Do U.S. Firms Hold More Cash than Foreign Firms Do?

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From 1998 to 2011, U.S. firms held more cash on average (but not at the median) than similar foreign firms (foreign twins) did. The average difference in cash holdings does not increase after 2008, and it is driven by highly R&D-intensive U.S. firms. Because there are almost no similarly R&D-intensive foreign firms, mean comparisons involving these U.S. firms are not reliable. Without these U.S. firms, neither U.S. multinational firms nor purely domestic U.S. firms hold more cash than their foreign twins do. Country characteristics have negligible explanatory power for differences in cash holdings between U.S. firms and their foreign twins. (*JEL* G30, G31, G32)

Received April 17, 2014; accepted August 4, 2015 by Editor David Denis.

Considerable attention is paid to the large cash holdings of American firms. Many observers have invoked U.S.-specific factors to explain these large holdings. A common view is that companies have been hoarding cash while "shying away from investing for the future."[1] Many commentators have argued that firms invest less and, therefore, accumulate cash because of a poor regulatory climate and excessive uncertainty. One article states, for instance, that "Companies are hoarding a record amount of cash as fears of another Lehman-like credit crisis, weak demand and a lack of incentives from the Obama Administration cause chief executives to choose a negative real return on their money over hiring workers or building a new plant."[2] Another

We are grateful for comments from Heitor Almeida, Jennifer Blouin, David Denis, Harry DeAngelo, Fritz Foley, Andrei Gonçalves, Kathy Kahle, Leslie Robinson, Henri Servaes, Stephanie Sikes, Denis Sosyura, and seminar participants at Georgetown University, George Mason University, the Ohio State University, the University of Hong Kong, the University of Michigan, and the 2014 American Finance Association meetings. We also thank Adam Davidson and Jason Sturgess for useful conversations and Brian Baugh, Yeejin Jang, Robert Prilmeier, and Matt Wynter for helpful research assistance. Send correspondence to René M. Stulz, The Ohio State University, Columbus, OH 43210; telephone: (614) 292-1970. E-mail: Stulz@cob.ohio-state.edu.

1 Nocera, Joe. "What is business waiting for?" The New York Times, August 15, 2011.

2 Ibid.

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doi:10.1093/rfs/hhv064 Advance Access publication October 31, 2015

frequently mentioned explanation for the high cash holdings of American firms is that repatriation of cash held abroad by multinational corporations has adverse tax consequences, and, therefore, it is advantageous for them to keep their profits abroad in the form of cash.[3] For instance, an article in The New York Times concludes, "the dominant explanation for the increased liquidity of nonfinancial corporations appears to be the growing role of multinational corporations and the profits of their foreign operations."[4] Further, policymakers have considered using the tax system to discourage firms from having high cash holdings, hoping that a decrease in cash holdings will promote growth. The issue figured prominently in President Obama's 2015 State of the Union address.

U.S. firms could have higher cash holdings for two fundamentally different reasons. First, something could be unique about the United States that leads U.S. firms to have higher cash holdings compared with foreign firms. Second, a given U.S. firm would hold the same amount of cash if it were located in a foreign country, but cash holdings differ depending on firm characteristics, and the United States has more of the type of firms that have high holdings of cash. With this explanation, on average, U.S. firms hold more compared with foreign firms, even though U.S. firms hold the same amount of cash as similar foreign firms hold. To assess which explanation is the most relevant, we compare the cash holdings of U.S. firms with those of similar foreign firms, their foreign twins, from 1998 to 2011. If U.S. firms hold more cash than their foreign twins do, the former explanation is the correct one. If they do not, the latter explanation is more appropriate.

Resolving the issue of whether the perceived high cash holdings of U.S. firms are a U.S.-specific phenomenon is important in understanding the cash holdings of these firms, the determinants of cash holdings in general, and the role of countries in affecting firm financial policies. Despite the importance of the issue, we know of no investigation of whether U.S. firms hold more cash than similar foreign firms do. Herein, we study this matter with a large panel of firms from 41 countries from 1998 to 2011. During our sample period, the average cash/assets ratio of U.S. firms increased from 16% to 21%. Throughout our sample period, foreign firms on average hold less cash than U.S. firms hold, and the rate of increase in their cash holdings is less than the rate of increase of U.S. firms.

We know well from the literature (e.g., Opler et al. 1999) that cash holdings of firms with different characteristics can be sharply different. Hence, finding that U.S. firms hold more cash than foreign firms do could be explained by differences in firm characteristics. To account for differences in firm characteristics, we conduct our analysis using twin pairs of firms. For each

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[3] Note that the cash is not literally kept abroad in many cases, but it is kept from the parent company. For instance, a foreign subsidiary could keep its cash at a bank in New York, but this cash could not be repatriated to the parent without adverse tax consequences.

[4] Bartlett, Bruce. "The growing corporate cash hoard." The New York Times, February 12, 2013.

U.S. firm, we find the foreign firm with observable characteristics that best match the characteristics of the U.S. firm for that year. If we cannot find a close match, we exclude the U.S. firm from our comparison for that particular year. We find that the median difference in the cash/assets ratio for U.S. firms and their twins is negative every year and that the average annual median difference is significantly negative. The average annual mean difference is significantly positive. The means have an inverted u-shape pattern, with the highest mean in 2006. Neither the mean nor the median are significantly different at the end of our sample period relative to the beginning of the sample period. Consequently, and contrary to some explanations for the high cash holdings of U.S. firms following the financial crisis of 2007-2009, there is no evidence that U.S. firms hold more cash relative to similar foreign firms after the financial crisis than before.

That the difference in cash holdings between U.S. firms and their foreign twins has a positive mean, but a negative median can be explained by the small number of U.S. firms with extremely large R&D outlays when measured against sales. When we define "high-R&D U.S. firms" as firms in the top-two deciles of U.S. firms with positive R&D outlays, we find that the mean annual difference between U.S. firms and their twins is insignificantly negative when the high-R&D U.S. firms are omitted from the comparison. The top-two deciles represent only 3.1% of matched firm-years, indicating the greater difficulty in matching the highest U.S. R&D-to-sales firms. Further evidence of this difficulty is that, when we annually rank firms in R&D deciles based on U.S. breakpoints, there are no foreign firms in the dataset with R&D outlays in the top decile for most years. When we find reliable matches for U.S. firms with positive R&D, which we do when we drop the top-two deciles of R&D to sales for U.S. firms, foreign firms hold as much or more cash as do U.S. firms.

When we consider multinational firms only, we find that the average median cash difference is negative, but insignificant, whereas the average mean difference is significant and positive. This evidence suggests that, while the typical U.S. multinational firm does not hold more cash than its foreign twin holds, there are some multinational firms with larger cash holdings than those of their foreign twins, and these firms skew the distribution of cash/assets differences so that the mean difference is larger than the median. Because high U.S. R&D firms cause the skewness in the full sample, we examine the effect of R&D within the sample of multinational firms. We find that U.S. multinational firms in the bottom half of R&D/sales (among firms that report R&D) have cash holdings that are indistinguishable from foreign multinational corporations. However, U.S. multinational firms that are in the top-two deciles of R&D/sales have cash holdings greater than their matched foreign multinationals by roughly 30% of assets. If we drop the top-two deciles, the mean difference is only marginally positive, whereas it becomes significantly negative if we drop the top-three deciles. Interestingly, we document a similar phenomenon that holds for purely domestic firms. Thus, the U.S. firms that have relatively high cash

holdings compared with those of foreign firms are firms with high R&D rather than simply multinational firms. This suggests that the tax incentive explanation for high cash holdings is at least limited.

Almeida and others (2014) and Damodaran (2005) review the literature on cash holdings. The latter paper discusses predictions for cross-country comparisons and concludes that firms in emerging countries and, more generally, firms in countries with weaker financial development should hold more cash. Additionally, those studies predict that U.S. firms should hold less cash than firms in countries with poor investor protection hold because agency problems are greater in such countries, and they find support for that prediction (see Dittmar, Mahrt-Smith, and Servaes 2003). Evidence in Kalcheva and Lins (2007) and Pinkowitz, Stulz, and Williamson (2006) shows that cash held by firms in countries that protect investors poorly is valued less, which is consistent with the view that, in such countries, agency problems lead firms to hold too much cash from the perspective of minority shareholders. The literature also predicts that firms should hold less cash in countries with better-developed financial markets because such development makes it easier for firms to raise funds when they need them. Yet, Kalcheva and Lins (2007) and Lins, Servaes, and Tufano (2010) find the opposite result using proxies for the development of credit markets.

A considerable amount of literature relates firm characteristics to country characteristics such as laws, enforcement of laws, and so on. This literature shows that a country's institutions affect the types of investments firms make in that country. A greater risk of expropriation makes it less likely that a firm will invest in assets that can be more easily expropriated. Therefore, cash holdings can differ across countries because differences in institutions cause differences in firm characteristics. We have nothing to say about the determinants of differences in firm characteristics across countries. We show that when U.S. firms are compared with firms that have similar observable characteristics, their cash holdings are very similar. Consequently, when comparing mean or median cash holdings of U.S. firms with mean or median cash holdings of foreign firms, differences arise mostly because of firm heterogeneity rather than because of country differences. Although we do not explore the implications of heterogeneity of firms in governance practices for cash holdings, Kalcheva and Lins (2007) show that cash holdings are related to the interaction of country characteristics and firm governance characteristics.

The existing literature comparing cash holdings across countries proceeds along two different tracks, but both tracks involve the use of linear regressions. One approach is to estimate a regression of cash holdings on firm and country characteristics. This approach was followed first by Dittmar, Mahrt-Smith, and Servaes (2003). They find that firms hold more cash in countries in which shareholder protection is weak. Kalcheva and Lins (2007) find that firms with more entrenched controlling shareholders hold more cash when investor protection is weak. Lins, Servaes, and Tufano (2010) use an international

sample of firms that answered a survey about their liquidity policies. They find a very strong negative relation between the ratio of credit to GDP and cash holdings. Another approach is followed by Iskandar-Datta and Jia (2012). They consider seven industrialized countries, estimate the same regression separately for each country, and conclude that the coefficients are generally similar. A number of studies look at individual countries. For instance, Pinkowitz and Williamson (2001) and Kato, Li, and Skinner (2013) show that Japanese firms hold more cash than U.S. firms hold, by using regression models controlling for firm characteristics. None of the papers discussed in this paragraph answer the question of whether U.S. firms hold more cash than similar foreign firms hold.

Finally, there is a growing body of literature on the role of taxes in the liquidity decisions of U.S. multinational corporations, following Foley and others (2007). Using data on U.S. firms' cash holdings in foreign countries and repatriation tax rates, this study finds that both firms with a higher repatriation tax rate and subsidiaries in lower tax rate countries hold more cash. Some studies find evidence that cash held abroad creates agency problems. For instance, Edwards, Kravet, and Wilson (2014) show that firms make poorer acquisitions out of cash held abroad than out of cash held domestically, and Campbell and others (2013) find that a marginal dollar of cash is worth less if acquired abroad than at home. None of this literature shows that the typical U.S. multinational firm does not hold more cash than similar foreign multinational firms hold despite the difference in tax regime.

Our study contributes to the literature on cash holdings, the implications of the U.S. tax regime for multinational corporations, differences in financial policies across countries, and the relation between financial policies and institutions.

1. The Dataset

Our dataset starts in 1998 and ends in 2011. Because of our use of international data from many countries and our dependence on country-level variables that are measured annually, we focus on annual data. Foreign countries experienced important changes in the 1990s as a number of countries liberalized. We choose the starting date for our sample after the wave of liberalizations ended. If we were to start before 1998, our sample would have had fewer countries.

We use Compustat to construct our U.S. sample. We include all publicly traded industrial firms with assets and market capitalization (in year 2000 dollars) greater than $5 million. Financial firms (SIC 6000-6999) and utilities (SIC 4900-4999) are excluded. Our data on foreign firms come from Compustat Global.[5] Though there has been some convergence in accounting rules across

[5] Using Compustat Global has two advantages, compared with using Worldscope. First, Compustat Global standardizes the data so that they are comparable to Compustat. Thus, we can match foreign firms to U.S.

foreign countries, these rules still differ between the United States and foreign countries. Compustat Global makes an effort to facilitate comparison of the data across countries, but it is important to remember that cross-country comparisons are subject to the caveat that there are differences in accounting rules, in enforcement of accounting rules, and in incentives of shareholders with respect to decisions that affect accounting variables. Foreign currency data are converted to dollars using exchange rates available in Compustat. For stock variables, we use the prevailing exchange rate at the end of the firm's fiscal year. For flow variables, we use the average of monthly exchange rates during the fiscal year. We only include countries that have at least 10 nonfinancial firms with data in Compustat Global each year.

Except for robustness checks, we assume that the firm characteristics that determine a firm's cash holdings are those used by Bates, Kahle, and Stulz (2009, hereafter BKS) in their regression models. These models make cash holdings depend on variables that proxy for the motives to hold cash that have been analyzed in the literature and are discussed further in the next section. The variables are a firm's cash flow to assets, its industry's cash flow volatility, the market value of its assets divided by the book value of its assets, the logarithm of its assets measured in 2000 dollars, its non-cash net working capital to assets, capital expenditures to assets, short- and long-term debt to assets, R&D expense to sales, an indicator variable that takes value one if the firm pays dividends, acquisitions to assets, net debt issuance to assets, and net equity issuance to assets. The details of the construction of these variables are shown in the Appendix.

Table 1 provides information on our dataset. We split the sample between advanced and developing countries, using the International Monetary Fund (IMF) classification, and sort the table by descending order of yearly firm observations. The first column lists the countries for which we have data. Not surprisingly, the sample of 41 countries has more countries categorized by the IMF as advanced countries than as developing ones. The number of firms differs sharply across countries and occasionally varies substantially across years within countries. Some of the within-country variation is explained by existing firms being added to Compustat Global. Because we require firms to have similar characteristics in our comparisons, the fact that firms are added to Compustat Global affects the number of pairs we find but not the comparison results for the pairs available to us. As we will see, because our tests are performed yearly, limitations of Compustat Global early in our sample do not affect results for the later years in the sample. As is commonly observed for international datasets, the number of firms from Japan dwarfs the number of firms of any other foreign country. Therefore, it will be important to make sure that our results are not due to Japan. This is especially important given that

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firms from Compustat. Second, we have more observations that we can use with Compustat Global than with Worldscope.

the literature has shown that Japanese firms tend to have high cash holdings (e.g., Pinkowitz and Williamson 2001). The foreign country with the second-highest number of firms is the United Kingdom. Hungary has the lowest number of firms.

The remainder of Table 1 provides information on the institutions, the financial development, and the economic development of the countries in our sample. As discussed earlier, the literature makes predictions on holdings of cash based on these country characteristics. There is much variation across countries for all the characteristics we consider. The source of the data is the World Bank Development Indicators database, except for the first index. The Worldwide Governance Indicators (WGI) of the World Bank provides a summary of the overall governance quality of a country. These indicators are obtained from combining several hundred individual variables into six indices, measuring political stability, government effectiveness, regulatory quality, enforcement of the rule of law, corruption, and the extent to which a country's citizens are able to participate in selecting their government. We follow Kaufmann, Kraay, and Mastruzzi (2009) and consider the mean of the six indices for each country, which we call the WGI index. The WGI index ranges between -2 and 2. Almost all of the advanced countries have an average WGI index over the sample period between 1 and 2. Typically, developing countries have an index below 1. The next index we use is the anti-self-dealing index (DLLS) from Djankov and others (2008). We normalize this index to range from 0 to 1. The index increases as investors have more protection from related transactions. There is much less of a distinction between advanced and developing countries. We then show values for the anti-director index (ADRI) from La Porta and others (1998) as revised in Djankov and others (2008). This index ranges from 1 to 5. Again, there is no clear distinction between the advanced and developing countries as there are countries with a value of five among the developing countries. The United States ranks below the average of advanced countries for the WGI and ADRI indices, but above the average for the anti-self-dealing index. Compared with developing countries, the United States ranks much higher than the average of the WGI indices for these countries. The averages of the two other indices for developing countries are similar to their values for advanced countries.

Turning next to measures of financial and economic development, we start with the ratio of the dollar amount of stock market trading divided by the stock market capitalization. We refer to this as turnover, which is a measure of the activity of the stock market and is an often-used measure of stock market development (e.g., Levine and Zervos 1998). We find that this measure is quite high for the United States. However, the measure is also quite high for countries that are surprising, as its highest value is for South Korea, and the second-highest value is for Pakistan. We use a measure of the development of the corporate bond market, namely bond market capitalization to GDP. The United States ranks very high on that measure, as well. The third measure of financial

Table 1
Sample of countries 1998–2011

Panel A: Advanced countries

Country	Minimum	Maximum	Mean	Median	WGI	DLLS	ADRI	Turnover	Bond mkt	Bank credit	GDP
United States	2,504	3,365	2,831.2	2,788	1.34	0.7	3.0	1.90	1.02	2.11	42.57
Japan	1,169	2,786	2,440.4	2,595	1.14	0.5	4.5	1.02	0.42	3.12	35.31
United Kingdom	654	1,019	883.1	912	1.50	1.0	5.0	1.21	0.16	1.62	36.55
Canada	576	771	667.7	666	1.63	0.6	4.0	0.72	0.30	1.69	35.10
Taiwan	95	1,296	660.1	735	0.88	0.6	3.0	.	.	.	.
Australia	237	757	480.0	557	1.60	0.8	4.0	0.81	0.52	1.27	34.21
Germany	294	502	442.1	454	1.49	0.3	3.5	1.28	0.42	1.36	34.23
France	340	474	434.2	453	1.22	0.4	3.5	0.93	0.43	1.15	33.39
South Korea	182	681	404.8	385	0.70	0.5	4.5	2.20	0.58	1.36	19.47
Singapore	178	459	333.4	350	1.48	1.0	5.0	0.71	0.16	0.76	29.93
Sweden	106	238	193.6	209	1.76	0.3	3.5	1.14	0.46	1.20	40.29
Italy	101	188	157.0	165	0.66	0.4	2.0	1.32	0.32	1.18	30.33
Switzerland	120	165	149.1	153	1.75	0.3	3.0	0.95	0.34	1.74	52.08
Hong Kong	86	240	131.2	112	1.34	1.0	5.0	0.93	0.16	1.54	27.33
Netherlands	90	137	116.6	117	1.74	0.2	2.5	1.27	0.58	1.75	38.88
Greece	36	169	112.1	116	0.63	0.2	2.0	0.55	0.09	1.13	21.36
Norway	63	147	105.1	99	1.69	0.4	3.5	1.12	0.26	0.79	64.30
Finland	56	110	93.9	101	1.90	0.5	3.5	1.10	0.24	0.78	36.67
Spain	77	91	85.6	86	1.04	0.4	5.0	1.67	0.34	1.66	25.10
Denmark	72	92	82.1	82	1.85	0.5	4.0	0.79	1.44	1.68	46.44
Israel	24	154	77.6	67	0.57	0.7	4.0	0.58	.	0.80	20.67
Belgium	49	89	73.4	73	1.33	0.5	3.0	0.41	0.40	1.14	35.61
New Zealand	37	72	58.0	63	1.76	1.0	4.0	0.45	.	1.29	26.65
Austria	43	59	52.1	52	1.61	0.2	2.5	0.44	0.42	1.29	36.98
Ireland	30	41	36.7	37	1.52	0.8	5.0	0.52	0.60	1.55	45.12
Portugal	32	40	36.4	36	1.12	0.4	2.5	0.65	0.34	1.53	18.17

(*continued*)

Table 1
Continued

Panel B: Developing countries

Country	Minimum	Maximum	Mean	Median	WGI	DLLS	ADRI	Turnover	Bond mkt	Bank credit	GDP
China	24	1,622	629.5	581	−0.54	0.8	1.0	1.43	0.16	1.38	2.36
India	45	1,259	541.8	467	−0.26	0.6	5.0	0.96	0.03	0.66	0.90
Malaysia	378	674	523.2	547	0.35	1.0	5.0	0.33	0.49	1.30	5.55
Bermuda	166	365	291.0	332	1.11	.	.	.	.	.	75.26
Thailand	131	326	234.4	246	−0.10	0.8	4.0	0.87	0.12	1.35	2.74
South Africa	95	187	148.6	154	0.34	0.8	5.0	0.46	0.16	1.78	5.24
Indonesia	93	219	141.1	136	−0.66	0.7	4.0	0.51	0.02	0.46	1.32
Cayman Islands	26	274	135.9	141	1.12	.	.	.	.	.	.
Poland	25	239	110.1	76	0.67	0.3	2.0	0.45	0.01	0.53	9.05
Brazil	38	176	96.3	64	0.02	0.3	5.0	0.57	0.17	0.87	5.07
Turkey	32	111	72.2	75	−0.10	0.4	3.0	1.58	0.00	0.52	7.18
Pakistan	26	113	69.9	59	−1.02	0.4	4.0	2.00	.	0.45	0.70
Philippines	39	81	56.7	55	−0.42	0.22	4.0	0.23	0.01	0.52	1.23
Mexico	43	73	55.6	57	−0.10	0.17	3.0	0.28	0.13	0.36	7.85
Hungary	10	15	13.1	13	0.89	0.18	2.0	0.80	0.06	0.65	10.14

Minimum, *Maximum*, *Mean*, and *Median* refer to number of firms within the country from 1998 to 2011. Advanced countries based on IMF classifications are shown in Panel A. Developing countries are shown in Panel B. Countries are sorted by declining mean number of firms. *WGI* is the equal-weighted average of the six components of the Worldwide Governance Indicators from www.govindicators.org. *DLLS* and *ADRI* are the anti-self-dealing and anti-director rights indices from Andrei Shleifer's Web site. *Turnover* is the ratio of total stock market value traded to total stock market cap, and it comes from the World Bank. *Bond mkt* is the value bonds issued by the private sector deflated by GDP. *Bank credit* is domestic credit provided by the banking sector. *GDP* is GDP per capita (in thousands of 2000 US$). *Governance* and *development* variables indicate the means of the variable, within country from 1998 to 2011. Total number of firm-years is 199,595.

development measures bank credit. That measure is high for the United States. The only country with a higher measure is Japan. Finally, we have GDP per capita. Not surprisingly, there is a large difference between developing countries and advanced countries. The countries with the highest GDP per capita are Norway and Switzerland.

2. Do U.S. Firms Hold More Cash than Similar Foreign Firms Do?

In this section, we investigate whether the cash holdings of U.S. firms differ from the cash holdings of comparable foreign firms over the sample period. We first show results for the dataset as a whole, without controlling for differences in firm characteristics. We then motivate our twins approach, implement it, evaluate the robustness of the results, and compare the results to the regression approach.

2.1 Cash holdings across countries

Because the level of cash a corporation holds is an increasing function of its assets, the finance literature compares cash holdings across firms, normalizing these holdings by assets. Therefore, we compare the ratio of cash to assets across countries. As shown in Table 1, the number of firms differs sharply across countries. To compare the U.S. firms with foreign firms, we could compare U.S. firms to all foreign firms together, but this approach would mean that Japanese firms would have more weight in the comparison than firms from any other country have. The approach we follow is to take the average or median of the cash/assets ratio within a country and then take the average of the country results. With this approach, every country has equal weight in the comparisons irrespective of the number of firms it has. Table 2 shows the mean and median annual cash/assets for the United States and foreign countries, as well as the ratio of U.S. cash/assets to foreign cash/assets. We also split the foreign countries between advanced and developing countries, using the IMF classification.

Whether we consider the mean or the median cash/assets ratio, it is clear from Table 2 that the U.S. firms hold more cash than foreign firms do at the end of our sample period. The mean ratio of the U.S. to foreign cash/assets has an average of 1.53 over our sample period. The ratio is at or below the mean every year after 2005, but it shows little variation. The minimum of the ratio, 1.45, is in 2008. The maximum is 1.64 in 2000. The evolution of the median is quite different. At the beginning of the sample period, the U.S. median is below the foreign median. Starting with 2001, the U.S. median is higher. The ratio peaks in 2005 at 1.43; it then falls steadily to reach 1.19 in 2007, before increasing again afterward. At the end of the sample, it is at 1.33, a level that is exceeded in 2004, 2005, 2009, and 2010.

It is interesting to note that the peak mean cash/assets ratio in our sample is in 2005 for U.S. firms and in 2007 for foreign firms. In contrast, the peak median cash/assets ratio is near the end of the sample for both U.S. firms and foreign

Table 2
Averages of country mean and median cash/asset ratios

Panel A: Annual cross-sectional means of cash holdings

	U.S.	Foreign ($N = 40$)		Advanced ($N = 25$)		Developing ($N = 15$)	
	Mean	Mean	Ratio	Mean	Ratio	Mean	Ratio
1998	0.1621	0.1103***	1.47	0.1121***	1.45	0.1073***	1.51
1999	0.1810	0.1132***	1.60	0.1157***	1.56	0.1090***	1.66
2000	0.1893	0.1155***	1.64	0.1160***	1.63	0.1146***	1.65
2001	0.1974	0.1278***	1.54	0.1282***	1.54	0.1273***	1.55
2002	0.1988	0.1297***	1.53	0.1305***	1.52	0.1283***	1.55
2003	0.2111	0.1350***	1.56	0.1404***	1.50	0.1259***	1.68
2004	0.2173	0.1380***	1.57	0.1433***	1.52	0.1291***	1.68
2005	0.2175	0.1394***	1.56	0.1456***	1.49	0.1290***	1.69
2006	0.2132	0.1400***	1.52	0.1460***	1.46	0.1299***	1.64
2007	0.2137	0.1432***	1.49	0.1475***	1.45	0.1360***	1.57
2008	0.1924	0.1328***	1.45	0.1361***	1.41	0.1273***	1.51
2009	0.2109	0.1414***	1.49	0.1469***	1.44	0.1322***	1.60
2010	0.2143	0.1401***	1.53	0.1453***	1.47	0.1315***	1.63
2011	0.2054	0.1368***	1.50	0.1399***	1.47	0.1315***	1.56
Panel B: Annual cross-sectional medians of cash holdings							
1998	0.0631	0.0767**	0.82	0.0766**	0.82	0.0769	0.82
1999	0.0649	0.0758**	0.86	0.0757	0.86	0.0758	0.86
2000	0.0696	0.0746	0.93	0.0716	0.97	0.0795	0.88
2001	0.0874	0.0814	1.07	0.0776	1.13	0.0877	1.00
2002	0.1003	0.0835***	1.20	0.0798***	1.26	0.0896	1.12
2003	0.1201	0.0911***	1.32	0.0903***	1.33	0.0925**	1.30
2004	0.1282	0.0946***	1.35	0.0952***	1.35	0.0937***	1.37
2005	0.1339	0.0936***	1.43	0.0959***	1.40	0.0896***	1.49
2006	0.1220	0.0950***	1.28	0.0956***	1.28	0.0939**	1.30
2007	0.1135	0.0955***	1.19	0.0948**	1.20	0.0966	1.18
2008	0.1064	0.0885***	1.20	0.0882**	1.21	0.0891*	1.19
2009	0.1362	0.1013***	1.34	0.1044***	1.30	0.0961***	1.42
2010	0.1436	0.1006***	1.43	0.1034***	1.39	0.0959***	1.50
2011	0.1265	0.0955***	1.33	0.0978***	1.29	0.0915**	1.38

Panel A (Panel B) shows the mean of the annual cross-sectional means (medians) of cash/asset for the U.S. firms and foreign firms based on country grouping. The column *Ratio* shows the ratio of the U.S. mean (median) to the foreign mean (median) for that year. *Advanced* is whether the country is defined as *advanced* by the International Monetary Fund, and *Developing* are all countries in the sample that are not designated as advanced. *, **, and *** indicate that the mean is significantly different than the U.S. mean at the 10%, 5%, and 1% levels, respectively, using a two-tailed t-test. The standard errors for the t-tests are based on the cross-sectional distribution of country means (or medians). The results in the category *Advanced* exclude the United States.

firms. Our data show a u-shape pattern in cash holdings around 2008, as in Kahle and Stulz (2013). Interestingly, this pattern holds for foreign countries, as well. At the beginning of the sample period, the mean cash/assets ratio of U.S. firms is higher than that of foreign firms, whereas the median cash-assets ratio is lower. Over time, the U.S. median increases faster than the foreign median does, so that the medians cross in 2001. When the median cash/assets ratio for U.S. firms exceeds the median cash/assets ratio for foreign firms, the difference is always less than it is for the mean. The difference for the medians never exceeds three percentage points, whereas the difference for the means is below three percentage points only once. At the end of the sample, the U.S. mean exceeds the foreign mean by 50%. Comparing average and median holdings for advanced and developing countries, we find that the mean of advanced

countries is always higher than the mean for developing countries. The highest difference is 1.66 percentage points in 2005.

The difference between the mean cash/assets ratio of a country and the median is striking. The reason for this difference is that the distribution of the cash/assets ratio is skewed to the right. It is more so for U.S. firms than for foreign firms. The normal distribution is rejected for both distributions. With this skewness, the median is a better measure of central tendency. In the following, we consider the median cash/assets ratio of a country to reflect the cash/assets ratio of the typical firm of that country.

As detailed in the Appendix, throughout the study we use cash plus marketable securities as our measure of cash holdings. During our sample period, Apple reclassified some of its holdings of marketable securities as long-term investments. Thus, Apple's cash holdings fell as a fraction of assets even though the sum of Apple's cash holdings and investments stayed relatively stable over time. To evaluate how our results might be affected if firms include liquid securities in investments, we investigate whether our estimates of the relation between holdings of cash of U.S. firms relative to foreign firms are affected if we use the sum of cash, marketable securities, and investments as our definition of cash holdings. We do not tabulate the results. This change increases cash holdings across the board, but it has almost no effect on the differences between U.S. firms and foreign firms because the correlation between both measures is extremely high.

We do not have data on lines of credit for foreign firms. Firms may use lines of credit as substitutes for cash holdings. The paper focuses on cash holdings of U.S. firms relative to foreign matched firms. The best evidence we have regarding the use of lines of credit by U.S. firms is from Sufi (2009), which shows that they represent about 16% of total assets. Lins, Servaes, and Tufano (2010) show that lines of credit are about 15% of total assets in their sample composed of more than 90% of foreign firms. That their usage appears similar for U.S. and foreign firms seems to suggest that their inclusion would not have a significant effect on our inferences.

Table 2 shows that U.S. firms hold more cash than foreign firms do. However, the table does not consider that firms differ across countries with respect to characteristics that are known to be related to cash holdings. Thus, in Table 2, we are not comparing similar firms and, therefore, the table does not show whether U.S. firms hold the same level of cash as similar foreign firms do. We next turn to developing an approach that allows us to answer this question.

2.2 An approach to identify comparable firms

It is well known that predictable differences in cash holdings across firms exist. A classic theory of cash holdings, that firms hold cash for transaction purposes (Miller and Orr 1966), shows that cash holdings as a percentage of assets should fall as firm size increases. Another classic theory, the precautionary theory of cash holdings (Keynes 1936), predicts that riskier firms and firms with more

Table 3
Summary statistics by country

Panel A: Means of country means

Variable	U.S.	Foreign ($N=40$)	Advanced ($N=25$)	Developing ($N=15$)
Cash	0.201	0.134***	0.138***	0.128***
MB	2.075	1.433***	1.459***	1.391***
Size	5.733	5.422***	5.524*	5.251**
CF	0.028	0.047***	0.042***	0.056***
NWC	0.068	0.022***	0.021***	0.023***
Capex	0.056	0.059	0.056	0.063*
Leverage	0.219	0.240***	0.242**	0.238
RD	0.204	0.016***	0.024***	0.003***
Dividend payer	0.290	0.415***	0.457***	0.346
Acquisitions	0.026	0.010***	0.012***	0.006***
Debt issuance	0.009	0.012***	0.013***	0.012
Equity issuance	0.046	0.008***	0.009***	0.005***
Ind. vol	0.108	0.059***	0.060***	0.057***
Panel B: Means of country medians				
Cash	0.107	0.090***	0.090**	0.090
MB	1.542	1.157***	1.180***	1.117***
Size	5.655	5.256***	5.344**	5.109**
CF	0.070	0.055***	0.053***	0.058**
NWC	0.054	0.019***	0.018***	0.022***
Capex	0.036	0.040***	0.038	0.043**
Leverage	0.175	0.225***	0.227***	0.220***
RD	0.003	0.001***	0.001***	0.000
Dividend payer	0.000	0.325***	0.400***	0.200*
Acquisitions	0.000	0.000	0.000	0.000
Debt issuance	0.000	0.001	0.001	0.001
Equity issuance	0.001	0.000***	0.000***	0.000
Ind. vol	0.102	0.051***	0.053***	0.049***

Table 3 shows means of means (Panel A) and medians (Panel B) calculated within country, using the pooled sample ($N=199,595$). *Advanced countries* are defined using the International Monetary Fund classification, and *Developing countries* are all countries in the sample that are not designated as advanced. *Cash* is cash to assets; *MB* is the market-to-book ratio of assets; *Size* is the logarithm of real assets, deflated to year 2000 US$, using the CPI; *CF* is cash flow to assets; *NWC* is non-cash net working capital to assets; *Capex* is capital expenditures to assets; *Leverage* is short- and long-term debt to assets; *RD* is R&D expense to sales; *Dividend payer* is an indicator if the firm paid common dividends in the year; *Acquisitions* is acquisitions to assets; *Debt issuance* is net debt issuance to assets; *Equity issuance* is net equity issuance to assets; *Ind vol* is the mean, by two-digit SIC code, of firm standard deviation of cash flow/assets for the prior 10 years. A minimum of 3 years is required to calculate firm volatility. The Appendix provides details on variable construction. *, **, and *** indicate that the mean is significantly different than the U.S. mean at the 10%, 5%, and 1% levels, respectively, using a two-tailed t-test. For each of the subgroups, the standard error for the t-test is based on the cross-sectional distribution of country means (or medians). The results in the category *Advanced* exclude the United States.

growth opportunities should hold more cash. Finally, much attention has been paid in the literature to the cash buildup resulting from a lack of investment opportunities for firms and the reluctance of managers to pay out this cash to shareholders (Jensen 1986). A large amount of empirical literature investigates the relative importance of these motives to hold cash.

Table 3 provides country means and medians of cash/assets and firm characteristics related to cash holdings according to the literature for the United States, all foreign countries, advanced foreign countries, and developing foreign countries. All of these variables are used by BKS in their regression models. The table shows that there are important differences across countries in

firm characteristics, so that cash holdings could differ across countries simply because firms differ.

The literature shows that the cash/assets ratio is increasing in the ratio of the market value of assets to their book value (see, for instance, Opler et al. 1999). Not surprisingly, this ratio differs substantially across countries. It is also much higher for U.S. firms, which could help explain why U.S. firms have larger cash holdings. The market-to-book ratio is often viewed as a proxy for growth opportunities, but so are R&D expenditures. If firms with better growth opportunities hold more cash, we would expect high-R&D firms to hold more cash. Further, it is more difficult to borrow to finance R&D expenditures than to finance capital expenditures. Therefore, we would expect the precautionary motive to be stronger for high-R&D spending firms, and the literature supports that prediction. The table shows that U.S. firms have higher R&D spending relative to sales than foreign firms do by an order of magnitude.

The transactions motive predicts that the cash/assets ratio should fall with firm size. We see that U.S. firm size, measured by the logarithm of the real value of assets, is higher than foreign firm size whether we consider the means or the medians. Firms with higher cash flow accumulate more cash, but they also need to keep less cash in reserve because they can replenish their holdings more quickly. The mean cash flow/assets ratio is lower for the United States than for foreign countries, whereas the median is higher. The non-cash component of net working capital is a substitute for cash. We see that U.S. firms have much higher net working capital than foreign firms do. The argument that firms hold more cash when they invest less suggests that capital expenditures are related to cash holdings. U.S. capital expenditures are similar to foreign countries. We would expect leverage to be related to cash holdings because it would make little sense for a firm to hold vast amounts of cash while it is heavily indebted. U.S. firms have lower leverage than foreign firms do. Dividend payments reduce cash. U.S. firms tend to pay dividends less frequently than foreign firms do, and they are more likely to spend on acquisitions compared with foreign firms. Finally, on average, U.S. firms raise more funds through equity issuance than foreign firms do but less through debt issuance. Existing evidence suggests that firms retain more cash from equity issues than from debt issuance (see McLean 2011). Finally, industry cash flow volatility is substantially higher in the United States than in our groups of foreign countries. With the precautionary motive of cash holdings, we expect firms from more volatile industries to hold more cash.

A concern with our data is that the accounting treatment of R&D expenses is not the same across countries. Generally, foreign firms have a greater ability to capitalize R&D expenses than U.S. firms do. However, it is not clear that they take advantage of this ability. For our comparisons involving high-R&D firms, most of our matches come from developed countries. Bhagat and Welch (1995) investigate the determinants of R&D expenditures for U.S., Canadian, British, European, and Japanese firms. They conclude that for these countries, R&D

is typically expensed. Thus, the greater ability of foreign firms to capitalize R&D is unlikely to bias materially our results. Notably, the difference in R&D expenditures between U.S. firms and foreign firms is much larger in our sample than in Bhagat and Welch (1995) because of a large increase in average R&D expenditures for U.S. firms in the 1990s.

As discussed in the introduction, the existing literature uses linear regressions to adjust cash holdings for firm characteristics across countries. This approach assumes that the relation between cash holdings and firm characteristics is the same across all countries. It then allows the intercept of the regression to vary across countries or with country characteristics. This approach makes strong assumptions about the relation between firm characteristics and cash holdings, in that it assumes the relation is linear and identical across countries. The benefit of the regression approach is that it is possible to use the model to evaluate cash holdings for all firms in a dataset. However, with this approach, one may draw inferences about the cash holdings of U.S. firms relative to foreign firms based on U.S. firms with characteristics that are rare among foreign firms. Hence, one might conclude that some U.S. firms have larger amounts of cash compared with foreign firms, when in fact the same firms, if they existed abroad, would have similar amounts of cash. To avoid these difficulties, we use a different approach. We try to find a twin for each U.S. firm in the comparison group using a matching approach (for further discussion of the advantages of a matching approach versus a regression approach, see Almeida et al. 2012). This approach does not require us to assume an identical linear relation between firm characteristics and cash holdings across the world, and it compares U.S. firms for which a twin to similar foreign firms exists.

To compare the cash holdings of U.S. firms with the cash holdings of similar foreign firms, we proceed as follows. We want the firms to be similar in firm characteristics that are associated with cash holdings in the literature. We use the propensity-score matching technique. This technique has been used before in comparing U.S. firms to foreign firms (see, for instance, Aggarwal et al. 2009; Bartram, Brown, and Stulz 2012). The propensity score of a firm is equal to the probability that the firm with given characteristics belongs to a particular group, called the treatment. The treatment in this case is whether the firm is a U.S. firm. For each propensity-score match, we use the determinants of cash holdings based on BKS as the covariates in the propensity-score regression along with higher-order terms of the covariates if doing so improves the quality of the matching.[6] Each year, for each U.S. firm, we select as its twin the foreign firm that has the closest propensity score without replacement. We require common

[6] To be specific, in Stata, we use the PSMATCH2 command from Leuven and Sianesi (2003) to construct our matches. Each year, we estimate a probit regression where the dependent variable equals one for U.S. firms and zero otherwise. The right-hand side variables are those from BKS. The predicted values from those probits are our propensity scores to be a U.S. firm given the variables known to affect cash holdings. Even though we use the same BKS variables each year, in some years, we use higher-order terms of those variables to improve the covariate balance. We assure that twin firms are relatively close to each other in terms of propensity score by specifying a caliper each year, which ranges from 0.02 to 0.05. Information about the exact specification and

Table 4
Comparison of the annual cash holdings of U.S. Firms and their foreign twins

Year	Median difference (U.S. minus foreign)	Mean difference (U.S. minus foreign)	Possible matches	Matched pairs	% Matched
1998	−0.012	0.002	3,365	1,348	40%
1999	−0.010	0.001	3,256	1,388	43%
2000	−0.014*	−0.003	3,095	1,595	52%
2001	−0.017**	−0.007	2,883	1,533	53%
2002	−0.009	0.006	2,781	1,503	54%
2003	−0.012	0.006	2,816	1,607	57%
2004	−0.017	0.001	2,831	1,671	59%
2005	−0.005	0.015*	2,794	1,749	63%
2006	−0.005	0.020**	2,770	1,904	69%
2007	−0.006	0.019**	2,742	2,018	74%
2008	−0.010	0.010	2,617	1,953	75%
2009	−0.002	0.014	2,614	2,123	81%
2010	−0.002	0.013	2,569	2,113	82%
2011	−0.006	0.010	2,504	2,061	82%
Fama-Macbeth	−0.009***	0.008**	39,637	24,566	62%

Table 4 shows differences in cash holdings annually for propensity-score-matched firms. For the match, each year, U.S. firms are propensity-score matched with foreign firms using a probit regression and nearest-neighbor match without replacement. The covariates are determined using the determinants of cash in Bates, Kahle, and Stulz (2009), along with higher-order terms to improve covariate balance. *Possible matches* is the minimum of the treated or control sample indicating the maximum number of matched pairs we could have. *Matched pairs* is the number of pairs that we successfully match. *, **, and *** indicate that the mean or median is significantly different than the U.S. mean at the 10%, 5%, and 1% levels, respectively, using a two-tailed t-test, which is conducted via (quantile) regression clustering at the country level for (medians) means. Statistical significance of Fama-Macbeth means is computed using Newey-West standard errors controlling for one lag.

support in our propensity-score distributions. Thus, we eliminate any U.S. firm with a propensity score higher than the largest propensity score of the foreign firms. Similarly, we eliminate any foreign firm with propensity score lower than the minimum score of U.S. firms. In addition, for each comparison, we require that postmatching a firm's characteristics is not useful to predict the country or group of countries it comes from. Without these restrictions, we might be comparing firms that exist only in the United States with firms that exist only in the foreign group. Although the firms that we compare have characteristics with values that can be found both in the United States and in the matching foreign firms, not all firms can be matched.

2.3 Comparing the cash holding of U.S. firms with the cash holdings of their twins

Table 4 first shows how the cash holdings of U.S. firms compare with the cash holdings of similar foreign firms from all countries in our dataset. We implement our approach annually. For each year, we first estimate a probit regression to determine the propensity score. When we estimate the propensity-score regression on the unmatched dataset (not tabulated), the p-value for the

caliper each year is available from the authors. Importantly, in our initial search for a specification to best match our data each year, we never examine the outcome before finalizing our choice of specification. We examine robustness of our choices in subsequent sections.

F-test of the joint significance of all coefficients is highly significant for each year. Nearly all of the BKS variables are individually significant at least at the 10% level, with a minimum of eight BKS variables significant at better than the 1% level each year. In contrast, virtually all variables are insignificant when we estimate the regression on the matched sample.[7] The pseudo R-squared of the probit regression is never below 27% for the unmatched sample and never above 0.5% for the matched sample. We compute the difference between cash/assets for each U.S. firm and its foreign twin and report the median and means for the differences in Table 4. For each year, we cluster standard errors by the country of the matched firm.

Examining first the median estimates, we see that the median difference is never positive during the sample period. Therefore, each year the typical U.S. firm holds less cash than its foreign twin does. Only two median differences are significant, in 2000 and 2001. There is a faint trace of an increase in the median difference over time, but this increase is not statistically significant. To assess significance of the mean of the annual medians, we allow for autocorrelation at one lag using Newey-West standard errors. We find that the mean of the medians is -0.9%, and it is significant at the 1% level.

Turning to the mean difference, it is positive in all years except 2000 and 2001. Thus, at the mean, the U.S. firm has more cash than its foreign twin does. The highest mean difference is 2.0% in 2006, so that the cash/assets ratio of the U.S. firm is two percentage points higher than the cash/assets ratio of the foreign firm. The annual mean differences seem to follow an inverted u-shape pattern. The difference at the end of the sample is not significantly different from the difference at the beginning of the sample. The average of the means is 0.8%. This average is significant at the 5% level when we allow for autocorrelation at one lag. These results show that the difference between the average mean and the average median is 1.7 percentage points. Such a result is evidence of skewness, where observations at the right tail influence the mean but not the median. It follows from this that the typical U.S. firm does not hold more cash than a similar foreign firm does, but the mean difference is pulled up by U.S. firms that have larger positive differences than their twins do.

Table 4 provides some additional details about the matching. It shows that the number of U.S. firms to be matched falls over time as the number of listed firms decreases in the United States. However, the fraction of U.S. firms matched over time increases over the sample period. Part of the reason for this is simply that Compustat Global has an increasing number of foreign firms over our sample period. Table 4 shows that while we match fewer than 50% of the U.S. firms in the first 2 years of the sample period, we match more than 80% of the firms in the last 3 years of the sample period. The last row shows that we match 62% of the firm-years in our sample.

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[7] Industry volatility is significant at the 10% level in 1998 for our matched sample.

Firm characteristics are known to differ across countries. For instance, it is well known that intangible assets are more important in countries with better protection of property rights (Claessens and Laeven 2003); therefore, twins of U.S. firms with large amounts of intangible assets are unlikely to be found in countries with poor investor protection. This suggests that we would expect to find more matches from countries more similar to the U.S. It is perhaps not surprising that while only 5.84% of the firms in our sample come from Canada, 14.16% of our twins come from Canada. In contrast, while 21.36% of the firms are from Japan, only 11.68% of the matches are. In our sample, advanced countries tend to have a higher percentage of twins than they have firms in the sample. The opposite is the case for developing countries. Nevertheless, all countries are represented in our matched sample.

2.4 Robustness of the results to alternative matching approaches

With our approach, a firm remains unmatched if there is no foreign firm that has characteristics that overall are similar to the characteristics of the U.S. firm. As just shown, this lack of matches is more important at the beginning of the sample period than it is at the end of the sample period. We now examine how the results are altered if we choose different matching approaches.

If we remove the constraints on the quality of the match, we can match every U.S. firm.[8] Doing so has a material effect on our conclusions because we introduce a number of poor matches. We do not tabulate the results. First, the median difference becomes positive each year except in 1998 but only significantly so in 2002. At the end of our sample period, the median difference is 0.7%. When we turn to the mean difference, it is positive and significant every year and much larger than in Table 4. In Table 4, the highest mean difference is 2% in 2006. When we match all firms, the lowest mean difference is 4.1% in 2011. The peak mean difference is 6.9% in 2000. Except for 1998 when the mean difference is 4.4%, the smallest mean differences are in the last 4 years of the sample. Thus, matching all firms regardless of how good the match leads to the conclusion that there is a much larger difference in cash holdings between U.S. firms and foreign firms. Not surprisingly, the statistics for the quality of the match show that the matching is quite poor, especially early in the sample period. We saw that for Table 4 the probit regression on the matched sample has a pseudo R-squared that is always less than 0.5%. For the 100% matching approach, the pseudo R-squared is higher than 10% from 1998 to 2005, and it falls below 10% in the final 6 years. In the first 2 years of the sample period, the pseudo R-squared is over 30%. Each year the BKS variables are jointly significant in the probit regression on the matched sample, whereas they are never jointly significant with the preferred matching approach shown in Table 4.

[8] We operationalize this by specifying a caliper of 0.9999 in the PSMATCH2 command in Stata. Because propensity scores lie between 0 and 1, all U.S. firms have a nearest-neighbor match, even if the nearest neighbor has a considerably different propensity score.

We also explore how the results are affected by the requirement that each foreign firm is only used once by allowing replacement in our matches. When we do that, the matching rate never falls below 77%, and it is at least 90% in all years since 2004. We find that the median difference is negative but not significant at the end of the sample period, and the mean difference is significantly positive. Allowing for replacement seems to introduce substantially more variability in the medians and means than when replacement is not allowed. However, the probit regression using the matched sample has a pseudo R-squared that is at least 10 times higher than when we do not allow for replacement and have the strictest requirement for matches. In another experiment, we remove the common support requirement but keep the other matching requirements. Our results are identical with this change in assumption, showing that the common support requirement is nonbinding each year in our sample.

Although our annual probits use the same BKS variables each year, we occasionally include the squares and cubes of some of those variables to improve covariate balance. We refer to these as our "preferred specifications." To examine whether that choice drives our results, we redo our analyses using the exact same specification and caliper every year. Specifically, we include squared and cubed terms for all the BKS variables except the dividend dummy because it is binary. Additionally, for consistency, we specify a caliper of 0.05 every year and do not require common support. Using the same specification each year means that, in some years, the match is not very good. Even though the pseudo R-squared of the probits is less than 0.1% in 11 of the 14 years, it is 1.2% in 2001 and a highly significant 2.4% in 2002 and 10.4% in 1998. Requiring the same specification each year means that we are also able to match fewer firms even though we use the widest caliper of any year from our preferred specifications. Instead of matching 62% of our 39,637 possible firm-years, we are only able to match 54% successfully by requiring the same specification. We find that U.S. firms never hold significantly more cash than their foreign twins do at either the mean or median. The average of the medians is significantly negative, and the average of the means is barely positive at 0.1%

Next, we use the same specification each year and allow for 100% matches by setting the caliper to one. Similar to the results of removing the caliper with our preferred specifications, we find that the U.S. firms hold significantly more cash than their matched firms do at both the mean and median. However, the quality of the matches is even worse than it is when removing the caliper from our preferred specifications. Our probits have pseudo R-squared values greater than 10% in all years except 2009 and 2010, where they are about 7%. From 1998 to 2003, the R-squared values are all greater than 19.2%.

The matching approach we use for Table 4 does not require that a U.S. firm's twin be in the same industry. We proceed this way because imposing such a requirement limits our ability to match firms. We now examine the robustness of our results when we match within industries, but we do not tabulate the

results. With this approach, we estimate a probit model for each industry-year. Estimating the model at the industry-year gives us added flexibility by allowing the coefficient estimates to vary across industries even within a year. In these specifications, we use firm cash flow volatility in our probits because all firms within an industry-year have the same industry cash flow volatility. Because we require at least three observations to estimate firm cash flow volatility, the requirement to use firm cash flow volatility limits the number of matches further. We perform our matching using different industry classifications.

First, we require firms to match at the one digit SIC code level. If we do that, the median annual difference is −0.004, and the mean is 0.012. Both estimates are significant at the 5% level. The results are, therefore, similar to the results in Table 4, but we are unable to match industries with SIC codes 0 and 9. We match next at the level of the Fama-French 12 industries.[9] In this case, the median is −0.003 and the mean is 0.009. The median is significant at the 10% level, and the mean at the 1% level. When we use the Fama-French 17 industries, the median is −0.002, and the mean is 0.013. The median is insignificant, whereas the mean is significant at the 1% level. Last, we match using the Fama-French 30 industries. When we do so, the median is unchanged, and the mean falls to 0.011. We can match only within 19 industries.

A simple way to summarize these results is that our choices of preferred specifications are not driving our results. Additionally, when we relax our criterion requiring a close match, the foreign firms that are considered twins for the U.S. firms are quite different. The additional firms that are matched tend to be firms with high cash holdings. Adding these firms to the comparison increases the cash holdings of U.S. firms relative to those of foreign firms. When we match within industries, we find similar results to our preferred specifications.

2.5 Regression results versus matching results

A regression approach can use the whole sample. We have already discussed the strengths and weaknesses of this approach. In this section, we implement this approach and compare it with our matching results. We use a U.S. indicator variable so that the cash holdings of U.S. firms can differ from holdings by firms from other countries. Using subscripts *i* for the firm and *c* for the country, we use the following model:

$$\begin{aligned}\left(\frac{Cash}{Assets}\right)_{i,c} = {} & \alpha + \delta US_{i,c} + \beta_1 CF_{i,c} + \beta_2 Ind\,Vol_{i,c} + \beta_3 MB_{i,c} + \beta_4 Size_{i,c} + \beta_5 NWC_{i,c} \\ & + \beta_6 Capex_{i,c} + \beta_7 Leverage_{i,c} + \beta_8 RD_{i,c} + \beta_9 Dividend_{i,c} \\ & + \beta_{10} Acquisitions_{i,c} + \beta_{11} Debt\,Issues_{i,c} \\ & + \beta_{12} Equity\,Issues_{i,c} + \varepsilon_{i,c} \quad \forall\ year\ t \end{aligned} \tag{1}$$

[9] We only match 10 industries because we do not have financial firms or utilities. This is true with the other Fama-French classifications, as well, so we only match 15 of the Fama-French 17 industries.

Table 5
Cash holdings in the United States and with MNC firms: Annual cross-regressions on the full-unmatched sample

	(1) OLS U.S. vs. foreign	(2) WLS U.S. vs. foreign	(3) Quantile U.S. vs. foreign
1998	0.014	0.030***	−0.007
1999	0.011	0.023**	−0.004
2000	0.007	0.013	−0.009
2001	0.000	−0.010	−0.014*
2002	0.012	0.005	−0.002
2003	0.008	−0.004	−0.005
2004	0.010	−0.002	−0.004
2005	0.017**	0.007	0.002
2006	0.022***	0.013	0.007
2007	0.024***	0.009	0.004
2008	0.018**	0.009	−0.001
2009	0.026***	0.017	0.012
2010	0.021**	0.022**	0.010
2011	0.018**	0.024**	0.003
Fama-Macbeth	0.015***	0.011**	−0.001

We estimate each year the OLS, WLS, and quantile regressions of cash on a U.S. dummy variable, along with *MB*, *NWC*, *Capex*, *Leverage*, *RD*, *Dividend payer*, *Acquisitions*, *Debt issuance*, *Equity issuance*, and *Ind. vol*, where *Cash* [che/at] is cash to assets; *MB* [((at-ceq)+(csho*prcc_f))/at] is the market-to-book ratio of assets; *Size* [log(at/cpi)] is the logarithm of real assets, deflated to year 2000 US$, using the CPI; *CF* [((oibdp-xint-txt-dvc)/at)] is cash flow to assets; *NWC* [(wcap-che)/at] is non-cash net working capital to assets; *Capex* [capx/at] is capital expenditures to assets; *Leverage* [(dltt+dlc)/at] is short- and long-term debt to assets; *RD* [xrd/sale] is R&D expense to sales; *Dividend payer* is an indicator if the firm paid common dividends [dvc] in the year; *Acquisitions* [aqc/at] is acquisitions to assets; *Debt issuance* [(dltis-dltr)/at] is net debt issuance to assets; *Equity issuance* [(sstk-prstkc)/at] is net equity issuance to assets; *Ind vol* is the mean, by two-digit SIC code of firm standard deviation of cash flow/assets for the prior 10 years. A minimum of 3 years is required to calculate firm volatility. Observations are at the firm i, country c level. The weights for WLS are the inverse of the number of firms in a country in a year. *, **, and *** denote significantly different from zero at the 10%, 5%, and 1% levels. Statistical significance of Fama-Macbeth means is computed using Newey-West standard errors controlling for one lag. In the table, we use the full sample of 199,595 firm-years and report the U.S. indicator variable δ from equation (1). Thus, the value is the difference of the United States from all foreign countries each year.

Table 5 shows estimates of the regression. Regression (1) estimates the model using OLS. We report only the coefficient for δ, which is the mean cash excess holding of U.S. firms, controlling for firm characteristics. We see that this mean is positive every year. It is positive and significant in the last 7 years of the sample, and insignificant in the first 7 years. The average yearly excess cash of U.S. firms is 1.5%, and it is significant at the 1% level when we use Newey-West standard errors calculated with one lag. Comparing the estimates of Regression (1) of Table 5 with the average mean difference in Table 4, we see that the regression approach leads to an estimate of the average excess cash holdings of U.S. firms that exceeds by 0.7 percentage points our estimate from the matched sample.

One concern mentioned earlier is that the number of firms differs sharply across countries. Thus, Japan is heavily weighted in the regression because it is the foreign country with the most firms. One approach to deal with this issue is to estimate a weighted least-squares regression where each country observation is weighted by the inverse of the number of firms in the country in that year. Regression (2) in Table 5 shows the estimate of δ using a weighted least-squares regression. The results are different from Regression (1). The estimate of δ is

significantly positive only in the first 2 years and the last 2 years, but in 2011, it is more than twice the estimate from Table 4.

We mentioned earlier that the cash/assets ratio has a skewed distribution. To address this issue, an approach is to estimate a median regression. Regression (3) shows estimates of a median regression. Again, the results are sharply different from the OLS regression as no estimate of δ is significantly positive. The average excess cash of U.S. firms is negative and insignificant. The only significant estimate is in 2001, and it is negative. For the last 3 years of the sample, the estimate is positive and insignificant. Inferences are quite different with the median regression than they are with the OLS regression. A major contributing factor to these differences is that cash holdings are skewed. Some firms have an extremely large cash/assets ratio. These firms are not typical, but they affect regression estimates with OLS and weighted least squares (WLS).

3. Why Is the Mean Difference Positive while the Median Is Negative?

Table 3 shows that the U.S. firms on average differ from the foreign firms along some important dimensions. Specifically, if we focus on characteristics associated with higher cash holdings, U.S. firms have a higher market-to-book ratio and higher R&D expenditures; they make more acquisitions, have higher equity issuance, and are in industries with higher volatility. The difference in R&D expenditures for the average is striking, as the average of R&D-to-sales ratio for U.S. firms is 10 times what it is for firms in advanced countries. None of the other variables differs from their foreign counterparts so dramatically. The average R&D-to-sales ratio of U.S. firms is relatively stable during our sample period. It was 20.4% in 1998 and 20.8% in 2011. The lowest ratio was 18.6% in 2009, and the highest ratio was 24.1% in 2005.

Not surprisingly, the matched firms have similar characteristics on average: the differences between the matched U.S. firms and the foreign firms are never significant. However, for the unmatched firms, the differences are large. Strikingly, the average R&D-to-sales ratio for the unmatched U.S. firms is 48.2%, whereas it is 1.5% for the foreign firms. The other large differences between the unmatched U.S. firms and the unmatched foreign firms are all characteristics associated with high-R&D-growth firms. There are too many high-R&D firms in the United States relative to foreign countries, to make it possible to match all of the high-R&D firms.[10]

Before matching, we have 199,595 firm-years, but firms do not report R&D expenditures for 61% of the firm-years. U.S. firms represent 20% of firm-years in the sample, but 26% of the firms with R&D expenditures. When we partition firms into R&D-to-sales deciles based on U.S. breakpoints, identifying decile 0 as firms with no reported R&D to sales, we find that decile 0 is much larger

[10] Results are not tabulated but are available from the authors.

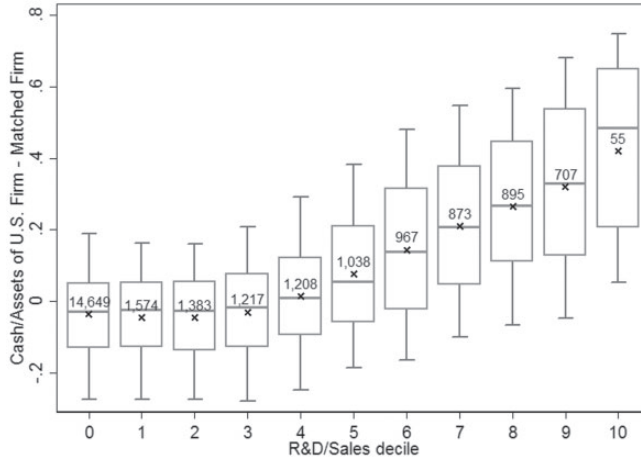

Figure 1
Difference in cash/assets between U.S. firms and matched foreign firms, by R&D decile
Deciles are calculated only with U.S. firms by year using the full Compustat sample. Decile 0 contains firms with no R&D spending. U.S. firms are propensity score matched to foreign firms. There are 24,566 matched pairs. The number of matched pairs in each decile is indicated in the box. The "X" in the box indicates the mean of the difference in cash/assets (U.S. versus foreign firms). The line in the box represents the median, whereas the top and bottom of the box (cap) are the 75th and 25th (90th and 10th) percentiles, respectively.

than the other deciles. Each decile other than decile 0 has approximately 2,070 firm-years, and decile 0 has 18,942 firm-years. Using the same breakpoints for foreign firms, we find that there are only 348 foreign firm-years in the top decile of U.S. firms for R&D expenditures out of 159,248 foreign firm-years. Worse, for all but 4 years in our sample period, no foreign firm has R&D expenditures that place it in the top decile of U.S. firms for R&D expenditures. It follows that when we match U.S. firms with the highest R&D expenditures, we match them to foreign firms with lower R&D expenditures. Hence, since we know that cash holdings increase with R&D expenditures, it is not surprising that we find a difference in cash holdings for high R&D expenditure firms that are matched.

When we examine the quality of the matches for firms in the top-two deciles of R&D expenditures using U.S. breakpoints, we find that the quality of matches is poor. All firm characteristics are significantly different between U.S. firms and their matches, whereas for the sample as a whole, none is. Not surprisingly, R&D to sales is sharply higher for the U.S. firms than their matches. However, the U.S. firms hold dramatically more cash than their matches do: approximately 32% of assets more. Because we are matching U.S. firms with foreign firms that are not as R&D intensive, the difference in R&D intensity could explain the difference in cash holdings.

In Figure 1, we show that R&D plays a critical role in explaining the mean difference in cash holdings between U.S. firms and their foreign twins. To arrive at the values shown in Figure 1, first, we split all the U.S. firms into

R&D-expenditure deciles. We then examine the average difference in cash holdings between U.S. firms and their twins based on how each U.S. firm in the pair fits in the deciles. The figure shows that the mean difference is essentially zero for deciles 0 to 4. After decile 4, the difference increases with each decile and it exceeds 0.4 for the 10th decile. However, we are able to match fewer firms as we move toward higher R&D/sales deciles, and very few U.S. firms in the 10th decile are matched. High-R&D-intensity firms are much more likely to be located in the U.S. than in foreign countries, and such firms hold much more cash. If foreign countries had more high-R&D-intensity firms, the U.S. high-R&D-intensity firms would be easier to match with foreign firms, and it would be easier to assess whether U.S. high-R&D-intensity firms hold more cash than similar foreign firms do. It follows from these results that the positive mean difference in cash holdings between U.S. firms and their foreign twins is driven by the firms in the top half of the distribution of R&D/sales.

To address the problem that high-R&D firms are matched poorly, we can remove from Table 4 the firms that are in the 9th and 10th deciles of R&D to sales for all U.S. firms each year. We show this in Table 6, Panel A. Because of the difficulty in matching firms in those deciles, we only drop 762 firm-years out of 24,566 firm-years or approximately 3.1% of the firm-years for the matched sample. With these firms excluded from the comparison, the mean of the mean annual differences is -0.2%, and it is insignificant. Moreover, no year has a positive significant mean difference. Removing these firms keeps the median difference significantly negative. If we were to drop firms in the top-three deciles of R&D/sales, or 7% of U.S. firm-years, the annual mean difference becomes -1.2%, and it is significant at the 1% level. We perform the same exercise with industry matches and the results are identical.

When we compare the raw cash holdings of U.S. and those of foreign firms by decile of R&D expenditures using U.S. breakpoints (not tabulated), it is noteworthy that foreign firms have higher cash holdings than U.S. firms do for firms with no R&D and for the first four deciles of firms reporting R&D. It is only for the next six deciles of firms reporting R&D that U.S. firms have higher cash holdings. Not surprisingly, with the regression approach, the firms in these deciles are influential because they have extremely high cash holdings. U.S. firms in the top decile of R&D expenditures have average cash holdings of 67% of assets. When we remove the high R&D U.S. firms from the sample for the OLS regressions, we find that the U.S. firms become more comparable with foreign firms. We show the results of this exercise in Table 6, Panel B. If we drop the top decile of high-R&D/sales firms, the mean difference between U.S. firms and their twins is significant in only 3 years, 2006, 2007, and 2009. In 2011, the difference is an insignificant 0.8%. As shown in Column 3, once we drop the top-three deciles, the difference is significant in just 1 year, 2006, and it is just 0.1% in 2011. However, although the annual average falls as we remove high R&D firms, if we drop the top-three deciles of high-R&D firms, the annual mean is 0.4%, and it is significant at the 1% level. For the

Table 6
Comparison of the annual cash holdings of U.S. firms and foreign firms: Eliminating high R&D U.S. firms

Panel A: Matching results

Year	Median difference drop deciles 9-10 $N = 23,804(-762)$	Median difference drop deciles 8-10 $N = 22,909(-1,657)$	Mean difference drop deciles 9-10 $N = 23,804(-762)$	Mean difference drop deciles 8-10 $N = 22,909(-1,657)$
1998	−0.013	−0.015	−0.005	−0.011
1999	−0.011	−0.013	−0.006	−0.013
2000	−0.016**	−0.019**	−0.011**	−0.020***
2001	−0.020**	−0.021***	−0.014**	−0.020***
2002	−0.012	−0.015	−0.002	−0.012**
2003	−0.015*	−0.019**	−0.006	−0.016**
2004	−0.020**	−0.023**	−0.009	−0.019**
2005	−0.008	−0.012	0.007	−0.001
2006	−0.008	−0.014***	0.01	−0.002
2007	−0.01	−0.017***	0.009	−0.004
2008	−0.015*	−0.019**	−0.003	−0.015*
2009	−0.006	−0.012	0.001	−0.01
2010	−0.009	−0.018**	−0.001	−0.015**
2011	−0.011	−0.017**	−0.002	−0.016**
Avg (Fama-Macbeth)	−0.013***	−0.017***	−0.002	−0.012***

Panel B: Regression results

	(1) OLS Drop top decile decile (2,063 U.S. firm yrs)	(2) OLS Drop top-2 deciles (4,134 U.S. firm yrs)	(3) OLS Drop top-3 deciles (6,201 U.S. firm yrs)	(4) WLS Drop top decile (2,063 U.S. firm yrs)	(5) WLS Drop top-2 deciles (4,134 U.S. firm yrs)	(6) WLS Drop top-3 deciles (6,201 U.S. firm yrs)
1998	0.009	0.008	0.006	0.024***	0.021***	0.016***
1999	0.008	0.009	0.006	0.016*	0.016**	0.012
2000	0.002	0.003	0.001	0.006	0.008	0.005
2001	−0.004	−0.003	−0.005	−0.010	−0.009	−0.011*
2002	0.004	0.005	0.003	0.003	0.005	0.002
2003	0.004	0.004	0.002	0.000	0.001	−0.002
2004	0.005	0.004	0.001	0.004	0.005	0.002
2005	0.009	0.009	0.007	0.009	0.009	0.006
2006	0.015**	0.013**	0.011*	0.015**	0.013**	0.011*
2007	0.014*	0.012*	0.010	0.012*	0.010	0.008
2008	0.008	0.005	0.000	0.014**	0.009	0.004
2009	0.017*	0.014*	0.011	0.020**	0.017**	0.013*
2010	0.012	0.010	0.005	0.022***	0.019***	0.014**
2011	0.008	0.005	0.001	0.026***	0.021***	0.016***
Fama-Macbeth	0.008***	0.007***	0.004***	0.011***	0.010***	0.007**

Panel A shows the results of our matching exercise, which are analogous to Table 4. In each panel, we show results when we eliminate firms in the top-two or top-three deciles of RD/sales calculated using U.S. breakpoints with the full sample of firms. For the match, each year, U.S. firms are propensity score matched with foreign firms using a probit regression and nearest-neighbor matched without replacement. The covariates are determined using the determinants of cash in Bates, Kahle, and Stulz (2009), along with higher-order terms to improve covariate balance. *Possible matches* is the minimum of the treated or control sample indicating the maximum number of matched pairs we could have. *Matched pairs* is the number of pairs that we successfully match. Panel B shows the estimates of the U.S. indicator variable δ from our regression approach and are analogous to Table 5. OLS and WLS regressions of cash/assets are estimated on a U.S. dummy variable along with *MB*, *NWC*, *Capex*, *Leverage*, *RD*, *Dividend payer*, *Acquisitions*, *Debt issuance*, *Equity issuance*, and *Ind vol*. Observations are at the firm i and country c level. The weights for WLS are the inverse of the number of firms in a country in a year. *, **, and *** indicate the mean or median is significantly different than the U.S. means at the 10%, 5%, and 1% levels, respectively, using a two-tailed t-test, which is conducted via (quantile) regression clustering at the country level for (medians) means. Statistical significance of Fama-Macbeth means is computed using Newey-West standard errors controlling for one lag.

WLS regressions, dropping the high-R&D-to-sales U.S. firms has the opposite result, in that more differences are significant. Further, the average mean falls only in a limited way, as it is 1.1% for the whole sample and 0.7% if we drop the top-three deciles of high R&D firms, shown in Column 6.

Table 4 shows that the mean difference in cash holdings between U.S. firms and their twins is significantly positive, whereas the median is negative. In this section, we provide an explanation for this result: it is because the high-R&D-intensity U.S. firms that are matched do not have twins with similarly high-R&D intensity because there are too few such foreign firms. If we restrict the sample by eliminating the high-R&D-intensity firms that are poorly matched, we find that the mean difference is negative and insignificant. It follows from our analysis that our results cannot be interpreted to mean that high-R&D U.S. firms hold more cash than high-R&D foreign firms do. There are too few high-R&D foreign firms to reach such a conclusion.

4. Do U.S. Multinational Firms Hold More Cash than Similar Foreign Firms Do?

As discussed in the introduction, one explanation advanced for the high cash holdings of U.S. firms is that U.S. multinational firms, in contrast to multinationals in most other countries, are taxed on their foreign income when it is repatriated. As shown by Foley and others (2007), this feature of the U.S. tax code creates incentives for firms to keep the cash generated by their foreign activities abroad. Our definition of a U.S. multinational firm is a firm with 25% of its sales abroad, according to Compustat Historical Segment data. A foreign firm is multinational if it has 25% of its sales abroad, according to Worldscope.[11] This definition has the advantage of making comparisons between U.S. and foreign multinational firms straightforward, as the definition is the same for both domestic and foreign multinationals. Because the 25% threshold is arbitrary, we show that alternative definitions lead to largely similar results.

Table 7 shows a comparison of the median and the mean of the differences between the cash holdings of U.S. multinationals and foreign multinationals. Although the number of listed U.S. firms falls in our sample, the number of U.S. multinational firms increases. Yet, we are less successful at matching multinational firms than we are at matching firms in the whole sample. The reason for this is straightforward. Many U.S. multinationals have high R&D expenses. In contrast, foreign multinational firms tend to have lower R&D expenses, so that it is difficult to match those U.S. multinationals with

[11] Note that we still use Compustat Global data for our analysis for the reasons discussed previously. We only use Worldscope data item WC08731 (foreign sales as a percentage of total sales) to determine if a foreign firm is a multinational, because the data are not available in Compustat Global. If a firm is in Compustat Global but not in Worldscope, we assume that it is not multinational, but we keep it in the sample. Therefore, we do not lose any firm years using Worldscope to determine if a firm is a multinational.

Table 7
Comparison of the annual cash holdings of multinational U.S. firms and multinational foreign firms

Panel A: Only MNC firms

Variable	Median difference (U.S. minus foreign)	Mean difference (U.S. minus foreign)	Possible matches	Matched pairs	% Matched
1998	−0.005	0.014	798	266	33%
1999	−0.018	−0.006	907	297	33%
2000	−0.009	0.020*	929	381	41%
2001	−0.022*	0.004	962	412	43%
2002	−0.014	0.008	1,004	438	44%
2003	−0.006	0.009	1,058	521	49%
2004	0.008	0.014	1,075	527	49%
2005	0.005	0.025**	1,086	553	51%
2006	0.004	0.025*	1,083	601	55%
2007	0.011	0.033***	1,132	685	61%
2008	0.001	0.017	1,114	676	61%
2009	0.007	0.011	1,148	783	68%
2010	0.012	0.020	1,139	839	74%
2011	0.010	0.028**	1,123	847	75%
Fama-Macbeth	−0.001	0.016***	14,558	7,826	54%

Panel B: MNC Firms—Annual cash differences each year for the full sample, eliminating top RD firms

Year	Median difference drop deciles 9-10 $N = 7,514(-312)$	Median difference drop deciles 8-10 $N = 7,087(-739)$	Mean difference drop deciles 9-10 $N = 7,514(-312)$	Mean difference drop deciles 8-10 $N = 7,087(-739)$
1998	−0.01	−0.011	0.002	−0.004
1999	−0.021*	−0.022*	−0.012	−0.025
2000	−0.012	−0.018**	0.014	0.002
2001	−0.023**	−0.025**	−0.003	−0.013
2002	−0.019**	−0.022***	−0.002	−0.011
2003	−0.014	−0.018*	−0.004	−0.017
2004	−0.002	−0.013	0.001	−0.012
2005	0.000	−0.004	0.014	0.004
2006	0.001	−0.003	0.016	0.002
2007	0.007	−0.005	0.021**	0.001
2008	−0.006	−0.011	0.000	−0.014
2009	0.004	0.000	0.002	−0.008
2010	0.006	−0.003	0.009	−0.005
2011	0.003	−0.002	0.014	0.002
Fama-Macbeth	−0.006*	−0.011***	0.005*	−0.007***

Panel A shows differences in cash holdings annually for propensity-score-matched firms, where firms are all multinational. "Multinational firms" are defined as any firm with foreign sales greater than 25% of sales. "Domestic firms" are firms with no foreign sales. For the match, each year, U.S. firms are propensity score matched with foreign firms using probit regression and nearest-neighbor match without replacement. The covariates are determined using the determinants of cash in Bates, Kahle, and Stulz (2009), along with higher-order terms to improve covariate overlap. Each year, the propensity-score-model parameters are identical to those used in the same year for Table 4. *Possible matches* is the minimum of the treated or control sample indicating the maximum number of matched pairs we could have. *Matched pairs* is the number of pairs that we successfully match. *, **, and *** indicate that the mean or median is significantly different from those of the U.S. firms at the 10%, 5%, and 1% levels, respectively, using a two-tailed t-test, which is conducted via (quantile) regression clustering at the country level for (medians) means. Statistical significance of Fama-Macbeth means is computed using Newey-West standard errors, controlling for one lag. In Panel B, we drop the top-two or top-three deciles of RD/sales using the U.S. breakpoints.

high-R&D expenses to foreign firms. The matching procedure performs well for most years. In particular, the pseudo R-squared of the probit regression estimated on the matched sample is less than 2% in each of the last 10 years. The pseudo R-squared was 11.8% in 1998 and 4.5% in 1999.

The results in Table 7, Panel A, show that the median difference is not significantly positive over the 1998 to 2011 period. It is significantly negative in 1 year. In contrast, the mean is never significantly negative. It is significantly positive in 5 years. In 2011, the mean is 2.8%, which is the second-highest value, as it is 3.3% in 2007. The mean is no higher in 2011 than in 2007, but it experiences a sharp u-shape around the crisis as it falls from 3.3% in 2007 to a low of 1.1% in 2009. The average of the medians is insignificant, but the average mean difference allowing for first-order autocorrelation is a significant 1.6%. The mean difference is larger for multinational firms than for the whole sample. However, the mean difference for multinational firms cannot be directly compared with the mean difference for the whole sample because, for multinational firms, we match only within multinational firms, whereas for the sample as a whole, a twin for a multinational firm might be a purely domestic firm.

We show in Table 8, Panel A, the results for purely domestic firms. The mean difference for purely domestic firms is lower than the mean for multinational firms, but it is statistically significant. The mean of the medians is insignificantly different from zero. The mean in 2011 is an insignificant 0.4%. In other words, in 2011, purely domestic U.S. firms hold the same amount of cash as purely domestic similar foreign firms do, whether the difference is evaluated with the mean or the median.

We investigate how our results about the cash holdings of multinational firms are affected when we change the definition of multinational firms.[12] First, we consider the cash holdings of firms that have positive foreign income. With this definition, the mean of the median differences is significantly negative, and the average of the mean differences is insignificant. To be sure, this is not because our statistical tests have low power because the point estimate for the mean is zero and the point estimate for the median is −1.14%. Interestingly, when we define purely domestic firms as firms that have no foreign income, the median is never significantly positive, but the mean is positive in 1998 and 2004–2007. In 2011, purely domestic U.S. firms hold more cash than purely domestic foreign firms do by 0.8 percentage points when a purely domestic firm is defined as one without foreign income. Second, we define as a multinational firm any firm with foreign sales. With that broader definition, the median is still never significantly positive. However, it is significantly negative in 1998, 2001, and 2005. The mean is significantly positive in 2005, 2006, and 2007.

It follows from the analysis that the typical U.S. multinational does not hold more cash than the typical foreign multinational does. However, the mean difference tends to be positive after 2005. With our stricter definition of a "multinational firm," we find similar results. These results imply that there is a subset of U.S. multinational firms with larger levels of cash compared with that

[12] For brevity, results are not tabulated but are available from the authors.

Table 8
Annual cash holdings of domestic U.S. firms compared with those of domestic foreign firms

Panel A: Only domestic firms

Variable	Median difference (U.S. minus foreign)	Mean difference (U.S. minus foreign)	Possible matches	Matched pairs	% Matched
1998	0.004	0.021	1,773	536	30%
1999	0.002	0.023	1,611	628	39%
2000	−0.005	−0.003	1,448	681	47%
2001	−0.001	−0.001	1,261	577	46%
2002	0.000	0.011	1,173	594	51%
2003	0.006	0.009	1,168	627	54%
2004	0.004	0.022***	1,138	613	54%
2005	0.006	0.010	1,101	692	63%
2006	0.002	0.024***	1,087	737	68%
2007	−0.001	0.016	1,030	752	73%
2008	−0.001	0.017*	960	679	71%
2009	−0.006	0.011	923	744	81%
2010	−0.011	0.000	891	724	81%
2011	−0.003	0.004	849	700	82%
Fama-Macbeth	−0.000	0.012***	16,413	9,284	57%

Panel B: Domestic firms—annual cash differences each year for the full sample, eliminating top RD firms

Year	Median difference drop deciles 9-10 $N = 9,073(-211)$	Median difference drop deciles 8-10 $N = 8,929(-355)$	Mean difference drop deciles 9-10 $N = 9,073(-211)$	Mean difference drop deciles 8-10 $N = 8,929(-355)$
1998	0.003	0.002	0.017	0.011
1999	0.002	0.001	0.018	0.015
2000	−0.006	−0.007	−0.013	−0.017
2001	−0.003	−0.004	−0.008	−0.009
2002	−0.001	−0.001	0.000	−0.003
2003	0.003	0.002	0.001	−0.006
2004	0.003	0.002	0.015***	0.013**
2005	0.005	0.004	0.004	0.000
2006	−0.001	−0.004	0.01	0.004
2007	−0.003	−0.004	0.006	−0.001
2008	−0.003	−0.005	0.008	0.002
2009	−0.009	−0.012	0.002	−0.003
2010	−0.018*	−0.022**	−0.017	−0.027*
2011	−0.007	−0.009	−0.008	−0.016
Fama-Macbeth	−0.003	−0.004	0.002	−0.003

Panel A shows differences in cash holdings annually for propensity-score-matched firms, where firms are all domestic. "Multinational firms" are defined as any firm with greater than 25% foreign sales. "Domestic firms" are firms with no foreign sales. For the match, each year, U.S. firms are propensity score matched with foreign firms using probit regression and nearest-neighbor matched without replacement. The covariates are determined using the determinants of cash in Bates, Kahle, and Stulz (2009), along with higher-order terms to improve covariate overlap. Each year, the propensity-score-model parameters are identical to those used in the same year for Table 4. *Possible matches* is the minimum of the treated or control sample indicating the maximum number of matched pairs we could have. *Matched pairs* is the number of pairs that we successfully match. *, **, and *** indicate that the mean or median is significantly different than that of the U.S. firms at the 10%, 5%, and 1% levels, respectively, using a two-tailed t-test, which is conducted via (quantile) regression clustering at the country level for (medians) means. Statistical significance of Fama-Macbeth means is computed using Newey-West standard errors controlling for one lag. In Panel B, we drop the top-two or top-three deciles of RD/sales using the U.S. breakpoints.

of their foreign twins, and these multinational firms pull up the mean difference. When we match multinational firms, our success rate in finding twins is lower than for the sample as a whole. We investigate how the results change if we relax the criteria for our matching approach so that all multinational firms are matched. When we do that, both the median and the mean are always positive

and significant, with the exception of 1998, 1999, and 2001, at the median. Interestingly, the peak differences do not occur after the financial crisis of 2007-2009. For the median, the highest difference is in 2004. For the mean, it is in 2000. For both the mean and the median, the highest difference is more than 50% higher than the 2011 difference.

Section 3 shows that there is no difference in cash holdings for the sample as a whole for firms that have no R&D expenditures or are in the lowest four deciles of the distribution of the R&D/sales ratio for all U.S. firms in the sample. To gain further insight in why the mean differs from the median for the sample as a whole and for multinational firms, we examine how differences in cash/assets ratios relate to R&D/sales ratios for multinational firms and purely domestic firms separately. As shown in Figure 2, we find the same pattern for multinationals and for purely domestic firms. Specifically, the mean difference is essentially zero for firms with no R&D expenditures and for firms with low R&D expenditures. For both domestic and multinational firms, the mean difference increases beyond the fourth decile. Strikingly, from decile four, the mean cash/assets difference for purely domestic firms is higher than the mean cash/assets difference for multinational firms.

We proceed to examine how sensitive the estimates of the average difference for multinational firms are to the elimination of the high R&D U.S. firms from the matched sample. In Panel B of Table 7, we show that if we eliminate roughly 10% of the multinational firms that have a high-R&D-to-sales ratio, the average difference is never significantly positive, and the time-series average is significantly negative. The estimate for 2011 is 0.2%. Except for the most R&D-intensive U.S. multinational firms, there is no difference in cash holdings between U.S. multinationals and similar foreign multinationals. As with the multinational firms, we repeat the exercise for domestic firms and remove the top-two or top-three deciles of R&D/sales firms based on U.S. breakpoints. The results in Table 8, Panel B, are similar, which indicates that the high-R&D effect is not restricted to the multinational firms in the sample.

As with the sample as a whole, we estimate regressions, where all firms can be included in the analysis. We add two variables to Equation (1). The first variable is an indicator variable for multinational corporations. The second variable is an interaction of the multinational indicator variable with the U.S. indicator variable. These changes yield equation (2):

$$\begin{aligned}\left(\frac{Cash}{Assets}\right)_{i,c} &= \alpha + \delta US_{i,c} + \gamma MNC_{i,c} + \lambda US_{i,c}{}^{*}MNC_{i,c} + \beta_1 CF_{i,c} + \beta_2 Ind\,Vol_{i,c} \\ &+ \beta_3 MB_{i,c} + \beta_4 Size_{i,c} + \beta_5 NWC_{i,c} + \beta_6 Capex_{i,c} + \beta_7 Leverage_{i,c} \\ &+ \beta_8 RD_{i,c} + \beta_9 Dividend_{i,c} + \beta_{10} Acquisitions_{i,c} + \beta_{11} Debt Issues_{i,c} \\ &+ \beta_{12} Equity Issues_{i,c} + \varepsilon_{i,c} \quad \forall\ year\ t \end{aligned} \tag{2}$$

Using equation (2), we can estimate the added cash/assets ratio for U.S. multinational firms compared with those of other multinational firms. We call

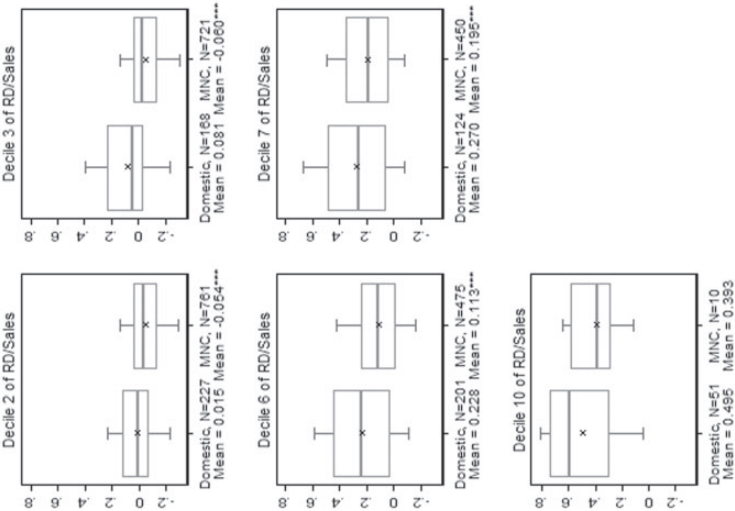

Figure 2
Difference in cash/assets between U.S. firms and matched foreign firms, by R&D decile for domestic and MNC firms
Deciles are calculated only with U.S. firms by year using the full Compustat sample. Decile 0 contains firms with no R&D spending. U.S. domestic (MNC) firms are propensity score matched to foreign domestic (MNC) firms. For each decile, the number of domestic matched pairs and MNC matched pairs are indicated in the legend. The mean of the difference in cash/assets (U.S. versus foreign firms) is indicated in the legend and denoted by the "X" in the box. The line in the box represents the median, whereas the top and bottom of the box (cap) are the 75th and 25th (90th and 10th) percentiles respectively. *, **, and *** indicate that the difference in cash holdings for domestic firms is significantly different from the difference in cash holdings for MNC firms at the 10%, 5%, and 1% levels, respectively.

Table 9
Cash holdings in the United States and with MNC firms: Annual cross-section regressions on the full-unmatched sample

	(1) OLS U.S. MNC vs. foreign MNC	(2) OLS U.S. dom. vs. foreign dom.	(3) WLS U.S. MNC vs. foreign MNC	(4) WLS U.S. dom. vs. foreign dom.	(5) Quantile U.S. MNC vs. foreign MNC	(6) Quantile U.S. dom. vs. foreign dom.
1998	0.009	0.016	0.027***	0.032***	−0.009	−0.006
1999	0.001	0.014	0.018*	0.026***	−0.009	−0.002
2000	0.007	0.007	0.015	0.015	−0.008	−0.009
2001	0.004	0.000	−0.002	−0.010	−0.008	−0.014
2002	0.019**	0.011	0.022**	0.000	0.004	−0.002
2003	0.014*	0.008	0.009	−0.007	0.002	−0.006
2004	0.020**	0.006	0.021**	−0.012	0.006	−0.006
2005	0.030***	0.011	0.028***	−0.005	0.015	−0.004
2006	0.035***	0.015**	0.034***	0.001	0.016**	−0.001
2007	0.032***	0.018**	0.028***	−0.005	0.015*	−0.004
2008	0.024**	0.013*	0.025**	−0.003	0.009	−0.010
2009	0.028***	0.023**	0.027**	0.011	0.022*	0.004
2010	0.024**	0.016*	0.033***	0.013	0.020	0.004
2011	0.031***	0.007	0.042***	0.009	0.015	−0.005
Fama-Macbeth	0.020***	0.012***	0.023***	0.005	0.006	−0.004***

Each year, we run OLS, WLS, and quantile regressions of cash on a U.S. dummy variable, an MNC variable, and their interaction, along with *MB*, *NWC*, *Capex*, *Leverage*, *RD*, *Dividend payer*, *Acquisitions*, *Debt issuance*, *Equity issuance*, and *Ind. vol*, where *Cash* [che/at] is cash to assets; *MB* [((at-ceq)+(csho*prcc_f))/at] is the market-to-book ratio of assets; *Size* [log(at/cpi)] is the logarithm of real assets, deflated to year 2000 US$ using the CPI; *CF* [((oibdp-xint-txt-dvc)/at)] is cash flow to assets; *NWC* [(wcap-che)/at] is non-cash net working capital to assets; *Capex* [capx/at] is capital expenditures to assets; *Leverage* [(dltt+dlc)/at] is short- and long-term debt to assets; *RD* [xrd/sale] is R&D expense to sales; *Dividend payer* is an indicator if the firm paid common dividends [dvc] in the year; *Acquisitions* [aqc/at] is acquisitions to assets; *Debt issuance* [(dltis-dltr)/at] is net debt issuance to assets; *Equity issuance* [(sstk-prstkc)/at] is net equity issuance to assets; *Ind vol* is the mean, by two-digit SIC code, of firm standard deviation of *cash flow/assets* for the prior 10 years. A minimum of 3 years is required to calculate firm volatility. Observations are at the firm i and country c level. The weights for WLS are the inverse of the number of firms in a country in a year. *, **, and *** denote significantly different from zero at the 10%, 5%, and 1% levels. Statistical significance of Fama-Macbeth means is computed using Newey-West standard errors controlling for one lag. In the first column of each set of regressions, we report the sum of U.S. indicator and U.S.*MNC ($\delta+\lambda$) from equation (2). Thus, the value is the difference of U.S. MNCs versus foreign MNCs. In second column of each regression, we report the U.S. indicator (δ) from equation (2) so the value is the differences of U.S. domestic versus foreign domestic.

the sum of the coefficients of the two variables our measure of excess cash for U.S. multinationals. The excess cash for purely domestic firms is just the coefficient for U.S. firms. Column (1) of Table 9 gives the results for OLS regressions for the multinational indicator interacted with the U.S. indicator variable. We find that U.S. multinational firms hold significantly more cash than foreign multinational firms do, on average. The average is 2%, which is significant at the 1% level. It is 0.4% higher than the matched approach annual average. The excess cash holdings of U.S. multinational firms have not materially changed since 2005. Therefore, U.S. multinational firms did not hold more cash after the crisis than before, using this approach. These results are similar to the results of Panel A of Table 7, using means, except that the U.S. firms appear to hold more cash relative to foreign firms' cash holdings, using the regression approach. Column (2) shows the results for domestic firms. The average difference in cash holdings for purely domestic U.S. firms is the same with the regression approach and with the matching approach. Turning to the

weighted least-squares regressions, we see that the results do not differ much for multinational firms. However, when we turn to purely domestic firms, the coefficient is never significant except for the first two years, and the average of the annual coefficients is not significant. Last, we show results for median regressions. The average of the excess cash for multinational firms using the median regression is insignificant, whereas the average for purely domestic firms is significantly negative.

As with the matching results, we check how robust the estimates are to elimination of the most R&D-intensive firms. If we eliminate the top decile of R&D/sales of U.S. firms with R&D, the mean excess cash for multinational firms drops from 2% to 0.7%, and it is only significant at the 10% level. The mean for purely domestic firms falls, as well, if we drop the top decile. This verifies again that results where the U.S. firms hold more cash on average are due to the firms at the tail of the U.S. distribution of R&D, which are also the firms at the tail of the U.S. distribution of cash/assets.

5. Understanding the Differences in Cash Holdings across Countries

In this section, we investigate whether differences in cash holdings can be predicted using country characteristics. Before considering specific country characteristics, we assess the importance of countries in explaining differences in cash holdings among twins, using country fixed effects. If we regress cash/assets differences from the matched sample of Table 4 on country indicators (based on the country of the matching firm), the adjusted R-squared is 1.25%. If we assume that the country effects are year dependent, the adjusted R-squared increases to 1.36%. These results are striking because they show that once we account for firm characteristics by focusing on twins, country differences explain almost nothing of the variation in cash holdings across countries. Note, however, that we do not include firm governance practices in the firm characteristics we use. Doing so would not be possible for our sample. It is well established that these governance practices have explanatory power for cash holdings and that this explanatory power depends on country characteristics, as shown by Kalcheva and Lins (2007).

As we discussed in the introduction, the agency theories of cash holdings predict that firms from countries where agency problems are more pervasive than in the United States have higher cash holdings compared with U.S. firms. We would also expect firms from countries with greater financial development to have lower cash holdings because they require less precautionary cash holdings. Both proxies for agency problems and proxies for financial development are correlated with measures of economic development. Further, we would expect that greater economic activity could be associated with greater cash holdings because firms might hold more cash in anticipation of greater investment.

Table 10 shows estimates of regressions of cash/assets differences between twins on country characteristics. We have three variables that proxy for the

Table 10
Regressions of differences in cash holdings between U.S. and matching firms (from our preferred matches) on differences in institutions

Panel A: Multiple regressions (pooled across years) OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WGI	0.000	−0.017	0.001	0.004	0.000	−0.011	0.002	0.006
ADRI	−0.002	−0.001	−0.001	0.000	−0.002	−0.001	−0.001	0.001
DLLS	0.025*	0.030**	0.022	0.017	0.027*	0.030*	0.022	0.015
Bank credit	0.016**	0.013*	0.016**	0.017***	0.015**	0.013*	0.016**	0.017**
Bond market	0.040**	0.039**	0.042**	0.044**	0.038*	0.039*	0.038*	0.037*
Turnover	0.001	−0.000	0.001	0.001	0.008	0.006	0.006	0.006
GDP (constant 2000 US$)		0.001*				0.001		
GDP growth (annual %)			0.095				0.133	
Yea-ahead GDP growth				0.275**				0.358***
Include BKS variables	No	No	No	No	No	No	No	No
Include year dummies	No	No	No	No	Yes	Yes	Yes	Yes
Adjusted R^2	0.0047	0.0051	0.0047	0.0052	0.0050	0.0051	0.0051	0.0057
N	21,109	21,109	21,109	21,109	21,109	21,109	21,109	21,109

Panel B: Multiple regressions (pooled across years) WLS

WGI	0.012*	−0.001	0.012*	0.013*	0.014**	0.006	0.014**	0.015**
ADRI	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
DLLS	0.039*	0.042*	0.036	0.035	0.042*	0.044*	0.040*	0.038*
Bank credit	0.004	0.002	0.004	0.005	−0.001	−0.002	−0.000	0.000
Bond market	0.007	0.003	0.008	0.008	0.005	0.003	0.006	0.006
Turnover	0.001	0.001	0.001	0.001	0.013**	0.013**	0.012*	0.012*
GDP (constant 2000 US$)		0.001				0.000		
GDP per growth (annual %)			0.061				0.063	
Year-ahead GDP growth				0.087				0.117
Include BKS variables	No	No	No	No	No	No	No	No
Include year dummies	No	No	No	No	Yes	Yes	Yes	Yes
Adjusted R^2	0.0052	0.0057	0.0052	0.0052	0.0074	0.0075	0.0074	0.0075
N	21,109	21,109	21,109	21,109	21,109	21,109	21,109	21,109

Panel C: Quantile regressions—pooled across years

WGI	−0.011*	−0.030**	−0.011	−0.009	−0.012*	−0.032**	−0.012	−0.010
ADRI	−0.002	−0.001	−0.001	−0.001	−0.001	−0.000	−0.001	−0.001
DLLS	0.004	0.010	0.003	−0.000	0.006	0.012	0.005	0.001
Bank credit	0.017**	0.014**	0.017***	0.018***	0.017**	0.013**	0.018***	0.018***
Bond market	0.022	0.022	0.023	0.024	0.024	0.027	0.025	0.023
Turnover	0.001	0.001	0.001	0.001	0.005	0.003	0.005	0.005
GDP (constant 2000 US$)		0.001**				0.001**		
GDP growth (annual %)			0.055				0.067	
Year-ahead GDP growth				0.180**				0.175
Include BKS variables	No	No	No	No	No	No	No	No
Include year dummies	No	No	No	No	Yes	Yes	Yes	Yes
Adjusted R^2	0.0030	0.0035	0.0030	0.0034	0.0035	0.0037	0.0035	0.0040
N	21,109	21,109	21,109	21,109	21,109	21,109	21,109	21,109

The dependent variable is the difference in cash/assets between the U.S. firm and its matched foreign firm. The independent variable is the difference in institutions between the U.S. firm, and its matched foreign firm. Matches are done yearly. *, **, and *** indicate significance at the 10%, 5%, and 1% levels. Possible *N* is 24,566 (sum of all the matched pairs in Table 4). Errors are clustered at the country level (country of matching firm).

quality of institutions. These variables are the *WGI*, the *ADRI*, and the *anti-self-dealing index (DLLS)*. We would expect cash holdings to decrease as institutions become better as we would expect firms to hoard less cash because of agency problems when these problems are better controlled in a country because of better institutions. The next three variables are proxies for financial development. The first variable, *bank credit*, is a proxy for the development of the banking sector. The second variable, *bond market*, is a proxy for the

development of the bond market. Finally, *stock market turnover* is a variable that proxies for the development of the stock market. Last, we use three different variables for economic activity. These variables are *GDP per capita*, *GDP per capita growth*, and *1-year-ahead GDP growth*. We expect cash holdings to increase with growth. We have no prediction for GDP per capita, but we want to make sure that our other variables do not proxy for GDP per capita. We estimate the regressions once without year indicator variables and once with.

Regression (1) has no year indicator variables and has no proxy for economic activity. We find that neither the WGI nor the ADRI is significant. The DLLS has a positive and significant coefficient. Both the bank credit and the bond market variables have positive significant coefficients, but the stock market development proxy is not significant. The regression with these variables has an adjusted R-squared of 0.47%. The significant coefficients in this regression are inconsistent with the theoretical predictions. In Regression (2), we add *GDP per capita*, which has a significant positive coefficient. The other variables remain significant. When we add contemporaneous or forward GDP growth, the anti-self-dealing index is not significant but the proxies for credit development remain significant. We estimate the same regressions with year indicator variables. The results are not affected except that *GDP per capita* is no longer significant. In Panel B, we show WLS estimates. With these regressions, the WGI has a positive significant coefficient in some regressions and the anti-self-dealing index is positive and significant in six regressions. However, the proxies for credit development are never significant. Finally, in Panel C we use median regressions. With these, the WGI has a negative significant coefficient in four regressions, and the domestic credit measure always has a positive coefficient.

A concern is that the credit variables are significant not because they proxy for financial development, but because credit is high when economic activity is high or because high credit means that firms have high cash balances as a result of having received loans. To examine that possibility, we lag the bank credit variable in a regression that is not tabulated and added domestic credit growth. With this approach, bank credit remains significant. Domestic credit growth does not always have a positive coefficient. We conclude from this exercise that the significance of the credit development variables is not due to their potential role as proxies for economic conditions and/or recent loan activity. However, we are less successful in trying to establish whether the credit variables are important on their own or whether they are correlated with some unobserved attribute of countries that is associated with cash holdings. We estimate (but do not tabulate) OLS regressions with country fixed effects but without the ADRI and the anti-self-dealing index because they are constant. When we do that, the bond measure still has a positive significant coefficient, but the bank credit measure has a negative significant coefficient. The negative coefficient is consistent with the prediction that firms in more financially developed countries should hold less cash, but this conclusion should be treated with caution because the variables we use are relatively stable over the sample period.

We also estimate regressions for the whole sample, where we add the country-specific variables to the BKS variables. We do not tabulate the results. With the OLS regressions, the only significant variable is *bank credit* in all regressions, *GDP per capita* when it is used, and the *WGI* in two regressions. The world governance index has a negative significant coefficient in the regressions that include GDP per capita but not in the other regressions. When we turn to the WLS regressions, the world governance index is still significant, but bank credit is not. Last, in the median regressions, the world governance index is significantly negative in four regressions, and *bank credit* is significant in all regressions. No other institution variable is significant.

It follows from this that inferences about the role of country characteristics are sensitive to the estimation method. This is probably not surprising because these country characteristics have extremely limited explanatory power. Across OLS and median regressions, the bank credit variable is by far the most robust country institutional characteristic. However, it is not significant in the WLS regressions. Comparing results where we explain the difference in cash holdings between U.S. firms and their twins and results where we use a regression with the whole sample, we find that significant coefficients can switch sign. For instance, the world governance index is positive and significant when we compare pairs and control for *GDP per capita* but negative and significant when we use the whole sample. The only consistent result is that there is no case where the ADRI and the anti-self-dealing index have the predicted negative sign.

We estimate all the regressions of Table 10 eliminating from the sample the U.S. firms in the top-two R&D deciles constructed using U.S. breakpoints to investigate whether the results are sensitive to the presence of these firms in the sample. With the OLS regressions, we find that *DLLS index*, *bank credit*, and *bond market* are always significant. No other variables are significant except for *GDP per capita growth*. The explanatory power of the regression falls slightly. The WLS results are very similar to those reported in the table. Finally, the quantile regressions are similar, as well, except that *1-year-ahead growth* is significant in Regression (4). It follows that the lack of explanatory power of country variables is not due to the large differences in cash holdings for the high R&D firms.

6. Conclusion

In this study, we show that the cash holdings of U.S. firms are no higher than the holdings of foreign firms when these firms are chosen carefully so that they are very similar to the U.S. firms. Further, there is no evidence that the cash holdings of U.S. firms are higher relative to the cash holdings of foreign twins after the financial crisis than they are before. To the extent that cash holdings of U.S. firms are higher, it is because the U.S. has a type of firm that is rare in foreign countries, namely firms with an extremely high-R&D-to-sales ratio. These firms have very high cash/asset ratios. Since Bates, Kahle, and Stulz

(2009), research in finance has increasingly emphasized the role of R&D in the increase in cash holdings of U.S. firms.[13] Our study shows that the importance of R&D for the cash holdings of U.S. firms also affects comparisons of cash holdings of U.S. firms with cash holdings of foreign firms.

As discussed extensively, however, results about the cash holdings of U.S. firms with the highest R&D-to-sales ratios must be used with a great deal of caution because there are few good matches for such firms, and many of the matches compare these firms with firms with lower R&D-to-sales ratios—firms that would be expected to hold less cash. Consequently, it would not be legitimate to conclude that U.S. firms with the highest R&D-to-sales ratios hold more cash than comparable foreign firms do. The more appropriate conclusion is that these firms are unique to the United States and that, if foreign countries had such firms, we do not know whether they would differ from U.S. firms in their cash holdings.

Observers and research in finance highlight the role of taxes affecting repatriation of foreign profits for multinational firms as a factor that leads to the higher cash holdings of U.S. firms, as compared with foreign firms. Because we show that U.S. firms mostly do not hold more cash than foreign firms do, the importance of the tax treatment of multinational firms in explaining the high cash holdings of U.S. firms has to be limited. We find that it is. The typical U.S. multinational does not hold more cash than the typical foreign multinational does. However, we also find that U.S. multinational firms hold more cash than similar foreign firms do when they have high R&D expenditures. Such a result is perhaps not surprising in light of the type of firms that observers have focused on. However, purely domestic firms with high R&D outlays have higher cash holdings, as compared with foreign firms, as well. Therefore, further research is required to establish how much of the cash holdings of high-R&D U.S. multinational firms is due to their greater ability to determine the location of their earnings, as compared with other multinationals, and, hence, to have cash accumulate in low-taxation countries, and how much is due to high-R&D firms holding cash for precautionary reasons or reasons unrelated to taxation.

There has been much research on the question of how a country's institutions affect financial policies. This study has shown that country characteristics by themselves play a rather small role in explaining the differences in cash holdings between U.S. firms and their foreign twins. The adjusted R-squared of a regression of cash/assets differences on yearly country indicators is only 1.4%. Estimates of the effects of country characteristics are sensitive to the estimation method. However, throughout our regressions, the coefficients on the ADRI and the anti-self-dealing index are positive or insignificant, which is inconsistent with the prediction of agency theory of a negative coefficient.

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[13] See, for instance, He and Wintoki (2014).

Appendix

Unless otherwise indicated, all variables are measured at time *t* and winsorized at the 1% tails.

Variable	Description and calculation *(Compustat data codes are italicized)*
Acquisitions	Acquisitions to assets: *aqc/at*
ADRI	The anti-director rights index from Andrei Shleifer's Web site
Bank credit	Domestic credit from banking sector, which is the percentage of credit from the banking sector; obtained from the World Bank, data code FS_AST_DOMS_GD_ZS
Bond market	Private domestic debt securities issued by financial institutions and corporations as a share of GDP taken from the Bank of International Settlements
Capex	Capital expenditures to assets: *capx/at*
Cash	Cash to assets: *che/at* (winsorized at the 1% tail on the high end)
CF	Cash flow to assets *(oibdp-xint-txt-dvc)/at)* winsorized at the 1% tail, lower side only
Debt issuance	Net debt issuance relative to assets: *(dltis-dltr)/at*; when *dltis* and *dltr* are missing, we calculate the net issuance of debt using the change in debt for the firm (*dd1*+*dltt*)-(L.*dd1*+L.*dltt*), where L. denotes the lag operator
Dividends	Indicator set to one if firm pays dividends: Set to one if *dvc*>0
DLLS	Anti-self-dealing index from Djankov and others (2008), from Andrei Shleifer's Web site
Equity issuance	Net equity issuance relative to assets: *(sstk-prstkc)/at*
GDP growth	Growth in GDP per capita, obtained from the World Bank, data code ny_gdp_pcap_kd_zg
GDP	GDP per capita in constant 2000 US$, obtained from the World Bank, ny_gdp_pcap_kd
Ind. vol	Mean, by 2-digit SIC code, of firm standard deviation of CF for the prior 10 years; a minimum of 3 years is required to calculate firm volatility
Leverage	Short- and long-term debt to assets: *(dltt+dlc)/at* winsorized between 0 and 1, inclusive
MB	Market to book of assets: *((at-ceq)+(csho*prcc_f))/at* winsorized at the 1% tail, upper side only; for foreign firms, Compustat does not include price or share data in their main dataset; prices and share data for foreign firms are from the Compustat Global – Security Daily file
MNC	Indicator variable set to one if the firm is multinational; firms are multinational if more than 25% of its sales come from outside its home country in any of the prior 3 years (based on Compustat for U.S. firms or Worldscope data item WC08731 for foreign firms); once a firm is defined as multinational, it remains multinational throughout the sample
NWC	Non-cash net working capital to assets: *(wcap-che)/at* winsorized at the 1% tail, lower side only
RD	R&D expense to sales: *xrd/sale*
Size	Logarithm of real assets, deflated to year 2000 US$ using the consumer price index: log*(at/cpi)*
Turnover	Stock market turnover, from the World Bank, data code GFDD_DM_01
WGI	WGI is the equal-weighted average of the six components of the Worldwide Governance Indicators from www.govindicators.org
Year-ahead GDP growth	1-year-ahead GDP growth

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