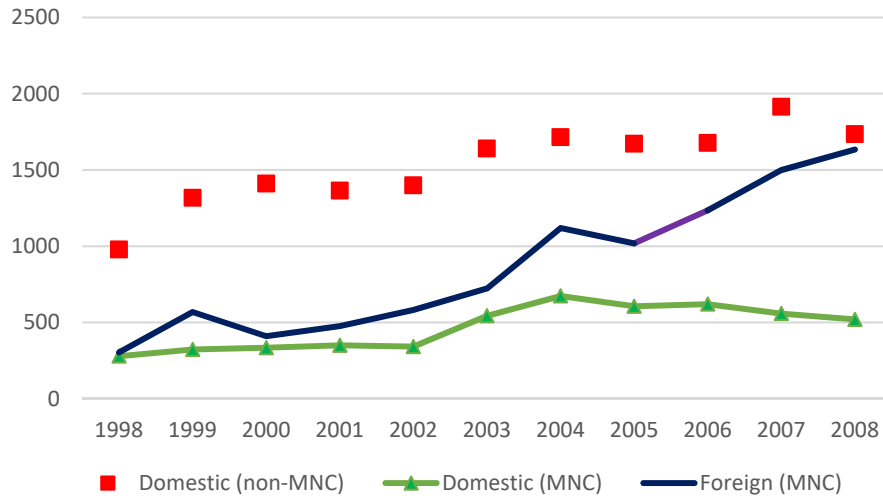
Notes:

The figure graphs the domestic cash of non-MNC and both the foreign and domestic cash for MNC in $B. Total cash is from Compustat, and foreign cash is from the BEA (see paper for details). Domestic cash for MNC is the difference between total cash and foreign cash. Domestic cash levels of domestic firms increase by a factor of 1.8x while domestic cash levels of MNCs increase by a factor of 1.9x over the sample period. GDP increases by a factor of 1.3x. The level of foreign cash (held by MNCs) increases by a factor of 5.4x.

Figure 3: Corporate Tax Rates: US and Foreign Rates
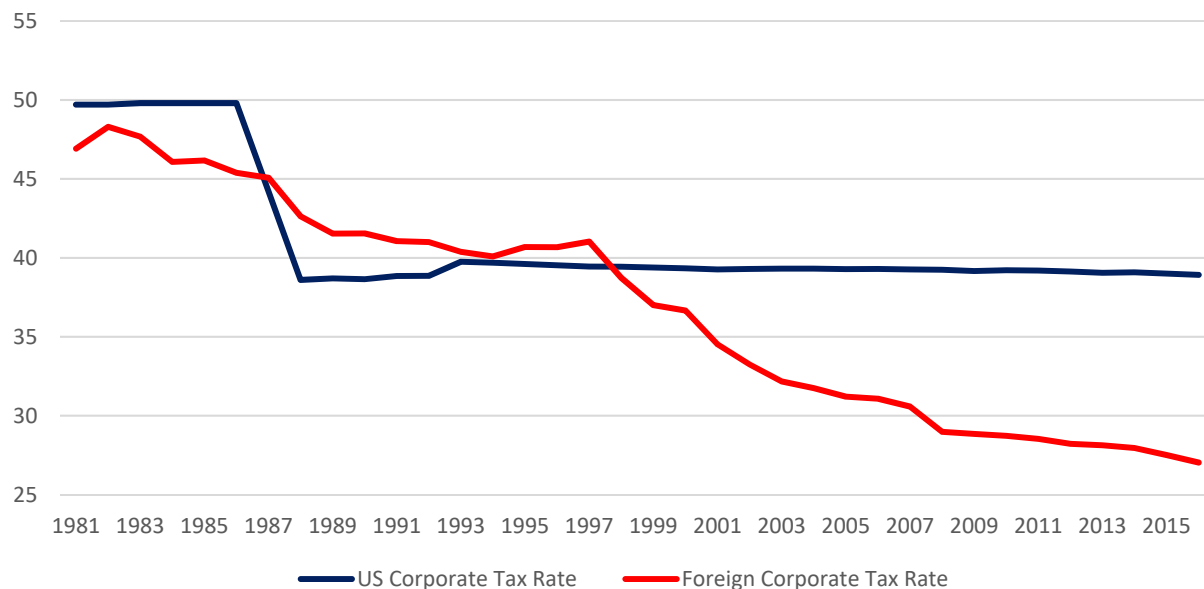
Notes:

The figure graphs the top US corporate tax rate and the average corporate tax rate across the following foreign countries: Australia, Belgium, Canada, Ireland, Italy, France, Germany, Japan, Luxembourg, the Netherlands, Switzerland, and the United Kingdom. These are the countries in the top 15 of cash holdings (see Table 2) where the tax rate data was available from the OECD website.[30]

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[30] http://www.oecd.org/tax/tax-policy/tax-database.htm#C_CorporateCaptial (before 2000) and http://stats.oecd.org//Index.aspx?QueryId=58204 (2000 and after). The data is not reported for Japan before 1990 or for Luxembourg before 2000. These countries are excluded from the average in these years.
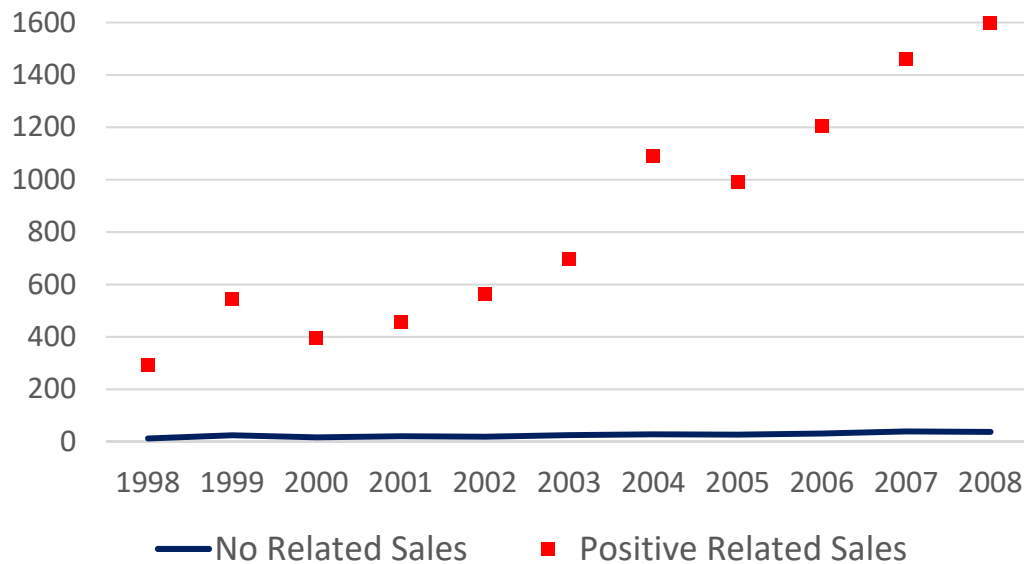
Figure 4: Foreign Cash of MNC by R&D
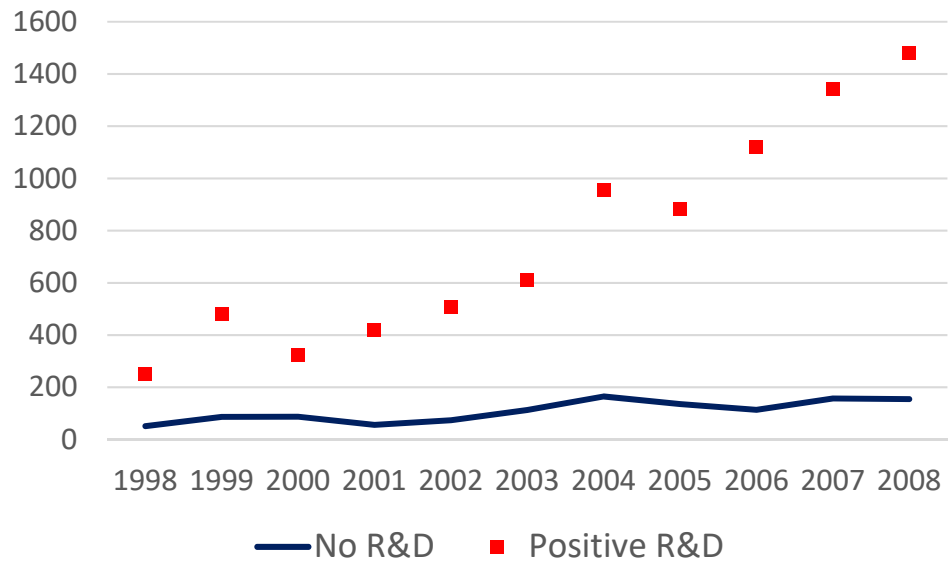
Notes:

      The figure graphs total foreign cash for two samples: MNCs that report zero R&D (or R&D is missing) and MNCs that report positive R&D. 61 percent of firm-year observations report positive R&D. Cash is reported in $B.

Figure 5: Foreign Cash of MNC by Related Sales

Notes:

        The figure graphs total foreign cash for two samples: MNCs that report no related sales and firms that report positive related sales. Related sales are subsidiary's revenue arising from sales to the other subsidiaries of the firm or to its parent. 65 percent of firm-year observations report positive related sales. Cash is reported in $B.

Figure 6: Percent of Income Earned by MNC in Their Foreign Subsidiaries
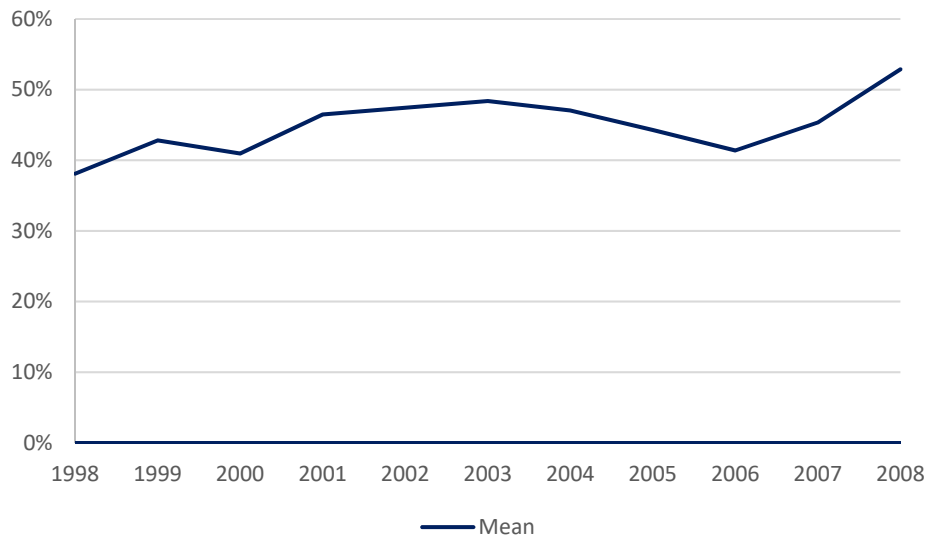
Notes:

        The figure graphs the mean percent of MNCs' income that is earned in their foreign subsidiaries (see Table 6).