The determinants of domestic and foreign cash holdings: an empirical investigation

Abstract:

This study extends the literature on cash holdings and international business by analyzing in detail and separately the determinants of domestic and foreign cash holdings. Toward our objective, we use a unique, hand-collected sample of a country (Brazil) where publicly listed companies voluntarily disclosed information about their foreign cash relative to domestic cash separately. Using this unique sample from 2010 to 2021, we first document that foreign (domestic) cash holdings account, on average, for 2.88% (7.24%) of total assets and 29.63% of global cash. Additionally, the statistical analysis shows that companies that voluntarily disclose information about their foreign cash holdings accumulate significantly higher cash savings (10.12%) than the other companies (7.69%). Furthermore, consistent with our research hypothesis, we empirically demonstrate that foreign cash holdings are positively associated with global cash. This evidence supports the argument that Brazilian companies that earn revenue outside of Brazil are motivated to keep some of their foreign earnings abroad in the form of foreign cash to avoid repatriation taxes. Finally, our regression analysis shows that the variables frequently used in the cash management literature to explain the variations in global cash levels explain much better the variations in domestic than in foreign cash levels. Our paper contributes to the literature by being the first study to examine the determinants of foreign cash relative to domestic cash based on the real amount of foreign cash disclosed by companies. Our findings also provide useful information for policymakers as we highlight the need for increased disclosures about firms' foreign operations.

Keywords: Cash holdings; Cash Management; Foreign Cash; Domestic Cash; Multinationals.

1. INTRODUCTION

This paper extends the literature on cash holdings and international business (IB) by analyzing in detail and separately the determinants of domestic and foreign cash holdings. Ensure that a company has enough cash balances to finance its growth opportunities is one of the most relevant financial decisions that managers make in the presence of market imperfections deriving from asymmetric information between managers and capital providers (Harford, 1999; Almeida, Campello, Cunha, & Weisbach, 2014; Manoel & Moraes, 2022b). The decision about corporate liquidity is even more important in times of recessions, like the Covid-19 pandemic crisis, because in scenarios of downturns, the availability of external finance is customarily scarcer and more onerous (Campello, Graham & Harvey, 2010; Almeida et al., 2014). Accordingly, if firms do not manage their cash reserves aiming to mitigate part of the problems resulting from market imperfections, then they run the risk of turning away valuable investment opportunities or even leading to bankruptcy in some extreme cases (Opler, Pinkowitz, Stulz, & Williamson, 1999; Almeida, Campello, & Weisbach, 2004; Campello et al., 2010; Almeida et al., 2014; Harford, Klasa, & Maxwell, 2014).

Firms maintain a significant quantity of cash and cash equivalents on their balance sheets and the investigation of firms' cash holdings has recently gained considerable media and international bodies' attention (Fernandes & Gonenc, 2016; Hanlon, Maydew, & Saavedra, 2017; Harford, Wang, & Zhang, 2017; Graham & Leary, 2018; Faulkender, Hankins, & Petersen, 2019; Chen, Chiu, & Shevlin, 2022; Eskandari & Zamanian, 2022; Manoel & Moraes, 2022a; Manoel & Moraes, 2022b). The recent stream of research on liquidity management attributes the growing focus to the determinants of cash holdings mainly due to the increase in the ratio of cash-to-assets of U.S. multinational firms (MNCs) (Edwards, Kravet, & Wilson, 2016; Fernandes & Gonenc, 2016; Graham & Leary, 2018; Faulkender et al., 2019; Chen et al., 2022). The general explanation for the record-high amounts of cash of U.S. Multinationals is the role of their foreign earnings and the repatriation tax concerns that cause these companies to hold trillions of dollars in their foreign subsidiaries as foreign cash, generally to avoid U.S. repatriation taxes (Foley, Hartzell, Titman, & Twite, 2007; Edwards et al., 2016; Fernandes & Gonenc, 2016; Gu, 2017; Harford et al., 2017; Faulkender et al., 2019).

As companies become increasingly global, so do their cash reserves. However, despite the rising body of research about corporate liquidity management in U.S. MNCs

since the 2000s, there is a lack of knowledge about the cash holdings of emerging markets multinationals (EMMs) (Manoel & Moraes, 2022b). Furthermore, an important dimension that needs to be better understood is the fraction of earnings that EMMs opt to maintain in their foreign subsidiaries in the form of foreign cash holdings. Indeed, the literature on cash management and international business has not made enough progress in understanding the determinants of foreign cash compared to domestic cash due to the lack of foreign cash disclosure.

Understanding firms' cash policies become more complicated when a significant portion of the cash is held abroad and companies do not disclose foreign cash relative to domestic cash. Even in the U.S. context, with the Securities and Exchange Commission (SEC) making repeated calls for voluntary disclosure of foreign cash holdings[1], there is scarce evidence on the determinants of foreign cash relative to domestic cash due to the unavailability of data on foreign cash (Almeida et al., 2014; Edwards et al., 2016; Gu, 2017; Harford et al., 2017; Blouin, Krull, & Robinson, 2018; Faulkender et al., 2019; Bjornsen, Downes, & Omer, 2020). The lack of foreign cash disclosure is even more worrying when companies have limited access to the cash held abroad, such as when they must pay repatriation taxes to use such funds domestically. Thus, the amount of global cash that MNCs retain can overstate the exact quantity of cash they have available to use domestically without paying the repatriation taxes.

Hence, the use of global cash holdings in existing research due to data constraints may have clouded the literature on cash management, given that the amount of global cash holdings a company has may not represent the actual amount of cash on hand at their disposal when part of the cash is "trapped abroad" (Almeida et al., 2014; Edwards et al., 2016; Harford et al., 2017; Laplante & Nesbitt, 2017; Faulkender et al., 2019). Therefore, understanding the determinants of foreign versus domestic cash is still an empirical question and a matter that attracts the interest of regulators, academics and financial statement users. In this respect, Almeida et al. (2014) call for more research to understand the portion of the cash that is held abroad. In this paper, we take a step toward these voids by analyzing in detail and separately the determinants of domestic and foreign cash. To make this study feasible, we use the Brazilian setting.

[1] In the United States, for example, the request for foreign cash holdings disclosure was initiated from the interest of the Securities and Exchange Commission (SEC) in the liquidity of U.S. MNCs and their access to foreign cash balances.

Brazil provides a unique setting for this research. First, the growing participation of EMMs from Brazil is a new and relevant phenomenon related to the increasingly integrated world economy (see, for example, the cases of Embraer, Gerdau, JBS, Petrobras and Vale). Furthermore, the stream of research on international business does not provide enough evidence to understand this recent phenomenon. Thus, our research help to shed light on this contemporary topic of the international expansion of EMMs. Second, unlike public companies from other economies, a significant part of Brazilian MNCs disclose information about foreign cash in their explanatory notes. Hence, we can incorporate the variable foreign cash into the cash management literature by drawing on a sample of Brazilian publicly traded firms. Therefore, Brazil provides a unique environment to conduct an in-depth analysis of the determinants of domestic and foreign cash holdings separately.

Due to the growing interest in companies' foreign cash by the media, investors, regulators, policymakers, and the lack of accurate information about the amounts of foreign cash that MNCs hold relative to their domestic cash, then our study is of great interest in itself. In addition, understanding the determinants and the magnitude of foreign cash allow us to determine better how much cash companies maintain abroad and examine whether the determinants of foreign cash are the same as those of domestic cash. Moreover, by examining the determinants of foreign and domestic cash separately, our research extends the prior empirical literature on cash management, which has focused only on global cash holdings, which for MNCs include cash held in their foreign subsidiaries.

No less important, while other papers within the U.S. setting rely on proxies for or estimates of foreign cash[2] (e.g., Edwards et al., 2016; Harford et al., 2017; Laplante & Nesbitt, 2017; Fabrizi, Ipino, Magnan, & Parbonetti, 2023), our study uses the actual foreign cash disclosed by Brazilian publicly listed companies in their explanatory notes. Thus, in using the actual foreign cash disclosed by Brazilian publicly listed companies, then our paper overcomes the limitations of estimates of foreign cash[3]. Finally, our sample

[2] For example, Harford et al. (2017) use permanently reinvested earnings (PRE) as a proxy for foreign cash holdings to examine how the U.S. tax constraint affects how the cash is deployed in U.S. MNCs and hence how investors value companies' foreign cash holdings. However, the empirical evidence of Blouin et al. (2018) shows that PRE is not a good proxy for foreign cash holdings. To achieve this conclusion, Blouin et al. (2018) used confidential data about foreign cash based on the Bureau of Economic Analysis (BEA) survey data. Therefore, according to Blouin et al. (2018), caution is needed when interpreting results based on PRE as a proxy for foreign cash.

[3] The studies of Foley et al. (2007), Blouin et al. (2018), and Faulkender et al. (2019) are an exception, given that they have information available about foreign cash based on the BEA survey. However, the BEA

covers a recent period (2010-2021), enabling us to provide timely empirical evidence on this topic and advance existing theories on the determinants of corporate cash holdings.

Our primary sample consists of an unbalanced panel data set of 382 Brazilian non-financial and non-utility publicly listed companies (2,958 firm-year observations) with annual data available over the period 2010-2021. The firm-level data come from the Economática® database. To examine the determinants of domestic and foreign cash separately, we manually collect from this sample those companies that voluntarily disclose information about cash held abroad in their explanatory notes. We obtained voluntary foreign cash reserves disclosure for 88 companies (631 firm-year observations), representing about 21.33% of the entire sample with data available to estimate our model.

We document several interesting results. For example, the mean ratio of cash held abroad (domestic) relative to total assets for these companies is 2.88% (7.24%). The foreign (domestic) cash-to-total assets ratio rose from 2.87% (7.11%) in 2010 to 3.20% (8.16%) in 2021. Furthermore, their foreign cash balances represent 29.63% of their global cash holdings. It is worth noting, however, that the average foreign cash to global cash ratio for these firms decreased from 30.33% in 2010 to 25.73% in 2021. Thus, while prior academic studies document a "dramatic growth" or a "cash buildup" in foreign cash holdings post-2000 (e.g., Graham & Leary, 2018; Faulkender et al., 2019), our empirical evidence does not indicate a secular increase in the foreign cash to assets ratio from 2010 to 2021.

We also document that, on average, non-financial and non-utility publicly listed companies in Brazil maintain 8.21% of their total assets in the form of global cash and cash equivalents. Additionally, the statistical analysis shows that companies that voluntarily disclose information about their foreign cash holdings hold approximately 10.12% of global cash holdings to total assets compared to 7.69% for companies that do not disclose such information or simply do not have foreign cash. Thus, companies that opt to disclose their foreign cash holdings accumulate significantly higher cash savings than the other companies throughout the 2010-2021 period (see Figure 1). The summary statistics also show that companies in the foreign cash reserves subsample are significantly larger, more profitable, more likely to pay dividends, have higher cash flow

survey of U.S.-based MNCs contains information about foreign cash holdings only for a small subset of companies and for a reduced sample period (1999-2008) (Campbell et al., 2016; Faulkender et al., 2019). Hence, the sample used by these authors is limited to U.S.-based MNCs and the years for which the foreign cash ratio is available (after 2008, foreign cash reserves are no longer collected).

to net assets, more asset tangibility, greater levels of net working capital, higher foreign growth opportunities and lower leverage. Companies that do not disclose information about their foreign cash or do not have foreign cash, on the other hand, have higher cash flow volatility and greater capital expenditure.

In sequence, we regress global, domestic, and foreign cash holdings on firm characteristics that prior research on the theme has been shown to have significant explanatory power on firms' cash position, such as firm size, dividends, cash flow, cash flow volatility, net working capital, short-term debt, leverage, profitability, tangibility, capital expenditure, and growth opportunities. In our baseline specification, we run firm-fixed effects regressions to control for unobservable time-invariant firm characteristics that might influence cash reserves (Fernandes & Gonenc, 2016; Manoel & Moraes, 2022b). In addition to firm-fixed effects, we also include year dummies. Our analysis reveals that certain firm characteristics, such as size, dividend dummy, and cash flow volatility, have a significant impact on domestic cash holdings. However, we find no statistically significant influence of these variables on foreign cash levels.

Furthermore, in line with our predictions, our empirical results reveal a positive relationship between foreign cash holdings and global cash. This evidence supports the argument that Brazilian companies that generate income outside the country's borders have incentives to maintain part of their foreign earnings abroad to avoid repatriation taxes imposed by the worldwide taxation system. As a result of tax considerations, companies tend to hold a portion of their foreign earnings in the form of foreign cash. Consequently, companies with larger amounts of foreign cash tend to accumulate higher levels of global cash. Last but not least, we also provide evidence that the firm characteristics identified by previous research on cash management as relevant in explaining the variations in global cash holdings explain much better the variations in domestic than in foreign cash holdings.

To ensure the validity of our findings, we conduct a series of robustness tests, including using an alternative measure of cash holdings, which confirms the consistency of our main results. We also address the endogeneity issue by utilizing the Generalized Method of Moments (GMM) estimation procedure developed by Arellano and Bond (1991). Additionally, we address the self-selection bias arising from the non-randomness of companies' choice to disclose information about foreign cash by applying the Heckman (1979) two-step procedure. Our analysis shows that our results remain robust even after

correcting for the potential sample selection bias caused by the non-randomness of the disclosure decision.

This article makes several important contributions to cash management and international business literature. First, our paper enriches the limited literature on foreign cash holdings by offering a better understanding of their determinants and representativeness relative to domestic and global cash reserves. This is particularly relevant to build and testing global cash holdings theories. Second, we demonstrate the relevance of considering foreign cash holdings in understanding the determinants of firms' global cash holdings. Third, this paper also contributes to the existing literature on disclosing MNCs' international activities (Fabrizi et al., 2023).

In addition to enriching the growing literature on cash management and international business, this article also provides relevant implications for investors, managers, and policymakers. For investors, we highlight the need to examine in detail the percentage of cash that a company retains abroad in relation to domestic cash since this information can influence their investment decisions. This analysis is relevant, even considering that information on foreign cash is only available for some companies in their explanatory notes. Furthermore, a better understanding of the determinants of foreign cash relative to domestic cash can also help EMMs' managers, as well as managers of companies that are starting their internationalization process, to understand better how business managers of EMMS in the country and each industry manage such resources. Finally, for policymakers worldwide, we highlight the need for mandatory and separate disclosure of domestic and foreign cash holdings in amount and geographic location. As pointed out throughout the article, publicly traded companies around the globe customarily do not disclose information about the amount of their foreign cash nor the specific locations where these funds are held, as disclosure of foreign cash reserves is not mandatory but rather a voluntary decision. However, from the available information on domestic and foreign cash in quantity and specific location, financial statement users will have more information to determine MNCs' liquidity positions.

The rest of this article is organized as follows. In Section 2, we present the theoretical background and the research hypothesis. Section 3 describes the data and the regression model used. In Section 4, we document the empirical results and the robustness checks. Finally, Section 5 concludes the article.

2. THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1. Theoretical Background

To examine the determinants of foreign cash holdings relative to domestic cash, it is first necessary to understand the factors that cause companies to retain global cash holdings. For example, if companies operate in a perfect capital market with no transaction costs, no agency problems, and no information asymmetry, the decision of the amount of total assets that should be retained in the form of cash and cash equivalents would be irrelevant for firm value. Moreover, considering there is no liquidity premium in such a theoretical world, holding liquid assets has no opportunity costs (Opler et al., 1999). However, this cash irrelevancy is not supported in a world of capital market frictions and uncertain growth opportunities. Hence, given that firms operate in capital markets that are far from perfect and that they cannot raise enough funds on a timely basis to finance all of their positive net present value (NPV) projects today and in the future, cash management is then a relevant component of overall corporate policy (Harford, 1999; Almeida et al., 2004; Graham & Leary, 2018; Faulkender et al., 2019).

Capital market imperfections provide a rationale for firms to hold some cash and cash equivalents (Kim, Mauer, & Sherman, 1998; Harford, 1999; Opler et al., 1999). In particular, the current literature on corporate cash holdings emphasizes five major reasons for firms maintaining part of their assets in cash and cash equivalents: precautionary, transaction, speculative, agency and tax motives. First, the precautionary motive refers to firms keeping cash to meet unexpected contingencies. Stately differently, under the precautionary motive introduced by Keynes (1936), companies hold cash reserves as a buffer to protect themselves against adverse cash flow shocks that could lead to underinvestment. Second, companies also stock cash for transactional cost motive to conduct regular business transactions, such as transacting with customers and paying suppliers without resorting to costly external financing. Third, the speculative motive posits that companies maintain liquid assets to exploit profitable growth opportunities that may arise unexpectedly (Keynes, 1936; Kim et al., 1998; Harford, 1999; Opler et al., 1999; Ferreira & Vilela, 2004; Bates, Kahle, & Stulz, 2009; Graham & Leary, 2018; Mortal, Nanda, & Reisel, 2020; Gao, Whited, & Zhang, 2021; Eskandari & Zamanian, 2022).

However, although a common proverb suggests that "cash is king", holding liquid assets can also have large potential costs (Kim et al., 1998; Almeida et al., 2014). First,

cash holdings are costly because a company foregoes investment in less liquid but more productive assets (Kim et al., 1998; Opler et al., 1999; Ferreira & Vilela, 2004). According to Dittmar, Mahrt-Smith, and Servaes (2003), this cost is called the cost of carry. Second, cash may have negative value implications if entrenched managers use liquid assets in value-decreasing investment decisions that benefit themselves but destroy shareholder value. More specifically, a prevalent argument among accounting and corporate finance scholars is that cash is highly vulnerable to managerial waste, given that managers have easy access to cash and much of its use is discretionary. For example, self-interested managers can squander cash resources by consuming perquisites, empire-building, excessive remuneration, inefficient investment decisions, or even theft. Thus, from an agency perspective, which the literature points to as the fourth reason for firms' liquidity preferences, managers can employ cash holdings in a manner that is not in the interest of minority shareholders but benefit themselves (Jensen & Meckling, 1976; Jensen, 1986; Harford, 1999; Opler et al., 1999).

More recently, the literature identified a fifth explanation for companies to hold cash: taxes. Many countries in the world tax the income of companies that operate within their borders. In the United States[4], for example, these taxes are equal to the difference between foreign income taxes paid and tax payments that would be due if foreign earnings were taxed at the North American rate. In order to avoid double taxation of foreign income, some countries, such as the United States, grant tax credits for foreign profit taxes paid abroad (Foley et al., 2007). Furthermore, U.S. MNCs are allowed to defer tax liabilities on foreign earnings until they are repatriated (Foley et al., 2007; Laplante & Nesbitt, 2017). To the extent that repatriation taxes represent a friction to multinationals' internal capital markets, Foley et al. (2007) predict and find that U.S. MNCs that incur higher tax costs when repatriating earnings tend to retain higher total cash holdings and foreign cash holdings. In sum, Foley et al. (2007) empirical findings show that tax burdens (pre-2018) create incentives for U.S. MNCs to maintain part of their earnings overseas, and to a large extent, in the form of foreign cash. Therefore, under a worldwide tax system, companies may have incentives to retain part of their foreign income abroad, either holding them as foreign cash holdings or by reinvesting in foreign operations as a strategy to avoid the tax on repatriated offshore earnings (Foley et al., 2007; Faulkender et al., 2019).

[4] In place prior to 2018, before the Tax Cuts and Jobs Act of 2017, enacted on December 22, 2017.

2.2. Hypothesis Development

Brazil, like the United States until the passage of the 2017 Tax Cuts and Jobs Act (TCJA), also applies a worldwide tax system with deferral. Therefore, under Brazilian tax laws, foreign operations of domestic companies are subject to a repatriation tax lax. The repatriation tax equals the Brazilian tax, generally 34%, minus a foreign tax credit for taxes paid to the foreign jurisdiction on the earnings. Thus, Brazilian law grants tax credits for foreign earnings taxes paid outside Brazilian borders' to avoid double taxation. It should be noted, however, that companies only need to pay the additional Brazilian tax in the case of a lower tax rate in foreign countries when the foreign income is repatriated to the parent company. Hence, the extra taxes can be deferral until earnings are repatriated. Finally, if the foreign income taxes paid to exceed the amount that would be due if taxed at the Brazilian rate, then no incremental taxes are due.

Due to this tax system on a worldwide basis with deferral, Brazilian MNCs may have incentives to retain earnings abroad to avoid repatriation taxes. To the extent that Brazilian MNCs' do not have immediate funding needs, then part of foreign earnings is likely to be retained in the form of foreign cash. In light of this tax argument, we predict that foreign cash holdings are positively associated with global cash holdings. Based on the aforementioned, our research hypothesis is:

H1: Foreign cash holdings are statistically and positively associated with global cash holdings.

3. RESEARCH DESIGN

3.1. Research Sample

Our initial sample is the set of all public corporations with shares traded on the Brazilian stock exchange, named "Brasil, Bolsa, and Balcão" or B3, for which annual financial data are available from 2010 to 2021. The data are obtained from the Economática® database, the most used dataset that contains balance-sheet information on publicly traded firms listed on the Brazilian stock exchange. We started our sample in 2010 because foreign cash reserves disclosure before 2010 is too scarce. Our sample includes both surviving and non-surviving firms with data available at any time in the

sample period. The panel data set of this research was constructed as follows. First, consistent with prior research, we remove financial and utility companies from the sample because the investment and financing decisions of these corporations are likely to be affected by statutory capital requirements and other government regulations (Opler et al., 1999; Foley et al., 2007; Bates et al., 2009). Second, we ensure that the sample comprises exclusively companies headquartered in Brazil. Third, we eliminate firms with insufficient financial statement data to estimate our model. We also require firms to have positive assets and sales as a final step. These criteria have provided us with a total of 382 companies, which represents 2,958 firm-year observations, with the required annual data available over the sample period. All data are in BRL.

The databases commonly used in accounting and finance research do not contain domestic versus foreign cash holdings breakdowns. Thus, the principal obstacle regarding this research's data was to capture Brazilian companies' foreign cash holdings. Most firms do not disclose this information because they are not required to. However, some companies voluntarily disclosed foreign cash in their explanatory notes after 2010. Then, to support this research, we manually read the explanatory notes of each Brazilian non-financial company of the reduced Economática® dataset sample of 382 companies (2,958 firm-year observations) to verify whether they provide separate information on the amount of domestic and foreign cash holdings. After hand-collecting foreign cash information, we supplement the Economática© database with this information.

Panel A of Table 1 displays the distribution of observations over the sample period.

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As shown in Panel A of Table 1, our final sample that contains the variable "foreign cash" consists of 646 firm-year observations (88 companies), accounting for 21.33% of our sample. Furthermore, we observed a rise in the disclosure of foreign cash throughout the sample period, from 38 firm-year observations out of 223 (17.04%) in 2010 to 69 out of 258 (26.74%) in 2021.

In Panel B of Table 1, we present the industry composition of our sample, including the percentage of firms by industry that discloses information separately about their foreign cash holdings. The industry with the largest representation in our sample is

Electricity, representing 10.07% of the whole sample. The Agriculture and Fisheries and Electronic Products companies have the lowest representations, with 1.08% and 1.72%, respectively. The largest proportion of foreign cash disclosure is in the Textile companies (16.96%), followed by firms from Vehicles (13.31%), Steel & Metals (8.56%), Oil and Gas (6.81%), and Food and Beverage (6.34%).

In Panel B of Table 1, we report the industry composition of our sample and the percentage of firms in each industry that disclose information separately about their foreign cash holdings. The Electricity industry has the largest representation in our sample, accounting for 10.07% of the total sample. In contrast, the Agriculture and Fisheries and Electronic Products industries have the lowest representation, accounting for only 1.08% and 1.72% of the sample, respectively. The Textile companies have the highest proportion of foreign cash disclosure at 16.96%, followed by firms in Vehicles (13.31%), Steel & Metals (8.56%), Oil and Gas (6.81%), and Food and Beverage (6.34%) industries. Conversely, companies in the Electricity (0.00%), Electronic Products (0.32%), and Construction (1.74%) industries are the ones that provide less information about their foreign cash or simply do not have foreign cash.

3.2. Empirical Model

3.2.1. Dependent variables

In the spirit of the seminal work of Opler et al. (1999), the primary dependent variable of our regression model is the natural logarithm of the ratio of cash and cash equivalents to net assets, where net assets are defined as total assets net of cash and cash equivalents. This proxy is a consolidated measure of cash reserves and avoids possible spurious associations with size and other variables that are divided by total assets. Moreover, by taking the natural logarithm, this dependent variable reduces the influences of extreme values on the estimates (e.g., Opler et al., 1999; Dittmar et al., 2003; Foley et al., 2007). After estimating the determinants of global cash holdings for a basis of comparison with previous studies on the topic, we examine whether foreign cash holdings are positively associated with global cash for the subsample of companies that disclose separate information about domestic and foreign cash.

In sequence, we separate total cash holdings into domestic and foreign cash components to examine in detail the determinants of domestic and foreign cash holdings

for the same subsample. We define domestic (foreign) cash as the natural logarithm of the ratio of domestic (foreign) cash to net assets. Even though our main measure of cash holdings is widely consolidated in the literature, we also use an alternative measure of cash holdings, computed as the ratio of cash and cash equivalents (global, domestic, and foreign cash holdings, each one at a time) to total assets (Ozkan & Ozkan, 2004; Bates et al., 2009; Hanlon et al., 2017), to assess the robustness of our findings with respect to different definitions of corporate cash holdings. The results with this alternative measure of cash are reported in the robustness check subsection.

3.2.2. Variable of interest

The key variable of interest to test our research hypothesis in the subsample of firms that disclose information about the amount of their foreign cash is foreign cash, computed as the natural logarithm of the ratio of foreign cash to net assets. Consistent with our hypothesis, we expect foreign cash holdings to be statistically and positively associated with global cash holdings.

3.2.3. Control variables

In this subsection, we briefly review the firm characteristics identified by previous literature as important in determining companies' global cash levels. Refer to Appendix A for variable definitions.

Size: Large enterprises hold significantly less cash holdings than small companies due to the economies of scale in cash management. Accordingly, we expect a negative association between firm size and cash holdings (Opler et al., 1999; Almeida et al., 2004). We use as our size measure the natural logarithm of net assets. Net assets are measured as total assets net of cash and cash equivalents.

Dividends: Reducing dividend payments when necessary is a way for companies that currently pay dividends to raise their cash holdings. In this sense, dividends are expected to correlate negatively with cash holdings (Opler et al., 1999; Ferreira & Vilela, 2004; Ozkan & Ozkan, 2004). Similar to Opler et al. (1999) and Foley et al. (2007), we examine the potential influence of a firm's dividend policy on its cash holdings by including a dummy variable equal to one if the firm pays a dividend in a given year and zero otherwise.

Cash Flow: To the extent that cash flow provides a timely source of liquidity, we expect a negative association between cash flow and cash holdings (Kim et al., 1998; Opler et al., 1999; Ferreira & Vilela, 2004). We measure cash flow as earnings after interest, dividends, and taxes but before depreciation, scaled by net assets (Opler et al., 1999).

Cash Flow Volatility: Companies with higher cash flow volatility are expected to build up more cash reserves to mitigate the expected costs of liquidity constraints. Accordingly, we expect a positive association between cash flow volatility and cash holdings (Ozkan & Ozkan, 2004; Bates et al., 2009). Following Ozkan and Ozkan (2004), we measure cash flow volatility as the standard deviation of cash flows over the average total assets.

Net Working Capital (NWC): Companies can use other liquid assets when they have cash shortfalls, so non-cash components of working capital can substitute for cash holdings. Thus, companies with higher ratios of net working capital, computed as the ratio of net working capital minus cash to net assets, are expected to hold less cash holdings (Bates et al., 2009; Harford et al., 2014).

Short-Term Debt (STD): Firms can increase their short-term debt levels aiming to build cash holdings (Almeida et al., 2004). Moreover, Arslan, Florackis and Ozkan (2006) contend that short-term debt can substitute for cash holdings. In this sense, we predict a negative association between short-term debt, computed as the ratio of short-term debt to net assets, and cash levels (Almeida et al., 2004).

Leverage: The literature recognizes that leverage plays a relevant role in shaping firms' cash policies. According to Ferreira and Vilela (2004), leverage increases the probability of bankruptcy due to the pressure that amortization plans on companies' treasury management. In order to lower the likelihood of facing financial constraints, companies with a high degree of leverage are more likely to accumulate cash, which suggests a positive relationship between leverage and cash. However, Ozkan and Ozkan indicate that a negative association is another possible outcome, given that the leverage ratio act as a proxy for the ability of companies to issue debt. The predicted association between cash savings and leverage is ambiguous (Ferreira & Vilela, 2004; Ozkan & Ozkan, 2004). Thus, the previous literature has posited reasons for both a positive and negative association between leverage and cash. Hence, we do not make a directional prediction for leverage. Similar to Ozkan and Ozkan (2004), we calculate leverage as the sum of short- and long-term debt to net assets.

Return on Assets (ROA): Profitable companies are better able to distribute dividends, pay off their debts, and accumulate cash out of their internally generated cash flows (Al-Najjar, 2013). Hence, we predict a positive association between a firm's profitability and cash holdings. As a proxy of profitability, we use the firm's return on assets (ROA), computed as net income before extraordinary items over net assets (Faulkender et al., 2019).

Tangibility: Companies with more tangible assets can sell part of their tangible assets if a sudden need for cash arises (Campello et al., 2010; Fernandes & Gonenc, 2016). In this sense, we expect a negative association between tangibility and cash reserves. We use the ratio of total property, plant, and equipment (PPE) over non-cash assets as a proxy for tangibility.

Capital Expenditure: Companies that invest more are expected to maintain less cash. In this sense, we expect a negative association between capital expenditure (Capex) as a proxy for a firm's level of investment and cash savings (Harford et al., 2014). We include the ratio of capital expenditure to net assets as our measure of investment activity.

Growth Opportunities: The empirical literature on corporate cash holdings predicts a positive association between cash reserves and growth opportunities based on the argument that companies with greater corporate growth prospects accumulate proportionally more cash to minimize the opportunity costs of foregone these valuable investment opportunities (Opler et al., 1999; Ozkan & Ozkan, 2004; Mortal et al., 2020). We, therefore, expect that higher global investment opportunities are associated with greater global cash holdings. Ideally, we would proxy for global investment opportunities using research and development (R&D) expenditure. However, data about R&D are not available for our Brazilian sample. Thus, we proxy for global growth opportunities using sales growth, computed as the year-on-year growth in global sales.

To account for different growth prospects in the domestic and foreign markets, we include both domestic and foreign sales growth separately in the regression when we individually examine domestic and foreign cash holdings instead of using global growth opportunities. As a proxy for domestic (foreign) growth opportunities, we use the percentage change in domestic (foreign) sales from year $t-1$ to year t.

3.2.4. Regression Specifications

As previously recognized by existing literature (e.g., Ozkan & Ozkan, 2004; Fernandes & Gonenc, 2016), the standard OLS regressions commonly used in accounting and finance studies are deemed inappropriate for empirical studies of corporate cash holdings. One of the main concerns in cash management studies is the endogeneity problem because cash level decisions are jointly determined with other corporate policies such as leverage and dividend payout decisions. This joint determination, in turn, can make our estimates inconsistent. To address this issue, one common approach is to use firm-fixed effects (Fernandes & Gonenc, 2016; Manoel & Moraes, 2022b). Therefore, we incorporate firm-fixed effects in our initial analysis to control for the effect of firm-specific omitted variables on our inferences. By doing so, we can alleviate concerns over potential endogeneity arising from time-invariant firm characteristics omitted from our regression. Furthermore, we include year-fixed effects in our baseline regression framework to account for economy-time trends (Harford et al., 2017).

We first estimate the following panel regression model (Equation 1) for global cash holdings for the full sample in order to compare our results with previous studies on cash management:

$$\begin{aligned} Global\ Cash\ Holdings_{i,t} &= \beta_0 + \beta_1 Size_{i,t} + \beta_2 DIV_{i,t} + \beta_3 Cash\ Flow_{i,t} \\ &+ \beta_4 Cash\ Flow\ Volatility_{i,t} + \beta_5 NWC_{i,t} + \beta_6 STDEBT_{i,t} \\ &+ \beta_7 Leverage_{i,t} + \beta_8 ROA_{i,t} + \beta_9 Tangibility_{i,t} + \beta_{10} Capex_{i,t} \\ &+ \beta_{11} Global\ Growth\ Opportunities_{i,t} + Year + u_{i,t} \quad (1) \end{aligned}$$

In Equation 1, the dependent variable is the natural log of global cash holdings to net assets (cash and cash equivalents/net assets). $Size_{i,t}$ is the natural logarithm of net assets. $DIV_{i,t}$ is a binary variable that takes the value of 1 if a firm paid dividend in the year and 0 otherwise. $Cash\ Flow_{i,t}$ is the ratio of cash flow to net assets; $Cash\ Flow\ Volatility_{i,t}$ is the standard deviation of cash flows over average total assets. $NWC_{i,t}$ is the net working capital ratio minus cash to net assets. $STDEBT_{i,t}$ is the ratio of short-term debt to net assets. $Leverage_{i,t}$ is the ratio of total debt to net assets. $ROA_{i,t}$ is net income before extraordinary items to net assets. $Tangibility_{i,t}$ is the ratio of property, plant and equipment to net assets. $Capex_{i,t}$ is capital expenditure divided by net assets. $Global\ Growth\ Opportunities_{i,t}$ is the yearly growth rate of a firm's sales. For more details on variable definitions, see Appendix A.

In sequence, we add the variable foreign cash holdings, measured as the natural logarithm of the ratio of foreign cash to net assets, for the subsample of firms that disclose information about the amount of their foreign cash to test our research hypothesis. As mentioned earlier, we expect foreign cash holdings to be statistically and positively associated with global cash holdings. No other variables of Equation 1 are redefined.

$$\begin{aligned} Global\ Cash\ Holdings_{i,t} &= \beta_0 + \beta_1 Foreign\ Cash\ Holdings_{i,t} + \beta_2 Size_{i,t} + \beta_3 DIV_{i,t} \\ &+ \beta_4 Cash\ Flow_{i,t} + \beta_5 Cash\ Flow\ Volatility_{i,t} + \beta_6 NWC_{i,t} \\ &+ \beta_7 STDEBT_{i,t} + \beta_8 Leverage_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} Tangibility_{i,t} \\ &+ \beta_{11} Capex_{i,t} + \beta_{12} Global\ Growth\ Opportunities_{i,t} \\ &+ Year + u_{i,t} \quad (2) \end{aligned}$$

Next, we examine in detail and separately the determinants of domestic and foreign cash holdings for those companies that disclose information about their foreign cash (Equation 3):

$$\begin{aligned} Domestic\ (Foreign)\ Cash\ Holdings_{i,t} &= \beta_0 + \beta_1 Size_{i,t} + \beta_2 DIV_{i,t} + \beta_3 Cash\ Flow_{i,t} \\ &+ \beta_4 Cash\ Flow\ Volatility_{i,t} + \beta_5 NWC_{i,t} + \beta_6 STDEBT_{i,t} \\ &+ \beta_7 Leverage_{i,t} + \beta_8 ROA_{i,t} + \beta_9 Tangibility_{i,t} + \beta_{10} Capex_{i,t} \\ &+ \beta_{11} Domestic\ Growth\ Opportunities_{i,t} \\ &+ \beta_{12} Foreign\ Growth\ Opportunities_{i,t} + Year + u_{i,t} \quad (3) \end{aligned}$$

In Equation 3, we define $Domestic\ (Foreign)\ Cash\ Holdings_{i,t}$ as the natural logarithm of the ratio of domestic (foreign) cash to net assets. Furthermore, to account for different growth opportunities in the domestic and foreign markets, we include both $Domestic\ Growth\ Opportunities_{i,t}$ and $Foreign\ Growth\ Opportunities_{i,t}$, computed as the yearly growth rate of a firm's domestic (foreign) sales. The other variables and specifications in Equation 3 are as previously defined in Equation 1.

4. RESULTS

4.1. Summary statistics and correlations

In Panel A of Table 2, we present the summary statistics of the variables used in our global cash holdings regressions. To mitigate the undue influence of extreme values

and possible data errors on the results, all continuous variables are winsorized at the 1% level in each tail of their distribution.

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Panel A of Table 2 reveals that the mean global cash holdings, normalized by total assets, is 8.21% and the median value is 5.92%. The mean and median values found in our sample of Brazilian companies are significantly lower when compared, for example, with Opler et al. (1999), which obtained an average (median) ratio of cash to total assets of 17% (6.5%) for a sample of publicly traded U.S. firms over the period 1952-1994.

The average value for foreign growth opportunities is 3.85% versus 5.16% for domestic growth prospects. Moreover, the average firm in the sample presented a 5.41% increase in global sales. As a fraction of net assets, i.e., total assets net of cash and cash equivalents, the average leverage of our sample is 33.22%, tangibility is 26.68%, short-term debt is 10.37%, and capital expenditure is 5.59%. The mean and median cash flow to net assets is similar, with values of 6.47% and 6.31%, respectively. Additionally, the fraction of firm-year observations that pay dividends over the sample period is 70.58%. Finally, on average, Brazilian publicly traded firms have a net working capital of 3.81%, a return on assets of 6.41%, and a log of size of 15.18.

In Panel B of Table 2, we present summary statistics separately for companies that disclose information about their foreign cash holdings relative to those firms that do not disclose their foreign cash holdings or that simply do not have foreign cash reserves. We also use *t*-tests (Wilcoxon rank sum *z* tests) in Panel B of Table 2 to test for differences in means (medians). As presented earlier, we obtained voluntary disclosure of foreign cash holdings for 88 companies (631 firm-year observations), representing about 21.33% of the sample. As shown in Panel B of Table 2, the average foreign (domestic) cash holdings relative to total cash for these firms is 2.88% (7.24%), and their foreign cash represents 29.63% of global cash.

In comparison, using BEA survey data from 1998 to 2008, Faulkender et al. (2019) report an average foreign (domestic) cash-to-total assets ratio of 8.9% (12.2%) for their sample of 13,153 firm-year observations of U.S. MNCs. Moreover, they find that foreign cash holdings of U.S. MNCs account for 42% of their global cash (Faulkender et al., 2019). Also examining a sample of U.S. MNCs, Gu (2017) verified that the foreign

cash holdings of 161 firm-year observations from 2001 to 2009 account, on average, for 50.41% of their global cash. Our summary statistics, therefore, reveal that publicly traded companies in Brazil accumulate significantly lower levels of foreign cash relative to global cash than U.S. companies.

Continuing with Panel B of Table 2, the results show that companies that voluntarily disclose information about their foreign cash holdings maintain approximately 10.12% of their total assets in the form of total cash, compared to 7.69% for the other firms (p-value = 0.001). The results are similar when we compare the median ratio of global cash and cash equivalents to total assets; that is, the median global cash levels of firms that disclose their foreign cash are significantly higher (8.58%) than for the other firms (5.28%) with a p value of 0.001. Thus, companies that disclose foreign cash tend to have significantly larger proportions of global cash to total assets. Therefore, the descriptive statistics provide the first piece of evidence supporting our research hypothesis that foreign cash holdings are positively related to global cash.

Some other interesting results in Panel B of Table 2 is that, compared with companies that do not disclose foreign cash holdings or that do not have foreign cash, firms that voluntarily disclose their foreign cash holdings are significantly larger, more likely to pay dividends, have higher cash flow to net assets, greater levels of net working capital, are more profitable (as captured by ROA), and have higher foreign growth opportunities. They also have substantially higher leverage (38.79% versus 31.71% on average) and higher asset tangibility (32.62% versus 25.07% on average) than the other companies. Conversely, companies that do not disclose information about their foreign cash or that do not have foreign cash holdings have higher cash flow volatility and greater capital expenditure. The evidence on cash flow volatility is consistent with the argument that geographic diversification enables Brazilian MNCs to have more stable cash flows. Lastly, the two subgroups do not exhibit significant differences in mean values regarding domestic and global growth opportunities and short-term debt.

In Figure 1, we present the time trend for mean values of the ratio of global cash holdings to total assets for three groups: the full sample, companies that report foreign cash holdings, and firms that either do not disclose or do not have foreign cash holdings over the sample period of 2010-2021.

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The average ratios of global cash holdings to total assets for the full sample were 8.76% in 2000 and 9.21% in 2021. This ratio reached its lowest average value in 2018 at 6.98% and peaked at 10.56% in 2020. Bates et al. (2009) provide empirical evidence that the average cash-to-total assets for U.S. industrial firms more than doubled from 10.5% in 1980 to 23.2% in 2006, attributing this cash run-up to an increase in the precautionary motive for cash savings. Similarly, Fernandes and Gonenc (2016) documented that the average ratios of cash and cash equivalents to total assets increased from 12.93% in 1990 to 18.26% in 2011 for a sample of publicly traded companies from 40 countries. More recently, Gao et al. (2021) observed that U.S. public companies have increased their cash balances from 4.1% in 1984 to 20.1% in 2017. Thus, while prior academic studies document that the average cash-to-assets ratio of publicly-traded companies worldwide has steadily increased in the last few decades, particularly driven by growth in foreign cash balances of U.S. MNCs, our analysis for the Brazilian setting does not indicate the same trend. Instead, we observe only a modest increase in global cash levels over our sample period.

We also observe in Figure 1 that the average global cash-to-total assets ratio of the companies that disclose (do not disclose) foreign cash increased from 9.98% (8.51%) at the beginning of our sample period to 11.36% (8.42%) in 2021. Figure 1 also shows that companies that disclose their foreign cash holdings accumulate higher cash and cash equivalents to total assets than the other firms for every year in the sample period.

Also of note, in Figure 1, we observe that during the COVID-19 crisis years (2020 and 2021), Brazilian companies accumulated the highest levels of global cash to total assets throughout the sample period. The substantial increase in the average cash-to-total assets ratios, particularly from 7.80% in 2019 to 10.56% in 2020, is consistent with the precautionary motive for holding corporate cash holdings, i.e., firms build cash reserves to better cope with adverse shocks in cash flows, especially in times of crisis. In other words, in the face of an uncertain future brought about by the turbulent environment resulting from the COVID-19 pandemic, particularly with corporate cash flows abruptly drying up due to lockdown measures aimed at curbing the spread of the virus, companies had a higher demand for precautionary savings[5] to ensure that they had enough cash on

[5] Ivashina and Scharfstein (2010) studied the effect of the banking panic on the supply of credit to the corporate sector during the 2008-2009 global financial crisis. The authors show that companies drew down their pre-existing credit lines at the onset of the Subprime Crisis to guarantee their cash level needs during the recession period when there was growing concern about the solvency and liquidity of the banking system. In other words, companies drew down their pre-existing credit lines due to concerns about the

hand to survive and prevent disruptions in their corporate policies. Our findings are consistent with the evidence of Acharya and Steffen (2020), who examined a sample of non-financial publicly listed firms in the United States and found that companies significantly increased their cash levels following the COVID-19 outbreak.

In sequence, Figure 2 illustrates and summarizes the evolution of the average domestic and foreign cash holdings relative to total assets for each year in the sample period from 2010 to 2021.

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As observed in Figure 2, the average foreign (domestic) cash holdings to total assets rose from 2.87% (7.11%) in 2010 to 3.20% (8.16%) in 2021. Thus, in contrast with the previous evidence of Graham and Leary (2018) and Faulkender et al. (2019)[6], who document a secular increase in foreign cash holdings post-2000 (and until 2017 with the recent changes in U.S. repatriation tax law) for U.S. MNCs, we do not observe a "huge run-up" in foreign cash ratios for public companies in Brazil from 2010 to 2021.

Next, Figure 3 depicts the evolution of the average domestic and foreign cash holdings relative to global cash reserves over the same period.

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We note in Figure 3 that the average domestic cash-to-global cash ratio increased from 69.66% in 2010 to 74.26% in 2021, reaching its lowest level in 2013 with 64.96%. Over our sample period, the mean foreign cash to global cash ratio decreased from 30.33% in 2010 to 25.73% in 2021, reaching its lowest level in 2011 with 24.80% and its highest level in 2013 with 35.03%.

ability of the banking sector to fund these commitments. Unfortunately, we do not have data available on credit lines to examine this issue in our paper. However, we know from the media that many public companies listed on the Brazilian stock exchange drew down from their existing credit lines following the outbreak of the pandemic crisis to ensure they had enough cash to survive during the COVID-19 period.

[6] Faulkender et al. (2019) attribute the rise in foreign cash holdings of U.S. MNCs to three factors: the growth of international business activity, the decline in foreign tax rates, and the ability of companies to shift their earnings into low-tax jurisdictions.

Finally, Table 3 reports the Pearson correlation matrix[7] of the variables used for the sample of firms that separately disclose information about their domestic and foreign cash holdings.

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It is worth noting that foreign cash holdings are significantly[8] and positively correlated to domestic and global cash holdings. These results are consistent with the argument that companies that voluntarily disclose their domestic and foreign cash holdings separately retain significantly higher domestic and global cash balances. Additionally, foreign cash is positively correlated with size, cash flow, cash flow volatility, leverage, ROA, tangibility, capex, and global and domestic growth opportunities. On the other hand, foreign cash is negatively associated with net working capital. Turning to domestic cash, we observe that it is positively related to dividend dummy, cash flow, short-term debt, leverage, and ROA, but negatively correlated with cash flow volatility and net working capital.

4.2. Cash holdings regressions

In this subsection, we conduct regression analyses, regressing cash holdings against variables frequently used in extant research to explain companies' cash positions. Column 1 of Table 4 presents the results from Equation 1 for the whole sample with the global cash holdings as the dependent variable, i.e., the natural logarithm of global cash scaled by net assets. The panel regression analysis of global cash holdings enables us to compare our findings with previous studies on the subject and highlight where our results are comparable or divergent. Next, in Column 2, we test our research hypothesis by examining whether foreign cash holdings are positively related to global cash holdings. For that, we add the variable foreign cash, measured as the natural logarithm of the ratio of foreign cash to net assets. Again, the natural logarithm of global cash scaled by net assets is the left-hand-side variable in Column 2. No other variables are redefined.

[7] We also conduct a variance inflation factor (VIF) test to check for the potential multicollinearity problem. Untabulated results to preserve space show that all VIF scores are below the threshold of 10, suggesting that multicollinearity is not an issue in interpreting our findings.
[8] Statistically significant, at least at the 10% level.

Columns 3 and 4 contain the results of estimating Equation 3 separately for domestic and foreign cash holdings as our dependent variables, i.e., the natural logarithm of domestic and foreign cash scaled by net assets, respectively. Robust standard errors clustered at the firm level are in parentheses. For the sake of brevity, we do not report the coefficients on the year dummies in all subsequent tables.

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We first observe in Column 1 that the coefficient on size is negative and statistically significant. The negative association between cash reserves and firm size is consistent with the economy of scale in the transaction motive for holding cash (Opler et al., 1999; Bates et al., 2009). We also note in Column 1 that although the results of Opler et al. (1999) suggest that companies that pay dividends retain substantially fewer cash balances, our findings indicate that the coefficient on the dividend dummy is positive and statistically significant. In this respect, Ozkan and Ozkan (2004) point out that dividend-paying companies can also retain substantially more cash than their non-paying counterparts to avoid a situation in which they are short of liquid assets to support their dividend payments. Moreover, it is relevant to note that corporate law in Brazil determines mandatory dividend rules for all profitable publicly traded companies (Manoel, Moraes, & Araujo, 2022). The mandatory dividend rules, in turn, can also explain the positive association between dividends and cash holdings in Brazil.

Continuing with Column 1 of Table 4, we observe that companies with higher cash flows hold more cash, given the positive and significant coefficient of cash flows. This positive coefficient is consistent with the argument that companies with higher cash flows are expected to retain large cash savings due to their preference for internal over external funds (Ozkan & Ozkan, 2004). The positive relationship between cash reserves and cash flows is also in line with the tradeoff and financial hierarchy models (e.g., Dittmar et al., 2003). Net working capital, as theoretically expected, exerts a negative and significant influence on companies' global cash holdings. This result suggests companies can use their non-cash liquid assets as a valid cash substitute (Dittmar et al., 2003; Ozkan & Ozkan, 2004). Additionally, consistent with the argument that firms can increase their short-term debt levels to build cash reserves (Almeida et al., 2004) and with the view that

short-term debt can be used as a substitute for cash (Arslan et al., 2006), Column 1 reveals a negative and significant association between short-term debt and global cash levels.

In line with the finding of Ozkan and Ozkan (2004), which suggest that greater debt levels can increase the likelihood of financial distress (Ozkan & Ozkan, 2004), our regression results show that more leveraged firms in Brazil retain significantly greater levels of global cash to diminish this possibility. Our analysis also indicates that those companies with higher ROA retain substantially larger amounts of global cash holdings. The coefficient estimates on sales growth, measured by the yearly growth rate of a firm's sales, is statistically significant with a positive sign. This evidence is consistent with the speculative and transaction motives for holding cash. It suggests that companies with greater growth options maintain higher cash savings to take up their attractive investment projects without resorting to costly external funds.

One of the coefficients outside the predicted effect is the estimated coefficient on cash flow variability. The coefficient is negative but insignificant. Moreover, we cannot find any evidence to support the argument that companies with greater tangible assets hold more global cash holdings. Finally, there is no evidence of a negative relationship between capital expenditure and global cash savings for our sample.

Moving on to the results presented in Column 2, we notice that the coefficient on foreign cash holdings ($\beta_1 Foreign\ Cash\ Holdings_{i,t}$) is positive and statistically significant at the 1% level. This finding supports our research hypothesis and indicates that firms with larger amounts of foreign cash holdings tend to have greater global cash holdings.

After establishing the determinants of global cash holdings and obtaining results consistent with our research hypothesis, we can now explore whether the determinants of domestic and foreign cash reserves are the same. In Column 3 of Table 4, we note that dividend, cash flow and domestic growth opportunities are positively related to domestic cash. Conversely, cash flow volatility, net working capital and foreign investment opportunities exert a negative and significant influence on firms' domestic cash balances. One interesting piece of evidence that stems from the regression results displayed in Column 3 is that the estimated coefficient of cash flow volatility is statistically significant with a negative sign. Though the estimated coefficient is significant at the 10% level, this evidence reveals that companies with more volatile cash flows accumulate lower domestic cash levels.

Column 4 reveals that cash flow, profitability (ROA) and domestic growth opportunities positively relate to foreign cash. In contrast, net working capital and short-term debt are negatively associated with foreign cash holdings. Our regression analysis also reveals that firm size, dividends, cash flow volatility and tangibility do not significantly influence firms' foreign cash holdings. Moreover, the adjusted R^2 of the regression for domestic cash is 19.81%, while the adjusted R^2 for foreign cash is 14.14%. The results of the adjusted R^2 reveal, therefore, that the variables commonly used in the cash management literature to explain the variations in global cash levels explain much better the variations in domestic than in foreign cash levels.

Before turning to the robustness tests subsection, it is relevant to note an interesting result in Table 4. Specifically, we observe that the estimated coefficients of ROA are positive and statistically significant for global and foreign cash holdings but insignificant for domestic cash. This evidence suggests that more profitable firms tend to hold significantly more global and foreign cash. It is worth contrasting our findings with those of Edwards et al. (2016), who found a negative relationship between foreign cash and profitability among US firms. Their study revealed that U.S. firms with greater cash retained abroad tend to make value-decreasing foreign acquisitions. In contrast, our results reveal a positive relationship between foreign cash and profitability. This indicates that cash retained abroad by Brazilian MNCs is associated with increased profitability.

4.3. Robustness tests

In this subsection, we perform a series of robustness checks to validate our findings further.

An alternative measure of cash holdings: In our baseline specification, we use the natural logarithm of the ratio of cash and cash equivalents (global, domestic and foreign) over non-cash assets as our dependent variable (Opler et al., 1999; Dittmar et al., 2003; Foley et al., 2007). However, to reduce the concerns that the choice of the dependent variable drives our findings, we start our robustness checks by examining the sensitivity of our results to changing our measure of cash holdings. Now, in the spirit of Ozkan and Ozkan (2004), Bates et al. (2009) and Hanlon et al. (2017), we measure cash holdings as the ratio of cash holdings (global, domestic, and foreign – one at a time) to total assets. All other variables are the same as defined previously. Furthermore, as in the

base specification, we include firm and year-fixed effects. The new results using this alternative measure of cash are reported in Table 5.

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When we reestimate our regression model with this alternative left-hand-side variable, as shown in Table 5, we observe that this measure does not affect our inferences about global cash materially, except for the coefficient of global growth opportunities, which is no longer statistically significant. Therefore, the significance of global growth opportunities is sensitive to whether the dependent variable is the ratio of global cash holdings to total assets or the log of the ratio of global cash to net assets. Additionally, the adjusted R^2 in Column 1 of Table 5 is 0.137, which is higher than the R^2 of 0.099 of our primary model in Column 1 of Table 5. Therefore, Equation 1 with our second dependent variable explains the variation in global cash levels much better.

In Column 2, we again verify that the coefficient on foreign cash holdings[9] is positive and statistically significant. This supports our research hypothesis and indicates that companies with more foreign cash tend to have higher global cash reserves. Therefore, our main empirical findings continue to hold when we measure global cash reserves as the ratio of cash and cash equivalents to total assets.

Column 3 of Table 5 shows that size has a negative and statistically significant coefficient, which is consistent with economies of scale in holding domestic cash. We also observe that the coefficient on leverage is now statistically significant with a positive sign, implying that firms with greater amounts of debt in their capital structure accumulate higher domestic savings. Finally, the estimated coefficient of domestic growth opportunities in Column 3 becomes insignificant. The other variables have coefficients that are similar to those reported in Column 3 of Table 5.

Turning to Column 4, we now note that leverage positively relates to foreign cash. The estimated coefficient of domestic growth opportunities is again positive but insignificant. On the other hand, foreign growth opportunities are now negatively and

[9] Untabulated results in the interest of brevity also show that our main conclusions are the same when we measure foreign cash holdings as the ratio of foreign cash to total assets instead of the natural logarithm of foreign cash to net assets.

significantly related to foreign cash. The sign and significance of the other variables in Column 4 are consistent with those displayed before. Moreover, when we use the ratio of domestic and foreign cash holdings to total assets as new dependent variables, the adjusted R^2 decreases from 0.198 to 0.183 and from 0.141 to 0.103, respectively. More importantly for our paper, we continue to observe that firm characteristics that existing studies on cash holdings literature have been used to explain the global cash positions of companies explain much better the variations in domestic than in foreign cash levels.

GMM method of estimation: In our main regression models, we control for firm-fixed effects to control for the effect of firm-specific omitted variables on our findings. Nonetheless, we acknowledge that the use of firm fixed effects estimations may not completely address the potential endogeneity in our research. Following Ozkan and Ozkan (2004), we explicitly consider the endogeneity problem in this article by using the GMM method of estimation for dynamic panel data. According to the authors, it is highly likely that observable and unobservable shocks affecting companies' cash holdings can also affect firm characteristics, such as leverage and investment opportunities. Moreover, observed associations between cash and its determinants may reflect the effects of cash on its determinants rather than vice-versa. In this sense, Ozkan and Ozkan (2004) suggest using the GMM estimation procedure to control for the endogeneity problem. The GMM estimator was developed by Arellano and Bond (1991) and allows researchers to mitigate the individual heterogeneity of firms and endogeneity concerns. Thus, we also estimate a GMM model as a further robustness check.

All the regression specifications have been carried out using the 2-stage GMM estimator, given that the 1-stage estimation can present heteroskedasticity problems, as evidenced by the rejection of the null hypothesis of the Sargan test. The statistical significance of the coefficients is determined by employing asymptotic standard errors that are robust to general cross-section and time series heteroskedasticity (Arellano & Bond, 1991). Table 6 contains the GMM estimation results. Additionally, we also display in Table 6 *Z*-statistics utilized to measure the first and second-order serial correlations. The results of *Z*-statistics reveal the existence of only first-order serial correlation but no second-order. In addition to the *Z*-statistics, we also report in Table 6 the Sargan Test to test the lack of correlation between the instruments and the residues. The Sargan test results suggest that there is no correlation between the instrument variable employed ($Cash_{t-1}$) and the error term.

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We first verify in Table 6 that the lagged dependent variables ($Cash_{t-1}$) in all columns are positive and statistically significant at the 1% level, which supports the dynamic behavior of cash holdings decisions. In other words, the decision regarding corporate cash holdings for a given period is impacted by the proportion of cash maintained in previous periods (e.g., Ozkan & Ozkan, 2004). Turning to the main results, we continue to observe that companies with larger amounts of foreign cash holdings tend to have greater global cash levels. Therefore, the GMM specification yields qualitatively similar results in line with our research hypothesis. Finally, the coefficients of the control variables are generally similar to those reported in Table 4, except that some of them are no longer statistically significant at the conventional levels.

Heckman's (1979) two-stage procedure: The decision to disclose information about foreign cash holdings separately is a non-random firm's choice, given that this disclosure is truly voluntary. Therefore, our inferences based on a sample of Brazilian companies with information available about foreign cash are subject to a potential self-selection bias. To alleviate this concern, we follow the Heckman (1979) approach and repeat our analysis in a two-stage framework to correct for the potential self-selection bias due to the non-randomness of our sample. In the first stage, we estimate a probit regression (selection equation) to model the decision of a Brazilian company to disclose information about their foreign cash. The dependent variable of the probit model is a dummy that equals 1 if the company discloses information about foreign cash in a given year and 0 otherwise. Following Harford et al. (2017) and Bjornsen et al. (2020), we include the following variables in the first stage: size, profitability (ROA), global cash, tangibility, leverage and global growth opportunities. Year and industry fixed effects are also included in the probit equation. The first stage regression can be observed in Equation 4.

$$\text{Probit Regression: } Dummy\ Foreign\ Cash = {}_{i,t}\alpha_i + \alpha_1 Size_{i,t} + \alpha_2 ROA_{i,t} + \alpha_3 Global\ Cash\ Holdings_{i,t} + \alpha_4 Tangibility_{i,t} + \alpha_5 Leverage_{i,t} + \alpha_6 Global\ Growth\ Opportunities_{i,t} + u_{i,t} \quad (4)$$

Panel A of Table 7 presents the results from the probit regression, while Panel B reports the results from the second stage. In the second stage, we include the inverse mills'

ratio obtained from the first stage as an additional variable in an Ordinary Least Squares (OLS) regression approach. The inverse Mills ratio addresses potential problems of endogeneity and self-selection bias. All the other variables are as defined earlier. Furthermore, we include industry and year-fixed effects to capture differences in cash levels across industries (Kim et al., 1998) and control for any macroeconomic events during the sample period (Mortal et al., 2020). To conserve space, we do not tabulate the coefficients on the industry and year dummies in Table 7.

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From the results in Panel A of Table 7, we observe that companies with a larger size, higher leverage, and greater global cash are more likely to disclose their foreign cash reserves. This finding leads us to interpret the positive and significant association between foreign cash disclosure and global cash levels as an indication that companies voluntarily disclose information about their foreign cash when they have greater global cash needs. In other words, firms that provide information about their foreign cash holdings are the ones that use additional global cash and need to disclose separate information about domestic and foreign cash to justify their greater global cash levels.

In Panel B of Table 7, we verify that the coefficients on the inverse mill's ratio are statistically significant, suggesting that sample selection bias is a concern in our research. However, despite the existence of the sample selection issue, we continue to observe that companies with greater foreign cash levels have larger amounts of global cash. Although still imperfect, the results of the Heckman (1979) two-stage procedure help ameliorate the concerns about self-selection bias that could confound our inferences and reinforce our research hypothesis.

COVID-19 pandemic crisis: The global outbreak of the COVID-19 pandemic has resulted in a significant crisis across the world. The pandemic has caused unprecedented levels of disruption to people's lives, health systems, economies, and communities. Furthermore, the crisis has led to widespread lockdowns, travel restrictions, and social distancing measures to curb the spread of the virus. Due to the fact that the COVID-19 pandemic crisis (2020-2021) falls within our sample period, we also reestimate our baseline regressions models after excluding the years 2020 and 2021 from our sample period to ensure that the economic downturn caused by the pandemic does not drive our

main results. The results of the regression estimations for the years 2010-2019 are displayed in Table 8.

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When we re-run our baseline regression model using the reduced sample period (2010-2019), as reported in Table 8, we obtain qualitatively similar. Therefore, the results reported in Table 8 provide some assurance that the COVID-19 pandemic crisis and the associated recession do not influence our conclusions.

Macroeconomic Conditions: The body of research on corporate finance emphasizes the important role that macroeconomic conditions play in determining financing decisions. For instance, Eskandari and Zamanian (2022) contend that the level of cash reserves can be influenced by macroeconomic factors that impact the opportunity cost of holding cash. Thus, as an additional robustness check, we also include inflation, interest rate and GDP growth in our regression models. To avoid any concerns about multicollinearity, we dropped the year dummies in this robustness check as the year fixed effects could span the variation in inflation, interest rate and GDP growth.

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Table 9 shows that our primary conclusions remain unchanged when incorporating these three macroeconomic variables. Additionally, we observe that the coefficient for inflation is statistically significant only in Column 1, with a positive sign, while GDP growth has a significant and negative coefficient only in Column 4. Finally, it is worth noting that the other coefficients of these macroeconomic variables did not achieve statistical significance at conventional levels.

5. CONCLUDING REMARKS

While advances have been made in understanding the determinants of global cash holdings, the determinants of foreign cash relative to domestic cash remain unexplained. In contrast to prior studies focusing on the determinants of global cash holdings, our paper

is the first to analyze in detail and separately the determinants of domestic and foreign cash holdings based on the real amount of cash held abroad versus domestic cash. Our study is based on a dataset comprising 2,958 firm-year observations from 382 publicly listed companies in Brazil. The dataset covers a period of 11 years, from 2010 to 2021. We obtained the firm-level data from the Economática® database. To examine the determinants of domestic and foreign cash separately, we manually collect from this sample those companies that voluntarily disclose information about cash held abroad in their explanatory notes. We obtained voluntary foreign cash reserves disclosure for 88 companies (631 firm-year observations), representing about 21.33% of the sample with available data.

Our investigation revealed several noteworthy results. One such result is that, on average, the companies we examined hold 2.88% of their cash in relation to their total assets abroad and 7.24% domestically. The ratio of foreign (domestic) cash to total assets increased from 2.87% (7.11%) in 2010 to 3.20% (8.16%) in 2021. Furthermore, their foreign cash balances represent 29.63% of their global cash holdings. It is worth noting, however, that the average foreign cash to global cash ratio for these firms decreased from 30.33% in 2010 to 25.73% in 2021. Thus, while previous academic studies document a "dramatic growth" or a "cash buildup" in foreign cash holdings post-2000 (e.g., Graham & Leary, 2018; Faulkender et al., 2019), our empirical evidence does not indicate a secular increase in the foreign cash to assets ratio from 2010 to 2021.

Additionally, our summary statistics reveal that companies that disclose their foreign cash holdings maintain substantially higher global cash reserves than those that do not disclose information about their foreign cash holdings or simply have no foreign cash holdings. Additionally, these companies are generally larger, more profitable, and have a greater propensity to distribute dividends. Moreover, they have higher cash flow to net assets, greater net working capital, higher leverage ratios, more tangible assets, and greater foreign growth opportunities. On the other hand, companies that do not disclose information about their foreign cash or simply that do not have foreign cash holdings exhibit higher cash flow volatility and rely more on short-term debt.

In sequence, to distinguish the motivations for holdings cash, we separately estimate a regression model to explain a firm's global, domestic and foreign cash holdings. By doing this, we can better test whether the motivations that lead firms to stockpile global cash holdings are the same for domestic and foreign cash reserves. After controlling for other determinants of cash levels and non-random choice to disclose

information about foreign cash holdings relative to domestic cash, we find that foreign cash reserves are positively related to global cash, which supports our research hypothesis. This finding is consistent with the argument that Brazilian companies earning income outside the country have incentives to keep a portion of their foreign earnings abroad in the form of foreign cash reserves to avoid repatriation taxes. Finally, our regression analysis indicates that firm characteristics that prior literature has shown as relevant in explaining companies' global cash position explain much better the variations in domestic cash than in foreign cash holdings.

There are several relevant features in our article, which, we believe, extend the existing literature on corporate cash holdings and international business. First, our unique, hand-collected dataset on foreign cash allows us to contribute to the literature on corporate cash holdings by providing a clearer and more detailed picture of the determinants of foreign cash holdings and their representativeness relative to domestic and global cash balances. This is an important addition to the limited literature on foreign cash holdings, especially because many of the rare articles on the topic use estimates of foreign cash. Second, our findings provide valuable contributions to the above literature by demonstrating the relevance of foreign cash holdings in understanding the determinants of worldwide consolidated cash holdings. Lastly, our paper adds to the existing literature on the disclosure of multinational corporations' international activities.

Our research is also relevant for investors, managers and lawmakers. Most MNCs worldwide disclose only global cash holdings, i.e., without distinguishing foreign cash from domestic cash. However, examining the determinants of MNC's cash holdings using global cash alone, instead of domestic and foreign cash separately, might lead to wrong conclusions. Accordingly, we emphasize the need for investors to examine the percentage of a company's cash held abroad relative to domestic cash, as this information can impact their investment decisions. This analysis is relevant even when information on foreign cash is only available in some companies' explanatory notes.

Moreover, understanding the determinants of foreign cash versus domestic cash can help Emerging Market Multinationals (EMMs) managers and managers of companies starting their internationalization process to understand better how business managers in EMMs and each industry manage their resources. For policymakers worldwide, we advocate for mandatory and separate disclosure of domestic and foreign cash holdings, including their amounts and geographic locations. Although publicly traded companies worldwide typically do not disclose information on the amount and location of foreign

cash holdings, providing such information can provide financial statement users with more details to determine MNCs' liquidity positions.

This research is subject to some relevant limitations. First, our inferences are based on a single-country analysis. The literature, on the other hand, documents that the determinants of cash holdings vary across countries and companies within countries. Therefore, our empirical evidence is not generalizable to other institutional settings. Thus, given that we have only considered Brazil in this research due to data limitations, future research should then consider whether our conclusions hold under different contexts as data surrounding the amount of foreign cash becomes available in other countries. Second, one of the challenges of our paper is the lack of enough data regarding firms' international operations. While some Brazilian companies have voluntarily disclosed their foreign cash holdings, this selectively disclosed is limited. Hence, our analysis is limited to the Brazilian companies that voluntarily disclose information on how much cash holdings are held in their foreign subsidiaries.

Furthermore, although some companies disclose the amount of foreign cash, they do not disclose the geographic locations where foreign cash holdings are held. Ideally, one would want to know the exact quantity of cash held abroad relative to domestic cash and its locations. Therefore, we acknowledge that the lack of geographic disclosures of foreign cash also limits our research. Third, we do not have detailed information about where companies have foreign operations. Thus, it is impossible to know exactly the effective tax rate a company would face if it repatriates its income. Fourth, another caveat of our paper is that we do not have information about credit lines to investigate whether the presence of credit lines influences our findings. Last but not least, we also recognize that despite our best efforts to consider the endogeneity of corporate financial policies, we cannot claim to have eliminated the possibility that endogeneity affects our empirical results.

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Appendix A. Description of the variables

Variable	Abbreviation	Definition
Global Cash Holdings	Global Cash	Natural log of (Worldwide consolidated Cash and Cash Equivalents/Net Assets)
Domestic Cash Holdings	Domestic Cash	Natural log of (the proportion of a firm's total cash that is held in the domestic market/Net Assets)
Foreign Cash Holdings	Foreign Cash	Natural log of (the proportion of a firm's total cash that is held abroad/Net Assets)
Net Assets	Net Assets	Total Assets net of Cash and Cash Equivalents
Size	Size	Natural logarithm of Net Assets
Dividend dummy	DIV	An indicator variable for whether a company paid dividends in a given year = 1; otherwise = 0
Cash Flow	Cash Flow	Cash Flow/Net Assets
Cash Flow Volatility	Cash Flow Volatility	The standard deviation of cash flows over average total assets.
Net Working Capital	NWC	(Non-Cash Current Assets - Current Liabilities)/Net Assets
Short-Term Debt	STDEBT	Short-Term Debt/Net Assets
Leverage	Leverage	The ratio of Total Debt/Net Assets
Return on Assets	ROA	Net Income before Extraordinary Items/Net Assets
Tangibility	Tangibility	Property, Plant and Equipment (PPE)/Net Assets
Capital Expenditures	Capex	Capital Expenditures/Net Assets
Global Growth Opportunities	Global Growth Opportunities	The percentage change in total sales from year $t-1$ to year t
Domestic Growth Opportunities	Domestic Growth Opportunities	The percentage change in domestic sales from year $t-1$ to year t
Foreign Growth Opportunities	Foreign Growth Opportunities	The percentage change in foreign sales from year $t-1$ to year t

Notes: Appendix A presents the description of the variables used in this article. All financial variables are expressed in BRL. To mitigate the undue influence of extreme values and possible data errors on the results, all continuous variables are winsorized at the 1% level in each tail of their distribution.

Table 1. Sample Distribution

Panel A: Sample distribution by year

	Full Sample		Foreign Cash Holdings Available (n)	
Year	Observations (n)	%	Observations (n)	%
2010	223	7.54%	38	6.02%
2011	236	7.98%	38	6.02%
2012	237	8.01%	41	6.50%
2013	239	8.08%	47	7.45%
2014	243	8.22%	50	7.92%
2015	243	8.22%	51	8.08%
2016	242	8.18%	54	8.56%
2017	256	8.65%	54	8.56%
2018	253	8.55%	59	9.35%
2019	259	8.76%	62	9.83%
2020	269	9.09%	68	10.78%
2021	258	8.72%	69	10.94%
Total	2958	100.00%	631	100.00%

Panel B: Sample distribution by industry

	Full Sample		Foreign Cash Holdings Available (n)	
Industry	Observations (n)	%	Observations (n)	%
Agriculture and Fisheries	32	1.08%	13	2.06%
Food and Beverage	120	4.06%	40	6.34%
Commerce	239	8.08%	22	3.49%
Construction	288	9.74%	11	1.74%
Electricity	298	10.07%	0	0.00%
Electronic Products	51	1.72%	2	0.32%
Industrial Machinery	58	1.96%	31	4.91%
Mining	75	2.54%	22	3.49%
Paper and Cellulose	55	1.86%	30	4.75%
Oil and Gas	82	2.77%	43	6.81%
Chemistry	60	2.03%	23	3.65%
Steel & Metals	179	6.05%	54	8.56%
Software & Data	74	2.50%	14	2.22%
Telecommunications	55	1.86%	13	2.06%
Textile	210	7.10%	107	16.96%
Transportation	204	6.90%	36	5.71%
Vehicles	129	4.36%	84	13.31%
Others	749	25.32%	86	13.63%
Total	2958	100.00%	631	100.00%

Notes: Table 1 provides the sample distribution used in this research. Our initial sample consists of 382 non-financial and non-utility publicly listed companies (2,958 firm-year observations) for which the required data items are available from 2010 to 2021. The final sample in which the variable foreign cash is available over the sample period consists of 88 companies (646 firm-year observations), representing 21.33% of our sample. Panel A displays the distribution of observations over the sample period, while Panel B presents the industry composition of our sample.

Table 2. Descriptive statistics

Panel A:

	Full Sample				
Variable	**Mean**	**1st Quartile**	**Median**	**3rd Quartile**	**SD**
Global Cash Holdings/Total Assets	0.0821	0.0207	0.0592	0.119	0.0804
Size	15.1860	14.0154	15.1683	16.3788	1.6926
Dividend dummy	0.7058	0.0000	1.0000	1.0000	0.4557
Cash Flow	0.0647	0.0173	0.0631	0.1131	0.0895
Cash Flow Volatility	0.0566	0.0285	0.0436	0.0687	0.0455
Net Working Capital	0.0381	-0.0600	0.0341	0.1745	0.2489
Short-Term Debt	0.1037	0.0320	0.0742	0.1389	0.1071
Leverage	0.3322	0.1715	0.3187	0.4642	0.2182
Return on Assets (ROA)	0.0641	0.0244	0.0677	0.1140	0.1017
Tangibility	0.2668	0.0508	0.2324	0.4096	0.2268
Capital Expenditure	0.0559	0.0155	0.0410	0.0410	0.0679
Domestic Growth Opportunities	0.0516	-0.0720	0.0263	0.1563	0.2586
Foreign Growth Opportunities	0.0385	0.0000	0.0000	0.0000	0.2969
Global Growth Opportunities	0.0541	-0.0654	0.0324	0.1554	0.2455

Panel B:

	Companies that disclose information about their domestic and foreign cash holdings separately			**Companies that do not disclose or simply do not have foreign cash**		
Variable	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Global Cash Holdings/Total Assets	0.1012***	0.0858'''	0.0773	0.0769	0.0528	0.0804
Domestic Cash Holdings/Total Assets	0.0724	0.0540	0.0651	-	-	-
Foreign Cash Holdings/Total Assets	0.0288	0.0107	0.0451	-	-	-
Domestic Cash Holdings/Global Cash Holdings	0.7036	0.8099	0.2954	-	-	-
Foreign Cash Holdings/Global Cash Holdings	0.2963	0.1900	0.2954	-	-	-
Size	15.7113***	15.5444'''	1.7715	15.0430	15.0200	1.6423
Dividend dummy	0.7686***	1.0000'''	0.4220	0.6888	1.0000	0.4630
Cash Flow	0.0778***	0.0751'''	0.0863	0.0612	0.0600	0.0900
Cash Flow Volatility	0.0541*	0.0426	0.0456	0.0573	0.0438	0.0454
Net Working Capital	0.0766***	0.0707'''	0.1896	0.0276	0.0233	0.2618
Short-Term Debt	0.1045	0.0770	0.1054	0.1035	0.0737	0.1076
Leverage	0.3879***	0.3722'''	0.2392	0.3171	0.3073	0.2096
Return on Assets (ROA)	0.0730**	0.0694	0.0986	0.0617	0.0670	0.1025
Tangibility	0.3262***	0.3225'''	0.1946	0.2507	0.1993	0.2322
Capital Expenditure	0.0521*	0.0425	0.0556	0.0569	0.0402	0.0708
Domestic Growth Opportunities	0.0476	0.0133'	0.2623	0.0527	0.0311	0.2577
Foreign Growth Opportunities	0.0835***	0.0000'''	0.3849	0.0263	0.0000	0.2669
Global Growth Opportunities	0.0542	0.0204	0.2289	0.0542	0.0351	0.2499

Notes: Table 2 provides the descriptive statistics of the variables used in this research. Variable definitions are provided in Appendix A. All financial variables are expressed in BRL. In Panel A, we present the summary statistics of the variables used in our global cash holdings regressions. In Panel B, we present summary statistics separately for companies that disclose information about their foreign cash holdings relative to those firms that do not disclose their foreign cash holdings or that simply do not have foreign cash reserves. Our initial sample consists of 382 non-financial and non-utility publicly listed companies (2,958 firm-year observations) for which the required data items are available from 2010 to 2021. The final sample in which the variable foreign cash is available over the sample period consists

of 88 companies (646 firm-year observations), representing 21.33% of our sample. We also use *t*-tests (Wilcoxon rank sum *z* tests) in Panel B of Table 2 to test for differences in means (medians). *, **, and *** ('", " and ′) indicate significance levels of 1%, 5% and 10% of the *T*-test (Wilcoxon rank sum *z* tests) for firms that disclose information about their foreign cash holdings and those that do not disclose their foreign cash holdings or that simply do not have foreign cash reserves having equal mean (median), respectively.

Table 3. Pearson correlation coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Global Cash	1.000															
(2) Domestic Cash	0.833*	1.000														
(3) Foreign Cash	0.494*	0.128*	1.000													
(4) Size	0.032	-0.024	0.075*	1.000												
(5) Dividend dummy	0.133*	0.244*	-0.051	0.272*	1.000											
(6) Cash Flow	0.287*	0.253*	0.140*	0.159*	0.230*	1.000										
(7) Cash Flow Volatility	0.030	-0.155*	0.126*	-0.424*	-0.244*	0.020	1.000									
(8) Net Working Capital	-0.166*	-0.135*	-0.093*	-0.266*	0.114*	0.029	0.123*	1.000								
(9) Short-Term Debt	0.091*	0.076*	0.062	-0.197*	-0.170*	-0.139*	0.096*	-0.393*	1.000							
(10) Leverage	0.155*	0.072*	0.170*	0.115*	-0.222*	-0.085*	-0.080*	-0.320*	0.438*	1.000						
(11) ROA	0.176*	0.147*	0.112*	0.100*	0.279*	0.564*	-0.019	0.195*	-0.132*	-0.111*	1.000					
(12) Tangibility	0.095*	0.023	0.260*	0.258*	0.079*	0.116*	-0.265*	-0.163*	-0.068*	0.211*	-0.024	1.000				
(13) Capex	0.054	-0.008	0.094*	0.103*	0.005	0.157*	0.028	0.029	-0.080*	0.073*	0.034	0.295*	1.000			
(14) Global Growth Opportunities	0.037	-0.022	0.113*	0.059	0.057	0.124*	-0.012	0.051	-0.022	0.055	0.404*	0.080*	0.213*	1.000		
(15) Domestic Growth Opportunities	0.064	0.029	0.094*	0.025	0.066*	0.104*	-0.017	0.069*	-0.032	0.018	0.378*	0.020	0.080*	0.818*	1.000	
(16) Foreign Growth Opportunities	-0.022	-0.058	0.049	0.094*	0.070*	0.064	0.004	0.017	-0.035	0.023	0.146*	0.088*	0.178*	0.410*	0.067*	1.000

Notes: Table 3 reports Pearson correlation coefficients. Variable definitions are provided in Appendix A. The superscript asterisk * indicates a statistical significance of at least 10%.

Table 4. The determinants of Global, Domestic and Foreign Cash Holdings

	Full Sample	**Companies that disclose information about their domestic and foreign cash holdings separately**		
	I	II	III	IV
	Global Cash	Global Cash	Domestic Cash	Foreign Cash
Variables	Coefficient	Coefficient	Coefficient	Coefficient
Constant	-1.382	2.930	-0.456	-6.589
	(1.218)	(2.127)	(2.237)	(4.201)
Foreign Cash	-	0.287***	-	-
		(0.053)		
Size	-0.149*	-0.284**	-0.185	0.121
	(0.079)	(0.134)	(0.144)	(0.272)
Dividend dummy	0.144*	0.272**	0.329**	-0.333
	(0.081)	(0.107)	(0.143)	(0.203)
Cash Flow	0.785**	1.903***	2.858***	2.023*
	(0.337)	(0.589)	(0.787)	(1.022)
Cash Flow Volatility	-0.544	-4.046*	-5.292*	2.005
	(1.110)	(2.408)	(2.851)	(3.959)
Net Working Capital	-1.109***	-1.293***	-2.407***	-2.576**
	(0.293)	(0.461)	(0.688)	(1.065)
Short-Term Debt	-1.734***	-0.247	-1.734	-5.070**
	(0.500)	(0.785)	(1.135)	(2.409)
Leverage	1.368***	0.618	0.679	0.521
	(0.286)	(0.433)	(0.537)	(0.945)
Return on Assets (ROA)	1.455***	-0.311	-0.495	3.168**
	(0.364)	(0.536)	(0.708)	(1.264)
Tangibility	0.356	-0.089	-0.514	-0.024
	(0.428)	(0.584)	(0.703)	(1.575)
Capital Expenditure	0.351	-0.427	0.747	-0.059
	(0.472)	(0.806)	(1.177)	(1.638)
Domestic Growth Opportunities	-	-	0.379***	0.490**
			(0.142)	(0.229)
Foreign Growth Opportunities	-	-	-0.240***	-0.154
			(0.086)	(0.145)
Global Growth Opportunities	0.186**	-0.052	-	-
	(0.089)	(0.131)		
Observations	2,958	631	631	631
p value	< 0.001	< 0.001	< 0.001	< 0.001
Year effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.099	0.437	0.198	0.141

Notes: Table 4 reports the results from estimating Equations 1 and 2 with firm and year-fixed effects. See the Research Design section (Section 3) for more details. In Columns 1 and 2, the dependent variable is the natural logarithm of the ratio of cash and cash equivalents to net assets. In Column 3 (4), the dependent variable is the natural logarithm of the ratio of domestic (foreign) cash holdings to net assets. See Appendix A for the other variable definitions. Robust standard errors clustered at the firm level are in parentheses. *, **, *** indicate the significance levels at 10%, 5% and 1% respectively.

Table 5. The determinants of Global, Domestic and Foreign Cash Holdings with an alternative measure of cash holdings

	Full Sample	**Companies that disclose information about their domestic and foreign cash holdings separately**		
	I	II	III	IV
	Global Cash	Global Cash	Domestic Cash	Foreign Cash
Variables	Coefficient	Coefficient	Coefficient	Coefficient
Constant	0.306***	0.404***	0.380***	0.059
	(0.097)	(0.142)	(0.133)	(0.135)
Foreign Cash	-	0.745***	-	-
		(0.161)		
Size	-0.016**	-0.021**	-0.020**	-0.002
	(0.006)	(0.009)	(0.009)	(0.008)
Dividend dummy	0.009**	0.012**	0.013**	-0.002
	(0.004)	(0.006)	(0.006)	(0.005)
Cash Flow	0.091***	0.147***	0.135***	0.042*
	(0.023)	(0.034)	(0.034)	(0.023)
Cash Flow Volatility	-0.110	-0.256*	-0.278*	0.110
	(0.107)	(0.143)	(0.149)	(0.114)
Net Working Capital	-0.085***	-0.099***	-0.087***	-0.050**
	(0.017)	(0.031)	(0.031)	(0.022)
Short-Term Debt	-0.133***	-0.080*	-0.061	-0.098**
	(0.031)	(0.046)	(0.046)	(0.042)
Leverage	0.104***	0.071**	0.060**	0.050*
	(0.023)	(0.032)	(0.029)	(0.028)
Return on Assets (ROA)	0.066***	0.014	-0.003	0.039**
	(0.022)	(0.044)	(0.039)	(0.019)
Tangibility	-0.005	-0.030	-0.030	0.009
	(0.026)	(0.031)	(0.031)	(0.032)
Capital Expenditure	0.047	-0.037	-0.023	-0.037
	(0.035)	(0.041)	(0.040)	(0.052)
Domestic Growth Opportunities	-	-	0.008	0.000
			(0.006)	(0.007)
Foreign Growth Opportunities	-	-	-0.007**	-0.007*
			(0.003)	(0.004)
Global Growth Opportunities	0.002	-0.003	-	-
	(0.005)	(0.008)		
Observations	2,958	631	631	631
p value	< 0.001	< 0.001	< 0.001	< 0.001
Year effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.137	0.459	0.183	0.103

Notes: Table 5 reports the results from estimating Equations 1 and 2 with firm and year-fixed effects. Now, we measure cash holdings as the ratio of cash and cash equivalents (global, domestic, and foreign – one at a time) to total assets. See the Research Design section (Section 3) for more details. In Columns 1 and 2, the dependent variable is the ratio of cash and cash equivalents to total assets. In Column 3 (4), the dependent variable is the ratio of domestic (foreign) cash holdings to total assets. See Appendix A for the other variable definitions. Robust standard errors clustered at the firm level are in parentheses. *, **, *** indicate the significance levels at 10%, 5% and 1% respectively.

Table 6. GMM estimations of the determinants of Global, Domestic and Foreign Cash Holdings

	Full Sample	**Companies that disclose information about their domestic and foreign cash holdings separately**		
	I	II	III	IV
	Global Cash	Global Cash	Domestic Cash	Foreign Cash
Variables	Coefficient	Coefficient	Coefficient	Coefficient
Constant	-0.886**	-0.740	-0.801	-3.898**
	(0.387)	(0.824)	(1.114)	(1.601)
Cash t-1	0.574***	0.310***	0.517***	0.648***
	(0.050)	(0.077)	(0.096)	(0.068)
Foreign Cash	-	0.205***	-	-
		(0.035)		
Size	-0.047**	-0.021	-0.062	0.057
	(0.019)	(0.039)	(0.060)	(0.088)
Dividend dummy	0.223***	0.253***	0.464***	-0.249
	(0.065)	(0.088)	(0.117)	(0.198)
Cash Flow	2.520***	3.349***	3.277***	2.025**
	(0.275)	(0.376)	(0.982)	(0.954)
Cash Flow Volatility	-0.110	-1.676	-2.490	6.243
	(0.852)	(1.963)	(2.084)	(3.096)
Net Working Capital	-0.329*	-0.264	-0.348	0.014
	(0.193)	(0.361)	(0.543)	(0.831)
Short-Term Debt	-0.547*	0.197	0.106	-1.517
	(0.314)	(0.796)	(0.998)	(1.893)
Leverage	0.964***	0.411*	0.649**	0.617
	(0.149)	(0.237)	(0.311)	(0.517)
Return on Assets (ROA)	-0.137	-1.104***	-1.028	1.251
	(0.307)	(0.397)	(0.751)	(1.416)
Tangibility	0.067	-0.601	-0.197	1.525**
	(0.133)	(0.471)	(0.540)	(0.726)
Capital Expenditure	-1.207***	-0.840	-2.773**	-1.809
	(0.430)	(1.011)	(1.401)	(1.915)
Domestic Growth Opportunities	-	-	0.553**	0.561**
			(0.241)	(0.280)
Foreign Growth Opportunities	-	-	-0.290**	0.088
			(0.119)	(0.192)
Global Growth Opportunities	0.312***	0.122	-	-
	(0.089)	(0.165)		
Observations	2,444	559	519	519
p value	< 0.001	< 0.001	< 0.001	< 0.001
Year effects	Yes	Yes	Yes	Yes
Correlation 1	-7.468	-3.314	-3.786	-3.056
Correlation 2	1.762	1.267	1.931	1.974
Sargan Test	130.44 (64)	117.09 (64)	116.88 (64)	112.16 (64)

Notes: Table 6 reports the Generalized Method of Moments cash holdings regressions results. See the Robustness Tests subsection for more details on this specification. In Columns 1 and 2, the dependent variable is the natural logarithm of the ratio of cash and cash equivalents to net assets. In Column 3 (4), the dependent variable is the natural logarithm of the ratio of domestic (foreign) cash holdings to net assets. See Appendix A for the other variable definitions. *, **, *** indicate the significance levels at 10%, 5% and 1% respectively. Correlations 1 and 2 are statistical tests (*Z*-statistics) utilized to measure the first and second-order autocorrelations in residuals. These tests are distributed according to a standard normal distribution $N(0,1)$ under the null hypothesis of no serial correlation. The Sargan test, on the other hand, is utilized to test the validity of instrumental restrictions and is distributed as a chi-square distribution. Degrees of freedom in brackets.

Table 7. The determinants of Global, Domestic and Foreign Cash Holdings by using Heckman's (1979) two-step selection model

Panel A: Probit Estimation - First Stage		**Panel B: OLS Estimation with the inverse Mills ratio - Second Stage**		
	Full Sample		**Full Sample**	**Companies that disclose information about their domestic and foreign cash holdings separately**
Variables	**Coefficient**	**Variables**	**Coefficient**	**Coefficient**
Constant	-2.874***	Constant	1.317***	1.310***
	(0.404)		(0.024)	(0.055)
Size	0.231***	Foreign Cash	-	0.006***
	(0.021)			(0.001)
Return on Assets (ROA)	0.025	Size	-0.063***	-0.058***
	(0.368)		(0.001)	(0.003)
Global Cash	0.161***	Dividend dummy	0.010***	0.017***
	(0.026)		(0.002)	(0.005)
Tangibility	0.082	Cash Flow	0.076***	0.069**
	(0.172)		(0.013)	(0.029)
Leverage	0.318**	Cash Flow Volatility	-0.010	0.031
	(0.149)		(0.023)	(0.052)
Global Growth Opportunities	-0.214	Net Working Capital	-0.033***	-0.057***
	(0.140)		(0.005)	(0.014)
Pseudo R^2	0.2538	Short-Term Debt	-0.062***	-0.100***
			(0.013)	(0.027)
p value	0.000	Leverage	-0.059***	-0.030**
			(0.007)	(0.012)
Year effects	Yes	Return on Assets (ROA)	-0.017	-0.008
			(0.012)	(0.026)
Industry effects	Yes	Tangibility	-0.026***	-0.077***
			(0.005)	(0.012)
Observations	2,660	Capital Expenditure	0.023	-0.015
			(0.016)	(0.038)
		Global Growth Opportunities	0.051***	0.032***
			(0.005)	(0.010)
		$\lambda_{j,i}$	-0.322***	-0.358***
			(0.006)	(0.016)
		Adjusted R^2	0.641	0.697
		p value	0.000	0.000
		Industry effects	Yes	Yes
		Year effects	Yes	Yes
		Observations	2,660	631

Notes: Panel A of Table 7 reports results from the first-step probit regression (selection equation). The dependent variable of the probit model is a dummy that equals 1 if the company discloses information about foreign cash in a given year and 0 otherwise. See Appendix A for the other variable definitions. Panel B reports the results from the second stage (outcome equation). In the second stage, we include the inverse mills' ratio obtained from the first stage as an additional variable in an Ordinary Least Squares (OLS) regression approach. $\lambda_{j,i}$(Lambda) refer to the inverse Mills ratios. The inverse Mills ratio addresses potential problems of endogeneity and self-selection bias. The dependent variable is the natural logarithm of the ratio of cash and cash equivalents to net assets. See the Robustness Tests subsection for more details on this specification. *, **, *** indicate the significance levels at 10%, 5% and 1% respectively.

Table 8. The determinants of Global, Domestic and Foreign Cash Holdings for the years 2010-2019

	Full Sample	**Companies that disclose information about their domestic and foreign cash holdings separately**		
	I	II	III	IV
	Global Cash	Global Cash	Domestic Cash	Foreign Cash
Variables	Coefficient	Coefficient	Coefficient	Coefficient
Constant	-1.131	3.764	-0.687	-4.495
	(1.483)	(2.541)	(2.691)	(5.000)
Foreign Cash	-	0.306***	-	-
		(0.064)		
Size	-0.177*	-0.346**	-0.187	-0.005
	(0.097)	(0.162)	(0.168)	(0.317)
Dividend dummy	0.143	0.279**	0.431**	-0.332
	(0.088)	(0.120)	(0.166)	(0.243)
Cash Flow	0.729*	2.290***	3.286***	2.655**
	(0.370)	(0.790)	(1.007)	(1.123)
Cash Flow Volatility	-0.139	-3.895	-5.461*	0.900
	(1.256)	(2.656)	(3.241)	(4.408)
Net Working Capital	-1.088***	-1.277**	-2.536***	-3.193***
	(0.321)	(0.571)	(0.860)	(1.191)
Short-Term Debt	-1.556***	-0.268	-2.287	-6.978**
	(0.519)	(0.998)	(1.377)	(2.841)
Leverage	1.645***	0.905*	1.122*	2.021**
	(0.319)	(0.480)	(0.631)	(0.995)
Return on Assets (ROA)	1.622***	-0.279	-0.657	1.906**
	(0.414)	(0.561)	(0.685)	(0.891)
Tangibility	0.430	0.207	-0.256	-0.501
	(0.490)	(0.639)	(0.812)	(1.724)
Capital Expenditure	0.173	0.279	1.459	-0.517
	(0.546)	(0.904)	(1.309)	(1.806)
Domestic Growth Opportunities	-	-	0.172	0.505*
			(0.169)	(0.279)
Foreign Growth Opportunities	-	-	-0.297***	-0.229
			(0.099)	(0.145)
Global Growth Opportunities	0.141	-0.317*	-	-
	(0.103)	(0.162)		
Observations	2,431	494	494	494
p value	< 0.001	< 0.001	< 0.001	< 0.001
Year effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.101	0.462	0.197	0.163

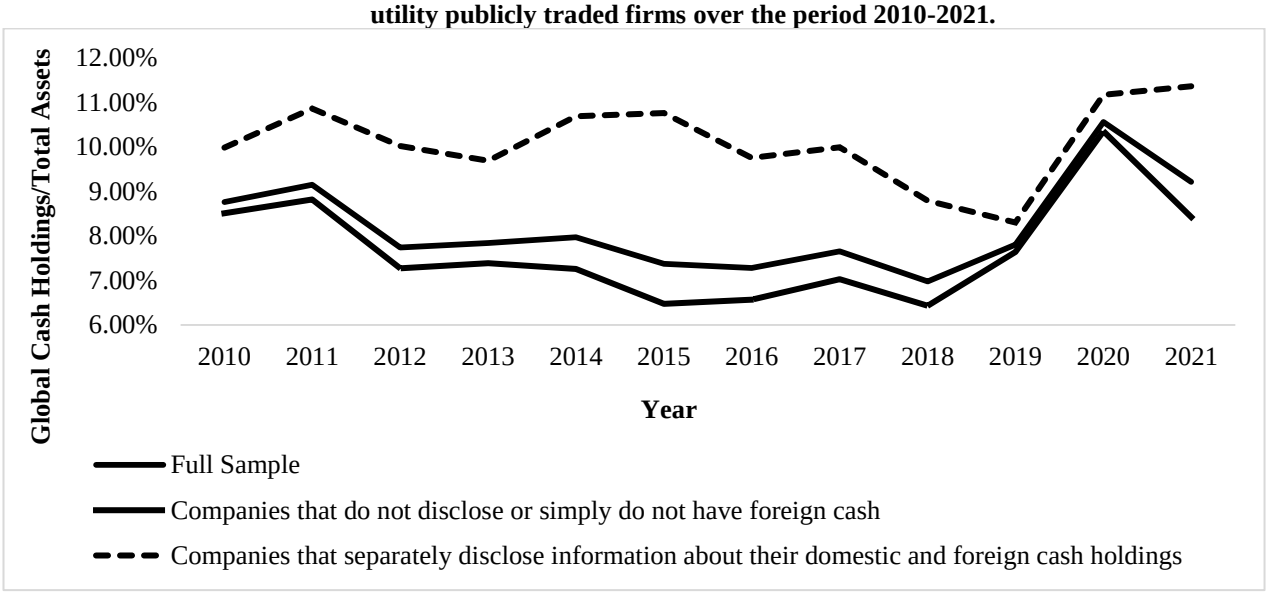
Notes: Table 8 reports the results from estimating Equations 1 and 2 with firm and year-fixed effects for the years 2010-2019. See the Research Design section (Section 3) for more details. In Columns 1 and 2, the dependent variable is the natural logarithm of the ratio of cash and cash equivalents to net assets. In Column 3 (4), the dependent variable is the natural logarithm of the ratio of domestic (foreign) cash holdings to net assets. See Appendix A for the other variable definitions. Robust standard errors clustered at the firm level are in parentheses. *, **, *** indicate the significance levels at 10%, 5% and 1% respectively.

Table 9. The determinants of Global, Domestic and Foreign Cash Holdings after controlling for three macroeconomic variables (inflation, interest rate and GDP growth)

	Full Sample	**Companies that disclose information about their domestic and foreign cash holdings separately**		
	I	II	III	IV
	Global Cash	Global Cash	Domestic Cash	Foreign Cash
Variables	Coefficient	Coefficient	Coefficient	Coefficient
Constant	-1.479	2.994	-0.467	-6.826
	(1.219)	(2.057)	(2.184)	(4.112)
Foreign Cash	-	0.287***	-	-
		(0.054)		
Size	-0.144*	-0.275**	-0.165	0.130
	(0.079)	(0.122)	(0.130)	(0.258)
Dividend dummy	0.152*	0.255**	0.301**	-0.396
	(0.081)	(0.100)	(0.135)	(0.201)
Cash Flow	0.803**	1.821***	2.740***	2.105**
	(0.342)	(0.579)	(0.762)	(1.007)
Cash Flow Volatility	-0.929	-3.534	-4.726*	1.404
	(1.096)	(2.173)	(2.598)	(3.391)
Net Working Capital	-1.006***	-1.385***	-2.432***	-2.451**
	(0.296)	(0.474)	(0.735)	(1.082)
Short-Term Debt	-1.555***	-0.338	-1.644	-4.868**
	(0.509)	(0.774)	(1.161)	(2.325)
Leverage	1.327***	0.664	0.685	0.422
	(0.290)	(0.418)	(0.535)	(0.933)
Return on Assets (ROA)	1.579***	-0.263	-0.427	3.160**
	(0.371)	(0.534)	(0.695)	(1.285)
Tangibility	0.571	-0.234	-0.545	0.240
	(0.415)	(0.524)	(0.676)	(1.498)
Capital Expenditure	0.701	-0.543	0.724	0.048
	(0.502)	(0.851)	(1.181)	(1.582)
Domestic Growth Opportunities	-	-	0.400***	0.431**
			(0.15)	(0.212)
Foreign Growth Opportunities	-	-	-0.222**	-0.131
			(0.087)	(0.148)
Global Growth Opportunities	0.156*	-0.022	-	-
	(0.090)	(0.123)		
Inflation	0.018*	0.025	0.020	-0.011
	(0.011)	(0.015)	(0.021)	(0.038)
Interest Rate	-0.014	-0.020	-0.010	0.048
	(0.009)	(0.013)	(0.015)	(0.030)
GDP Growth	-0.005	-0.004	-0.020	-0.051**
	(0.007)	(0.01)	(0.014)	(0.021)
Observations	2,958	631	631	631
p value	< 0.001	< 0.001	< 0.001	< 0.001
Year effects	No	No	No	No
Adjusted R^2	0.082	0.429	0.182	0.114

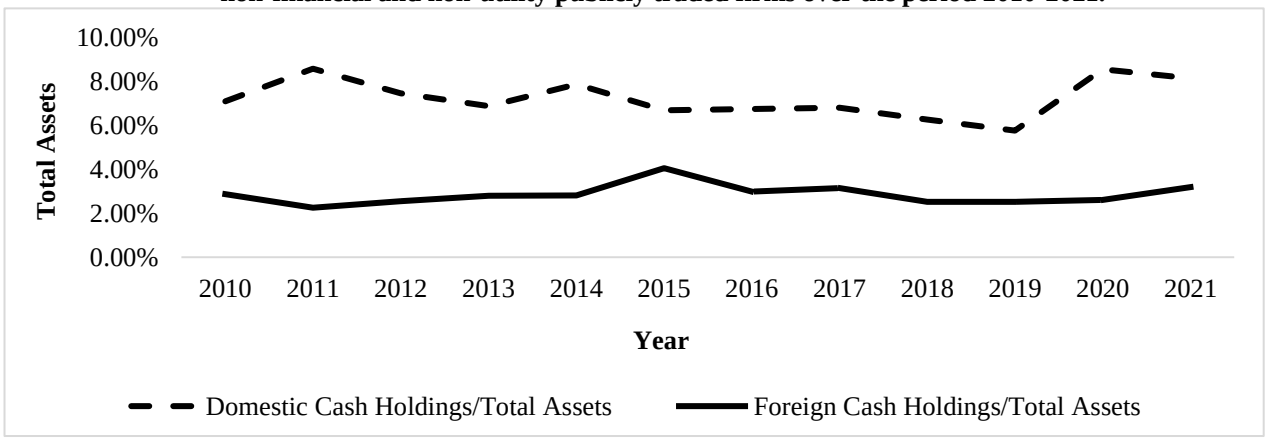
Notes: Table 9 reports the results from estimating Equations 1 and 2 with firm fixed effects. See the Research Design section (Section 3) for more details. This specification includes three macroeconomic factors (inflation, interest rate and GDP growth). In Columns 1 and 2, the dependent variable is the natural logarithm of the ratio of cash and cash equivalents to net assets. In Column 3 (4), the dependent variable is the natural logarithm of the ratio of domestic (foreign) cash holdings to net assets. See Appendix A for the other variable definitions. Robust standard errors clustered at the firm level are in parentheses. *, **, *** indicate the significance levels at 10%, 5% and 1% respectively.

Figure 1. Evolution of the average global cash holdings to total assets of Brazilian non-financial and non-utility publicly traded firms over the period 2010-2021.



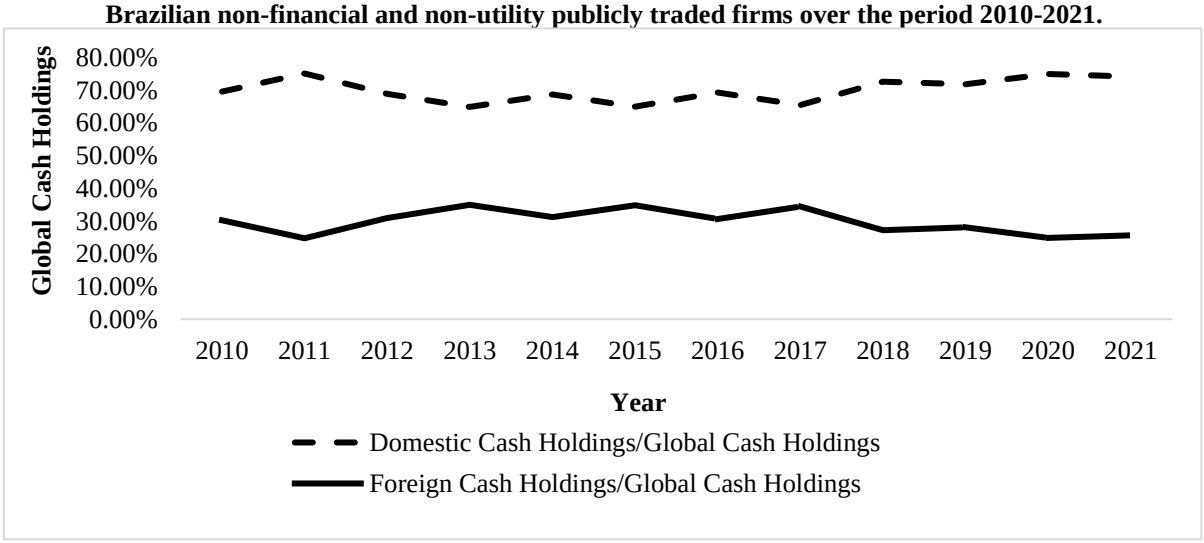
Notes: Figure 1 displays the evolution of the average global cash holdings to total assets for the full sample of Brazilian non-financial and non-utility publicly traded firms, for those that report foreign cash holdings, and for companies that do not disclose or simply do not have foreign cash over the period from 2010 until 2021.

Figure 2. Evolution of the average domestic and foreign cash holdings relative to total assets of Brazilian non-financial and non-utility publicly traded firms over the period 2010-2021.



Notes: Figure 2 displays the evolution of the average domestic and foreign cash holdings relative to total assets of Brazilian non-financial and non-utility publicly traded firms for each year in the sample period from 2010 to 2021.

Figure 3. Evolution of the average domestic and foreign cash holdings relative to global cash holdings of Brazilian non-financial and non-utility publicly traded firms over the period 2010-2021.



Notes: Figure 3 reports the evolution of the average domestic and foreign cash holdings relative to global cash holdings of Brazilian non-financial and non-utility publicly traded firms over the period from 2010 until 2021.