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# **Bubble Thy Neighbor: Direct and Spillover Effects of Capital Controls\***

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**Abstract:** We use changes in Brazil's tax on foreign investors from 2006 to 2011 to test for any direct and multilateral effects of capital controls on portfolio flows. The analysis is structured based on information from a series of investor interviews. We find that increases in Brazil's capital controls cause investors to decrease their portfolio allocations to Brazil. Investors simultaneously decrease portfolio allocations to other countries believed to be more likely to use controls, and increase allocations to other countries in Latin America, that constitute a large share of the benchmark index, and that have substantial exposure to China. The results suggest that much of the effect of capital controls on portfolio flows is through signalling rather than the direct cost of the controls. The results also suggest that any assessment of capital controls should consider their spillover effects on investment in other countries.

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## 1. Introduction

Economists and policymakers have recently become more supportive of capital controls, especially controls on capital inflows, to limit the appreciation of overvalued currencies and reduce financial fragilities resulting from large and volatile capital flows.<sup>1</sup> This support has been bolstered by the empirical literature on the macroeconomic effects of capital controls. Although there are some differences across individual papers, surveys generally conclude that controls on capital inflows have no significant effect on the volume of capital inflows, but can shift the composition of capital flows to reduce country vulnerability.<sup>2</sup> Since this literature generally finds little effect of controls on total capital inflows, there was little concern about the spillover effects of capital controls on capital flows to other countries.

But what if, as many policymakers currently believe, controls on capital inflows can significantly reduce the volume of certain types of capital flows into a country? For example, the finance minister of Brazil, Guido Mantega, stated: “We took tough measures...and we succeeded in stemming the flow [of capital inflows].”<sup>3</sup> And if capital controls affect flows into one country, what are the multilateral effects? Do controls simply shift the challenges of large capital inflows—such as asset bubbles and currency appreciation—from one country to another? If so, which countries are most affected? These types of externalities could be particularly important in the current environment of large global imbalances in which macroeconomic policies in some countries are already distorting capital flows in ways that foster fragilities and could create future challenges (e.g., Rajan, 2010).<sup>4</sup>

In order to assess the direct effect of capital controls on the country instituting the controls as well as the multilateral effects on other countries, this project takes a different approach than the existing literature. Instead of examining how controls affect one country’s macroeconomic variables—such as the exchange rate, total volume of inflows, interest rates, or liability structures—it analyzes how capital controls affect country allocations and flows in investor portfolios. More specifically, we use the Emerging Portfolio Fund Research (EPFR) database, which has detailed information on fund-level investments by countries, to assess how equity and bond funds adjust their country portfolio allocations in response to changes in capital controls. This paper is the first analysis (to our knowledge) to document at the portfolio level how investors respond to capital controls and if there are any multilateral effects. In our analysis, we focus on the impact of new capital controls in a country which previously had a relatively

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<sup>1</sup> IMF (2010, 2011) show this shift in sentiment in an institution that was previously cautious about capital controls.

<sup>2</sup> For example, Ostry et al. (2011) finds that countries with capital controls tend to have a less crisis-prone external liability structure and when combined with FX regulations these countries appear to have greater growth resilience during a sudden-stop episode. For surveys on the effects of capital controls, see Magud, Reinhart and Rogoff (2011), Cardarelli, Elekdag and Kose (2009), and Forbes (2007).

<sup>3</sup> *Institutional Investor*, “Brazil Says Capital Controls are Working,” May 30, 2011.

<sup>4</sup> Also see Jeanne (2011), which discusses how capital controls in China have supported an undervalued exchange rate, thereby suppressing domestic demand and acting as an impediment to a global recovery and reduction in global imbalances.

open capital account, since this measure has recently gained some support in the policy arena. We do not explicitly analyze situations in which capital controls are in place for an extended period of time or in countries that have relatively closed capital accounts, although our results have implications for the multilateral effects of these types of situations.

Before analyzing how investors respond to the implementation of new capital controls, however, we begin by interviewing a variety of investors to better understand how they evaluate and respond to capital controls. These interviews provide useful information to structure the empirical analysis—such as helping define the framework by which investors make their decisions, the time period in which to expect an effect of controls, and how investors think about reallocating assets across countries in response to controls. These interviews suggest that simple theoretical models of how investors respond to a tax on one asset in one country could miss important dynamics of the impact of capital controls on capital flows across countries.

In our empirical analysis, we focus on the use of capital controls by Brazil over the period from 2006 through 2011. During this period, Brazil had a fairly open capital account but on several occasions added, removed, or raised a tax on certain types of foreign portfolio inflows. Focusing on one country has the disadvantage that the analysis may not generalize to other countries' experiences with controls—or even to a different type of controls within the same country. We focus on this specific example, however, for two important reasons. First, one problem with the analysis of cross-country effects of controls is that different countries have adopted very different types of controls, with different levels of enforcement, and different goals. Imposing the assumption in a cross-country study that these very different experiences have the same effect would bias estimates toward finding no effect of controls. Second, capital controls in countries with small equity and debt markets would be less likely to have any type of measurable multilateral effects. Since this is the first paper assessing whether capital controls could have multilateral effects, we want to begin by analyzing a setting more likely to have some type of spillovers. Since Brazil is the largest equity and debt market in Latin America, and a large component of most emerging market indices against which portfolio investors are benchmarked, it is a logical place to start.<sup>5</sup> If there is no evidence of spillovers in this setting, it is unlikely (although not impossible) that there would be economically significant multilateral effects from smaller countries implementing capital controls.

In order to analyze the effects of capital controls in Brazil, we focus on an empirical framework in which investors adjust their portfolio shares allocated to each country based on the country's weight in the relevant benchmark. We find that changes in capital controls in Brazil have a significant effect on the share of funds' portfolios allocated to Brazil. More specifically, reducing Brazil's tax on foreign

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<sup>5</sup> Brazil's share of JPMorgan's EMBIG benchmark index ranged from 7% to 11% over our sample period from 2006 to mid-2011.

purchases of fixed income by 6 percentage points (i.e., reducing the current tax of 6% to zero) corresponds to an increase in the share of foreign equity and debt portfolios allocated to Brazil of 0.47 to 1.39 percentage points over three months.<sup>6</sup> The largest estimated effects are for Latin American funds and the smallest effects are for bond funds. Back-of-the envelope calculations suggest that this effect is not only significant, but the magnitude of the impact on portfolio flows is large (an increase of roughly \$9-\$16 billion over three months), while the impact on the overall stock of foreign investment is moderate. The significant effect of a tax that only applies to bonds on foreign investment in equities suggests that the primary impact of capital controls is not the direct cost to investors, but instead the signalling effect of a government that is less supportive of foreign portfolio flows.

Given these significant direct effects of capital controls on foreign portfolio allocations to Brazil, it is not surprising that there are spillover effects on portfolio allocations to other countries. These spillovers, however, are extremely heterogeneous and depend on country characteristics. More specifically, there are no multilateral effects of changes in Brazil's capital controls, on average, to all the emerging markets in our sample. There also do not appear to be significant spillovers to markets which commove more closely with Brazil's markets. Instead, the investor interviews suggested several different approaches towards allocating investment across countries which explain the diverse spillover effects. When Brazil increases its capital controls, investors increase their portfolio allocations to other countries that are in Latin America, that are large shares of the benchmark, and that are closely linked to growth in China (through commodity dependence or regional exports). At the same time, increased capital controls in Brazil cause investors to reduce their portfolio allocations to countries that have a higher risk of implementing new controls (including countries that are traditionally open but recently imposed new controls and countries that traditionally have extensive restrictions on capital mobility). These results confirm that much of the effect of controls is from changes in investor expectations about government policy—even for countries other than that adjusting its capital control regime.

These results have important implications for the debate on the effectiveness and desirability of capital controls. A recent paper by the International Monetary Fund concluded that: “Capital controls are an important part of the policy toolkit for managing surges in capital inflows.....”<sup>7</sup> This conclusion rested largely on the evidence that capital controls could shift the composition of capital inflows to reduce country vulnerability, without significantly affecting the total volume of inflows. Our analysis shows that capital controls can reduce portfolio inflows, a form of capital flows generally believed to be riskier, more

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<sup>6</sup> To put this in context, at the end of our sample in July 2011, Brazil's average portfolio share for global emerging market bond funds was 11.6%, for global emerging market equity funds was 15.9%, and for Latin American equity funds was 66.7%.

<sup>7</sup> Ostry et al. (2011), pg. 29.

volatile, and less desirable than foreign direct investment.<sup>8</sup> Since our data only contains information on equity and debt flows, however, we are not able to test if this reduction in portfolio flows is balanced by other types of capital inflows.

This renewed support for capital controls has also rested on the belief that capital controls in one country had no significant spillover effects on other countries. Our analysis shows, however, that this may not be true. Capital controls in Brazil not only caused investors to reduce the share of their portfolios allocated to Brazil, but also caused them to increase the share of their portfolios allocated to other groups of countries—especially to countries that have fewer restrictions on capital flows. Therefore, the reduction of investor’s exposure to Brazil was not equally distributed among all other countries in their portfolios. As a result, although capital controls may have reduced the risks of bubbles, overheating and exchange rate appreciation in Brazil, this occurred at the expense of other countries. If capital controls simply shift vulnerabilities from one country to another, this “bubble thy neighbour effect” should be incorporated in any reassessment of the desirability of capital controls. Moreover, if several countries simultaneously adopted controls as part of a standard “policy toolkit”, or if a single large country adopted more stringent controls than the small tax analyzed in this paper, the spillover effects could be substantial. These results therefore support a role for international coordination or oversight of the use of capital controls to avoid a “beggar thy neighbour” effect which could lead to retaliation across countries and worsen current distortions to global capital flows.

The remainder of this paper is as follows. Section 2 briefly surveys the literature on capital controls and portfolio allocation. Section 3 summarizes a series of interviews with investors on how they think about and respond to capital controls. Section 4 discusses the dataset and capital control events used for the analysis. Section 5 develops the estimation framework and presents a series of results focusing on the direct effect of capital controls on Brazil. Section 6 presents results focusing on the spillover effects of Brazil’s capital controls on other countries. Section 7 concludes.

## **2. Literature on Capital Controls and Portfolio Allocation**

Basic theoretical models of portfolio allocation suggest that if new capital controls in a country reduce the expected return on assets in that country, then holding everything else constant (including investor wealth and expected returns in other countries), investors would reduce the share of their portfolios allocated to that country and increase holdings in other countries. For example, Stulz (1981) develops an equilibrium model showing how costs associated with holding foreign assets will induce investors to hold fewer foreign assets and increase holdings of domestic assets. This intuitive result, however, may be missing important nuances in how capital controls work and how investors allocate their

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<sup>8</sup> See Levchenko and Mauro (2007) or Aizenman and Sushko (2011).

portfolios across countries. This section briefly surveys the academic literature on capital controls, focusing on papers that inform our analysis of portfolio allocation across countries

The literature on capital controls is extensive and has been well summarized in Magud, Reinhart and Rogoff (2011), Cline (2010), Ostry et al. (2010), Cardarelli, Elekdag and Kose (2009), Forbes (2007), and Henry (2007) and Prasad, Rogoff, Wei and Kose (2003). The theoretical literature suggests that capital account liberalization can have widespread benefits (such as providing financing for high-return investment, providing opportunities for risk diversification, increasing market discipline, and raising investment and growth) as well as substantial costs (such as appreciating exchange rates which can reduce competitiveness, increasing country vulnerability to sudden stops and crises, and leading to inefficient overinvestment). Most of the empirical literature on capital controls attempts to assess whether a specific benefit or cost of controls is supported empirically. For example, papers test if capital controls reduce currency appreciation or capital flow volatility or credit booms. Although there are some differences in results across studies, this macroeconomic literature is generally interpreted as showing that controls on capital inflows do not significantly affect the total volume or volatility of capital flows, but can shift the composition of these inflows toward “safer” flows that could reduce vulnerability in the future.<sup>9</sup>

A closely related literature focuses on the equity market or microeconomic effects of capital controls and finds stronger evidence on the relationship between capital controls and capital inflows. For example, Henry (2007) surveys the evidence on equity market liberalization and concludes that lifting controls on foreign ownership of equities leads to increased capital inflows, higher equity market returns, and higher investment. Forbes (2007) surveys the literature on the microeconomic effects of capital controls and concludes that: “capital controls tend to reduce the supply of capital, raise the cost of financing, and increase financial constraints—especially for smaller firms...”<sup>10</sup> Ostry et al. (2011) find that capital controls can shift the structure of country debt (reducing the share of portfolio debt and of bank foreign-exchange lending), which can strengthen economic resilience during crises. These papers raise an important challenge for the macroeconomic literature which generally finds no significant effect of controls on net capital inflows. Are the effects documented in the microeconomic studies so small that they are difficult to capture at the macroeconomic level? Or are the changes in a specific type of capital inflow documented in these studies balanced by changes in other types of capital flows, so that the net effect is insignificant?

Despite this extensive literature analyzing the macroeconomic and microeconomic effects of capital controls, there has been limited analysis of how capital controls affect investor portfolio

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<sup>9</sup> Forbes and Warnock (2011) find that capital controls do not significantly reduce the probability of a country experiencing a surge of capital inflows, but do not test if controls shift the types of inflows underlying a surge.

<sup>10</sup> Forbes (2007).

allocations. Several papers, however, find evidence that suggests there may be an effect of capital controls on portfolio allocation across countries. Chari and Kehoe (2003) develop a model showing that countries with weaker reputations and more policy uncertainty increase investors' fear of expropriations, causing herding behavior and sudden outflows of capital. Gelos and Wei (2005) show that international investors systematically invest a smaller share of their portfolios in countries with less government transparency and greater "opacity". Gelos (2011) summarizes a number of papers that show that foreign investors tend to invest less in countries with more restrictions on foreign ownership, weaker investor protection, weaker disclosure, weaker accounting standards, weaker shareholder rights and weaker legal frameworks. These papers suggest that the announcement of new capital controls—announcements generally viewed as increasing policy uncertainty, reducing government transparency, and weakening investor protection—could reduce foreign investors' portfolio allocations to the country.

Despite this series of results suggesting that capital controls could affect the share of investors' portfolio allocated to a country, there has been no analysis of the multilateral effects of capital controls, perhaps due to the lack of strong evidence on the aggregate effects of capital controls on capital inflows. This void is surprising for several reasons. First, the literatures on equity market liberalizations and firm-level effects suggest there may be an effect of capital controls on net inflows. Second, even if there is no effect on aggregate inflows but capital controls affect the composition of inflows, this could still generate spillover effects in terms of the composition of capital flows to other countries. Third, the literature on portfolio allocation and contagion across countries shows that country policies which increase uncertainty and reduce transparency, or country shocks of any kind, could affect portfolio investment in other countries.<sup>11</sup> Finally, since the seminal work of Viner (1950), a key focus of the academic literature on trade restrictions is the potential for "trade diversion" as well as "trade creation". It is surprising that there has been no analogous literature on the potential "capital flow diversion" from capital controls.

### **3. Investor Surveys**

To better understand how investors respond to changes in capital controls and more accurately structure our empirical tests, we interviewed 15 different groups of investors (with group size ranging from one to five investors).<sup>12</sup> In each group the investors represented the same company, but usually were from different divisions or managed different types of funds. Each investor had a mandate for some international exposure—ranging from global funds with small exposure to emerging markets to funds

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<sup>11</sup> See Bae, Karolyi and Stulz (2003), Bekaert and Harvey (1995), Claessens and Forbes (2001), and Forbes and Rigobon (2002) for evidence of contagion at the country level, or Bekaert, Ehrmann, Fratzscher and Mehl, 2011 for evidence in country-industry portfolios. See Broner, Gelos and Reinhart (2006), Curcuru, Thomas, Warnock and Wongswan (2011), and Jotikashthira, Lundblad, and Ramadorai (2009) for evidence at the fund level.

<sup>12</sup> All interviews were conducted under the condition that the identity of the fund manager, the fund, and the fund's positions were confidential.

mandated to focus entirely on emerging markets within a specific region. Otherwise the funds were selected to represent a diverse group. About half of the investors focused on equity funds and half on bond funds (with about one-quarter of the investors holding both asset classes). About half the investors ran mutual funds, and the other half was an assortment of hedge funds or managers of funds for a specific client (a wealthy investor, pension fund or government agency). Most of the investors managed medium- or large funds or were part of a larger asset management company or investment bank, although two investors represented smaller, stand-alone funds. We focused on three topics: (1) their general response to a country's announcement of new capital controls; (2) how this affected their investments in the country/asset class on which the controls were applied; and (3) how this affected their investments in other countries/asset classes. For concreteness, we often focused on the recent controls in Brazil (discussed in Section 4), but then asked for more general responses and reactions to other specific cases of controls recently implemented (such as Thailand in 2006 and Peru and Indonesia in 2010).

The investors expressed a remarkable range of views in their general response to a country's announcement of new capital controls. The majority of the investors viewed capital controls as a “cost of doing business” and would adjust their assessment of returns in the country by incorporating the additional cost—supporting the framework in Stulz (1981). Several investors, however, were more negative, interpreting controls as indicating an “anti-investor bias of the country,” “an increase in policy uncertainty in the future,” “a government that does not know what to do,” or a “lack of stability in economic policy”—supporting the framework of Chari and Kehoe (2003) and Gelos and Wei (2005). These more negative views ranged from making “investors more nervous” to being interpreted as “a draconian policy” that would severely deter foreign investment. In sharp contrast, other investors had a favourable reaction to new controls. Several investors viewed capital controls as making a country more attractive because it showed the country was addressing potential vulnerabilities due to a rapid expansion of credit related to capital inflows, implying that the controls could raise long-term returns in the country—as modelled in Korinek (2010). One large investor even saw controls as a buying opportunity as he could “avoid the herd” by buying assets that others were selling.

When asked to move from a general evaluation of controls to the specific issue of how investors would adjust their portfolios, the variation in responses was correlated with the type of fund the investor managed. Most equity investors stated that most of the recent capital controls were so small that they did not materially affect their portfolio allocations. Their main consideration was that new controls could change their assessment of the government's general support for foreign investors and whether they were viewed as “market-friendly” or more likely to experiment with “heterodox” policies that raised uncertainty about the investment climate. Bond investors often saw capital controls as having a more

meaningful effect as their expected returns were smaller and the tax on fixed income was often higher.<sup>13</sup> Also important in determining the investors' response was how the manager was compensated. Managers of mutual funds (both equity and debt) expressed frustration that the lower return from taxes was not incorporated in the index on which their compensation was based. Therefore, controls made it more difficult to beat their benchmarks—but they still had limited ability to reduce their holdings as the country's weight in the benchmark generally did not change.<sup>14</sup> Other investors—such as hedge funds—which focus on absolute instead of relative returns could more quickly reduce country exposure if capital controls reduced the absolute return so that it was no longer above their investment threshold.

Some investors also mentioned they would try “to minimize the cost in the country that was already selected” by adjusting which assets they held or how their transactions were structured.<sup>15</sup> In most cases, however, these alternative structures involved some additional cost (in some cases the additional cost almost equalled the cost of just paying the new tax) and/or involved taking on additional risks—especially counterparty risk. Therefore most investors claimed to make minimal use of these alternative structures to get around capital controls, at least for countries such as Brazil where the tax was fairly low. It is unclear, however, how candid investors would be about strategies to avoid the controls.

One area on which there was moderate agreement was on the timing of how new capital controls would change investment allocations. Most investors—even those strongly opposed to controls—admitted they would not usually make an immediate portfolio adjustment after new capital controls were implemented, although there was a good chance they would adjust their flows to the country over time. For example, many stated that the recent capital controls in Brazil would have “the biggest impact on new inflows into Brazil,” but “minimal effect on current allocations.” This suggests that after new controls are put into place, there would be little immediate active portfolio reallocation, although there could be some adjustment in portfolio holdings due to passive rebalancing if there were any changes in returns.

The reasons for this lagged adjustment varied across investors. Several investors stated that they usually knew when new controls were coming—and even if they didn't know the exact day or exact

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<sup>13</sup> For example, the IOF tax of 2% that Brazil levied on foreign equity investment in 2010 was just a rounding error on one equity investor's expected return of 10-15%; he stated it was “less than average daily volatility in the Brazilian equity market” and “equivalent to the 1-2% cost of trading on the Brazilian exchange before the controls”. In contrast, one bond investor expected a return of about 6% in Brazil, so that the IOF tax that began at 2% and was increased to 6% would wipe out any profits from investing in Brazil.

<sup>14</sup> If the capital controls are substantial, they can influence a country's weight in the benchmark. This is discussed in more detail in Section 5.

<sup>15</sup> Investors had a range of suggestions of how to accomplish this. For example, in order to minimize the cost of investing in fixed income in Brazil, the fund could trade Brazilian bonds issued in NY under NY law to avoid the tax. In many cases, however, since the bonds would pay in dollars the company would be accruing additional currency risk, which could be reflected in a lower return for the foreign investor. Other investors had more complicated structures to minimize the tax—such as through the creation of “pass-through vehicles”, using local accounts to invest as a domestic resident, interest rate swap transactions, offshore transactions, or finding alternative structures to label investment as FDI.

structure of the controls—they would have already priced in some effect on their current holdings.<sup>16</sup> When the capital controls were actually announced, only the difference between the controls versus what was expected would affect portfolio allocations. Other investors said that new capital controls could generate a fundamental rethinking of the attractiveness of a country for investment—but it was only one piece of information that would go into the broad reassessment—and this broad reassessment would take time. For some investors, fund allocations had to be discussed and approved by a committee, and this process generally involved a lengthy process of meetings, documentation and approvals. Therefore, after allocating funds to a country, the investors would “not want to derail the allocation process because of a small tax” and would only adjust investments in the future during the next series of pre-set allocation meetings. An additional reason for a lagged response was that one investor wanted to wait and see how other investors responded to the controls, and then respond to the response.

A final focus of these interviews was how investors would adjust their portfolio allocations to countries other than the country implementing the new capital controls. Investor responses were highly varied and largely depended on the type and mandate of the fund. For many global fund managers with a mandate that included developed and emerging markets, there was little discussion of reallocation effects after new capital controls were introduced in Brazil. These funds generally had such a small portion of their portfolios in any one emerging market, that even if the controls induced them to sell Brazilian assets, this was such a small amount of new cash that it was within the daily volatility of changes in their cash positions and would not cause a reassessment of portfolio allocation elsewhere. For many hedge funds—which are not benchmarked against a specific index and focus on absolute returns—investors rarely spoke of any reallocation into other countries or assets. They would only invest in assets for which they expected a return above a certain threshold, and if they had already identified those opportunities, they would already be invested in them. If capital controls reduced returns in one country or asset so that the return was no longer above their threshold, they would simply sell that asset and keep the cash.

A few fund managers, mainly for emerging-market mutual funds and dedicated Latin American funds, did discuss reallocation strategies after new capital controls. Not surprisingly, these investors also tended to be those who stated they would be more likely to reduce their investments in a country after controls were implemented. There was a range of views, however, on which types of countries would be affected by any reallocation effects. Even for funds that appeared to have similar mandates, it was striking how the approach of each fund manager to portfolio reallocations across countries varied based on their individual approach to investing. For example, some fund managers focused more on regions. Other

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<sup>16</sup> One investor claimed that his firm had a short window after the announcement of a change in the IOF and before the higher tax was implemented during which they could shift cash to a Brazilian subsidiary. Then they drew from these domestic cash holdings to make investments that were not subject to the tax, avoiding the tax for over a year.

managers, especially of large funds, focused on the size and liquidity of markets, while others prioritized the type of exposure they were getting from each country—such as exposure to growth in China. Finally, some investors emphasized the importance of the government’s attitude toward foreign investment, including their level of concern about capital inflows and capital flow volatility and their tendency to use “heterodox” policies. All of these factors could increase uncertainty and the risks of investing in a country. Section 6, which focuses on measuring the spillover effects of capital controls, discusses these different approaches toward portfolio allocation across countries in more detail.

To summarize, these investor surveys provide useful guidance on how to structure an analysis of the effects of capital controls on portfolio allocation. First, the surveys suggest that any immediate effect of capital controls is likely to be small, with a larger impact over time as investors adjust portfolios. Second, the surveys suggest that even though the IOF targeted fixed income investment more than equities, there still could be significant effects on equity investments if controls cause a reassessment of the overall “anti-investor” or “policy uncertainty” risk in a country. Third, the surveys suggest that any reallocation effects would be greater in mutual funds than hedge funds, and in emerging market funds rather than in global funds that include developed markets. Finally, these surveys show the range of possible effects on investor portfolios—both directly on investment in Brazil as well as indirectly due to different strategies toward reallocation to other countries. This supports the many theoretical models of portfolio allocation which assume that investors have heterogeneous beliefs and therefore hold diverse portfolios (see Broner et al., 2006). This also agrees with the conclusion in Gelos (2011) that: “..any simplistic characterization of the behavior of these funds is likely to be misleading...emerging market funds do not move in tandem as a single herd.” (pg. 9) These varied investor responses to capital controls suggest that a complete empirical analysis is necessary in order to fully understand the direction and size of the effects of controls on portfolio investment.

#### **4. The Events and Data**

##### ***4a. The Events***

We analyze the effects of one type of capital control used by one country—the *Imposto de Operações Financeiras* (IOF) used by Brazil. Focusing on this specific control in one country has the disadvantage that the analysis may not generalize to other countries’ experiences with controls or to different types of controls within the same country. We focus on this specific example, however, for several important reasons. First, we can more precisely estimate the effect of the IOF rather than aggregating a range of different controls in different countries, which could have a range of effects and therefore bias estimates toward finding no consistent effect of controls. Second, Brazil is a large emerging market that is fairly open to foreign investors and is a large share of the key benchmarks against which

investors are assessed. Therefore, capital controls in Brazil would be more likely to cause spillover effects than in countries where foreign investors have less exposure. Finally, Brazil is a useful natural experiment as it changed its controls on several occasions in a few years. These changes were well publicized, often garnering substantial attention in not only investment reports but even in the broader business and economics press. For all of these reasons, if there is no evidence of spillover effects in this setting, it is unlikely (although not impossible) that there would be substantial spillover effects from other countries, and especially smaller countries, adding new capital controls.

Our analysis focuses on four episodes when the IOF on capital inflows to Brazil changed during the sample period from January 2005 through July 2011.<sup>17</sup> The IOF was originally established in 1993 and has been used intermittently since then. The four episodes on which we focus are:

<b>Date</b>	<b>Description</b>
03/2008	Introduced IOF of 1.5% on fixed income
10/2008	IOF on fixed income reduced to 0%
10/2009	Introduced IOF of 2% on portfolio inflows of fixed income and equities; also implemented 1.5% tax when foreign investors converted ADRs into receipts for shares issued locally
10/2010	Increased IOF to 4% on fixed income; then increased IOF to 6% on fixed income and over next two months adopted a number of restrictions to close loopholes that were used to avoid the tax <sup>18</sup> ; Finance Minister Mantega also announced that other measures were under consideration

To the best of our knowledge, there has not yet been any published, formal analysis of the impact of the IOF on portfolio flows to Brazil, including on whether there were any spillover effects to other countries. The only published discussion of the controls which we have been able to find is several pages in IMF(2011). This paper states that “the IOF measure did not have a clear, long-lasting effect on the exchange rate” and finds that even though the controls did not affect the volume of total inflows, they appear to have shifted the composition of capital inflows into the futures market due to “the IOF’s favorable treatment of futures.”

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<sup>17</sup> Brazil also adopted several prudential measures and other types of controls during this time period, although most were not specifically targeting foreign portfolio flows. For example, in December 2010 Brazil raised bank capital requirements for certain consumer credit operations (including car loans) and raised the unremunerated reserve requirements on time deposits; in January 2011 Brazil imposed reserve requirements on banks’ short dollar positions in the cash market. In January 2011 Brazil reduced the tax on inflows into investment funds and to finance long-term infrastructure investments and exempted foreign investors from this tax. In April 2011, Brazil introduced a 6% IOF on external loans shorter than 1 year and then extended the IOF of 6% to all external loans with a maturity up to 2 years.

<sup>18</sup> For example, these measures included: (1) increased tax from 0.38% to 6% on the margin payments required on derivative transactions; (2) limited the ability of foreign investors to shift investment from equity to fixed income investment in their 2689 accounts; and (3) restricted foreign investors in the futures markets from being able to meet their margin requirements via locally borrowed securities or guarantees from local banks.

#### ***4b. The Data***

To analyze the direct impact of the IOF on portfolio investment in Brazil and the indirect effects on other countries, we use a dataset on international portfolio flows and holdings at the fund level compiled by Emerging Portfolio Fund Research (EPFR). This is a novel database that is only starting to be used in academic research.<sup>19</sup> It contains information on daily, weekly, and monthly flows for more than 16,000 equity funds and more than 8,000 bond funds. It also contains data on funds' total assets under management (AUM) in each country at the end of each period, as well as information to calculate how changes in AUM in each period can be disaggregated into net capital flows and valuation changes (due to asset returns and exchange rate movements). One disadvantage of this EPFR data is that it only includes information on mutual funds and does not include flows through banks, hedge funds, foreign direct investment, or any non-mutual fund investors that could respond differently to capital controls. The data also captures only about 5% to 20% of total market capitalization for most countries. Despite all of these shortcomings, the data is believed to be a fairly representative sample of international portfolio flows and is the most comprehensive dataset on international portfolio flows that is currently available at a high frequency with detailed geographic coverage.<sup>20</sup>

For our base case, we focus on monthly EPFR data which covers the period from January 2006 through July 2011. This time period allows us to analyze the effect of several changes in capital controls in Brazil, including the short-lived controls in 2008 and the most recent tax increases in 2010.<sup>21</sup> The data is aggregated so that we focus on the investment allocation into each country by each fund group for equity and debt. Table 1 shows the number of observations over the full sample period, with each observation representing an allocation by a fund group into a country in a month. The table also shows total AUM at the end of 2010 for each fund group. At end-2010 the EPFR data covers over four times more AUM in equities than debt; for comparison, international portfolio investment in equities tends to be roughly half that for bonds.<sup>22</sup> This better coverage of equity than debt investments in the EPFR data will be an important factor to consider when interpreting the empirical results.

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<sup>19</sup> The only other papers of which we are aware that use this data are: Fratzscher (2011), Raddatz and Schmukler (2011), and Jotikasthira, Lundblad and Ramadorai (2010). Each of these papers addresses very different questions.

<sup>20</sup> For example, Jotikasthira et al. (2010) show a close match between EPFR data and portfolio flows stemming from balance-of-payments data.

<sup>21</sup> We also perform sensitivity tests using more detailed, weekly fund-level data. This more detailed data does not include as large a sample of funds and is only available through September 2010, therefore missing the most recent capital controls enacted in October 2010.

<sup>22</sup> For example, at year-end 2009 (the last year for which data is available), cross-border portfolio investment assets in equities and debt were \$13.7 trillion and \$23.6 trillion, respectively. Source: IMF, *Coordinated Portfolio Investment Survey*, updated June 2011.

The right side of Table 1 shows the average share of each fund group's portfolio allocated to Brazil over the full sample period. Most fund groups have little or no exposure to Brazil—which is not surprising as many fund mandates (such as for Emerging Europe) do not include Brazil. The column on the far right shows AUM in Brazil for each fund group at the end of 2007, just before the first capital control event in our sample. The data set includes \$98.4 billion and \$14.1 billion in equity and debt investment in Brazil at end-2007, respectively, capturing 34% and 17% of total foreign portfolio investment in Brazil's corresponding markets.<sup>23</sup> In the empirical analysis below, we primarily focus on fund groups that meet two criteria: fund groups that have at least 5% of their AUM in Brazil (on average over the full sample period) and that have at least \$1 billion in AUM in Brazil at year-end 2007 (before the first capital control event in our sample). This limits the sample to fund groups that have enough exposure to Brazil that they would be expected to follow events in the country and consider portfolio changes in response to changes in the IOF tax.<sup>24</sup> This also limits the sample to fund groups that are large enough that their actions will not be driven by the idiosyncratic behaviour of a small number of funds in the group. These criteria restrict our initial sample to three fund groups: Global Emerging Market equities, Global Emerging Market debt, and Latin America Regional Equities. These funds in our sample capture 26% of foreign portfolio investment in Brazil's equities and 13% in its debt. We also do sensitivity tests with the larger sample, but begin with this set of funds which the investor surveys suggest are the most likely to show some response to the capital controls.

Figure 1 graphs portfolio allocations to Brazil of these three fund groups in our sample and the weight of Brazil in the relevant benchmark index.<sup>25</sup> It also graphs the level of the IOF on fixed income (the primary form of the IOF adjusted over this period). Although far from definitive evidence, these graphs show some patterns that are consistent with investors reducing their exposure to Brazil after increases in the IOF. For example, the Global Emerging Market equity funds were overweight Brazil (relative to the MSCI benchmark) from the beginning of the sample until the first capital control event. Once the IOF was increased in early 2008, these funds reduced their overweight exposure to benchmark allocations. When the tax was reduced to zero in the fall of 2008, investors increased their exposure to become slightly overweight Brazil again and continued to be overweight relative to the benchmark for much of the period until Brazil raised the tax again in the fall of 2009. Other periods and funds, however,

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<sup>23</sup> Based on data from the IMF's *Coordinated Portfolio Investment Survey*, updated June 2011, which reports that total portfolio investment in Brazil at year-end 2007 was \$290 billion in equities and \$83 billion in debt.

<sup>24</sup> The discussions with investors found that managers of global funds generally focused their attention on events in the large, developed markets and often did not closely monitor events in emerging markets.

<sup>25</sup> The benchmark for the Global Emerging Market equities and Latin America Regional equities funds are the MSCI global emerging market and MSCI Latin America indices. The benchmark for the Global Emerging Market bond funds is JPMorgan's EMBI global index.

show different patterns. For example in the Global Emerging Market bond funds, investors switched from benchmark weights to substantially overweight Brazil during 2008 when the IOF was positive.

Finally, since our analysis focuses on fund exposure to countries relative to benchmark weights, we drop country holdings that are outside the fund’s mandate (such as allocations to South Africa for a fund with a mandate for Latin America Regional). Table 2 shows the resulting number of fund-group observations for each country in the base-case sample used for the analysis below. Funds have equity or debt investment in 25 countries (including Brazil) and represent a range of emerging markets around the world.

## 5. Model and Estimation: Direct Effects of Capital Controls

This section develops the modelling framework to test for the direct effect of capital controls on Brazil and the spillover effects on other countries. Then it estimates the model and presents a series of results, focusing on understanding how capital controls directly affect portfolio allocations to Brazil. The next section explores spillovers to other countries in more detail.

### 5a. The Model

Gelos (2011) provides an excellent summary of the literature on portfolio allocation across countries. This literature highlights the important role of benchmarks (whether due to compensation structures, fund mandates, or other factors) in determining the country shares in investor portfolios. The investor interviews discussed in Section 3 also highlight the role of benchmarks in determining mutual funds’ allocations across countries—and these are the funds represented in the EPFR data.<sup>26</sup> Therefore, our analysis builds on Gelos and Wei (2005), which uses a model that assumes that each fund allocates its portfolio across countries based on the country’s weight in the fund’s benchmark, a fund fixed effect, and an error term. This framework can be derived directly from the International Capital Asset Pricing Model.

More specifically, in the absence of capital controls, country portfolio allocation is:

$$\omega_{i,j,t} = \alpha_{i,j} + \beta \cdot \omega_{i,t}^{benchmark,j} + \varepsilon_{it} \quad , \quad (1)$$

where  $\omega_{i,j,t}$  is the share of the portfolio allocated to country  $i$  for fund group  $j$  at time  $t$ ;  $\alpha_{i,j}$  is the country-fund group fixed effect;  $\omega_{i,t}^{benchmark,j}$  is the weight of country  $i$  in the relevant benchmark for fund group  $j$  at time  $t$ ; and  $\varepsilon_{it}$  is the error term. We include a country-fund fixed effect (instead of simply a fund fixed

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<sup>26</sup> Also see Broner, Gelos and Reinhart (2006), Hau and Rey (2008), Curcuru, Thomas, Warnock, and Wongswan (2011), and Raddatz and Schmukler (2011), for the importance of benchmarks in international portfolio allocations.

effect as used in papers such as Gelos and Wei, 2005) in order to capture the fact that some funds tend to be overweight or underweight specific countries relative to the benchmark, on average, over the sample period.<sup>27</sup> Next, if Brazil adjusts its capital controls, the new controls could have a direct effect on the share of the funds' portfolios allocated to Brazil and spillover effects on the shares allocated to other countries. Adding these effects of capital controls to equation (1) yields:

$$\omega_{i,j,t} = \alpha_{i,j} + \gamma_D \text{Control}_t^{\text{Brazil}} + \gamma_S \text{Control}_t^{\text{ExBrazil}} + \beta \cdot \omega_{i,t}^{\text{benchmark},j} + \delta \chi_{it} + \varepsilon_{it}, \quad (2)$$

where  $\text{Control}_t^{\text{Brazil}}$  is the level of Brazil's IOF if the country allocation ( $i$ ) is to Brazil;  $\text{Control}_t^{\text{ExBrazil}}$  is the level of Brazil's IOF if the country allocation ( $i$ ) is to any country other than Brazil; and  $\chi_{it}$  are a set of macroeconomic control variables.

In order to focus on how changes in Brazil's capital controls affect changes in portfolio allocations to different countries, we first-difference equation (2) to obtain:

$$\Delta \omega_{i,j,t} = \gamma_D \Delta \text{Control}_t^{\text{Brazil}} + \gamma_S \Delta \text{Control}_t^{\text{ExBrazil}} + \beta \cdot \Delta \omega_{i,t}^{\text{benchmark},j} + \delta \Delta \chi_{it} + \mu_{it}. \quad (3)$$

This specification is the base case for the analysis below. It assumes that the size of any change in the tax affects the magnitude of any portfolio reallocations (rather than assuming that any change in the capital controls would have an equally-sized effect on reallocations). We focus on testing two hypotheses:

- $\gamma_D < 0$  : an increase in the IOF decreases the share of funds' portfolios allocated to Brazil; and
- $\gamma_S > 0$ : an increase in the IOF increases the share of funds' portfolios allocated to countries other than Brazil.

In order for the coefficient estimates in equation (3) to be unbiased and consistent, it is necessary to make two assumptions. First, changes in the IOF must not be correlated with changes in the country weights in the benchmark indices. In other words:

$$\text{Corr}(\Delta \text{Control}_t^{\text{Brazil}}, \Delta \omega_{i,t}^{\text{benchmark},j}) = 0, \text{ and}$$

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<sup>27</sup> This could happen for a number of reasons. For example, if a fund allocates a portion of its AUM to countries that are not in its benchmark, then its allocation to countries in the benchmark would, on average, be below benchmark weights. Some large funds also tend to systematically underweight smaller countries (such as for equities in Colombia and Chile) and overweight larger markets (such as Indonesia and Thailand) as they place a premium on liquidity and being able to hold large enough positions to have a significant effect on returns versus their benchmark.

$$\text{Corr}(\Delta \text{Control}_t^{\text{ExBrazil}}, \Delta \omega_{i,t}^{\text{benchmark},j}) = 0. \quad (4)$$

To test if these assumptions are valid, we consulted with senior investors at JPMorgan (which creates one of the benchmark indices) and they confirmed that in some cases changes in a country's capital controls can change its weight in a benchmark index. Stringent capital controls which affect the ability of foreigners to invest in a country or substantially raise the cost to foreign investors will, over time reduce the country's weight in the benchmark.<sup>28</sup> Brazil's IOF during the sample period, however, did not affect Brazil's benchmark weighting because of "the small size of the tax" and the fact it "did not significantly impede foreign investment". To confirm this assessment, Table 3 lists changes in Brazil's weight in the benchmark indices for global emerging market equity and bond funds during each of the three months that the IOF was raised and the following two months. The table does not show any clear negative effect of increases in the tax on Brazil's benchmark weights. Moreover, the graphs in Figure 1, which show the size of the IOF and benchmark weights for Brazil, also show no evidence that an increase in the IOF caused a decrease in Brazil's share in the benchmark indices.

The second assumption required for unbiased and consistent estimation of equation (3) is that there is no endogeneity between the share of investors' portfolios allocated to Brazil and the government's decision to adjust the IOF. Unfortunately this assumption is unlikely to hold. Instead, the government is more likely to take steps to slow capital inflows, such as raising the IOF when capital inflows to Brazil surge, market returns are high, and funds are increasing their portfolio allocations to Brazil. Figure 2 graphs net portfolio liabilities as a share of GDP for Brazil and the level of the IOF on bonds over time. Although far from a definitive analysis, it supports the hypothesis that the IOF is often increased after portfolio inflows surge and decreased when inflows drop sharply. This potential endogeneity resulting from the positive effect of changes in Brazil's share in investor portfolios on the government's decision to change the IOF, however, would bias estimates of  $\gamma_D$  downward. In other words, this endogeneity would reduce estimates of the effect of capital controls on portfolio allocations below their actual values and could lead to an inaccurate conclusion that any effect is insignificant. Similarly, some plausible omitted variables (such as any positive shock that caused investors to increase their portfolio allocations to Brazil and simultaneously increase the government's concerns about capital

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<sup>28</sup> MSCI (the most popular benchmark index for emerging market equities) uses a "liquidity inclusion factor" (LIF) to calculate what percent of a country's stock market index is tradable. Countries with greater capital controls have a smaller LIF and therefore a smaller share in the benchmark. Calculating the LIF (or equivalent measure for other indices) is largely based on the assessment of the company calculating the benchmark, often with substantial input from investors and in some cases discussions with the government. Small changes in capital controls, especially when in the form of a tax that does not directly impede investment but only raises the cost, generally has no effect on the share of a country's index assessed to be "tradable."

inflows) would also bias estimates of  $\gamma_D$  downward. Due to these econometric issues, the actual effect of capital controls on portfolio allocations may be larger than the estimates reported below.

### ***5b. Estimation and Results: The Direct Effect of Capital Controls on Brazil***

To estimate equation (3), we measure each fund group's allocation to each country in the sample as a share of the fund group's total portfolio, using the data discussed in Section 4. To measure changes in Brazil's capital controls, we use the change in the IOF on fixed income (which is the primary mechanism by which Brazil adjusted its controls during the sample period). The investor interviews in Section 3 suggested that many funds only respond to capital controls with a lag, so we allow for a lagged effect over three months starting with the month when the IOF is changed. To measure the benchmark weights, we use the most widely used benchmarks that correspond to the fund groups' mandates and confirm the choice in the investor interviews.<sup>29</sup> There are a range of control variables that could be included in  $(X_{it})$ , so we estimate the model with no control variables and then with a set of controls that capture "push" and "pull" variables that are believed to affect capital flows and portfolio allocations across countries. Our variable choice is also limited to data that are available at the monthly frequency used for estimation and available across the countries in the sample. The control variables for our base case are: the U.S. TED spread, the U.S. VIX index, country  $i$ 's change in the exchange rate versus the U.S. dollar, country  $i$ 's interest rate, U.S. equity returns, country  $i$ 's interest rate differential versus the United States based on 3-month money market interest rates, and the intra-month volatility in country  $i$ 's equity returns and interest rates.<sup>30</sup> Each of these control variables is first differenced (except in robustness tests of equation (2) when all variables are expressed in levels.) Most of the macroeconomic control variables are lagged by one month. Table 4 provides more information on the definitions, sources, means and standard deviations of each of the variables used in the base-case regressions.

Results from estimating equation (3) for the equity and bond funds, both with and without the macroeconomic controls, are reported at the left of Table 5. All estimates, unless stated otherwise, include robust standard errors clustered by fund group and country. The coefficient estimates for our main variables of interest are highly stable for a range of different macroeconomic controls, so we do not report a series of sensitivity tests with different controls. Each specification shows a significant negative effect of an increase in the IOF on portfolio allocations to Brazil. Using the estimates with the full set of

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<sup>29</sup> The benchmarks are: MSCI's Emerging Markets (EM) Index for the Global Emerging Market equity funds; JP Morgan's EMBI Global Diversified Index for the Global Emerging Market bond funds, and MSCI's Emerging Market America's index for the Latin American Regional equity funds.

<sup>30</sup> See Bae, Karolyi and Stulz (2003) and Fratzscher (2011) for justifications and examples of models including these variables. See Adrian and Shin (2010) and Brunnermeier and Pedersen (2009) for models that highlight the role of liquidity and see Bacchetta and van Wincoop (2010) and Gourio, Siemer, and Verdelhan (2010) for models highlighting the role of risk.

controls, the  $-0.0356$  coefficient indicates that increasing the IOF tax by 4% (as occurred in October 2010) would cause funds to reduce their portfolio weights allocated to Brazil by 0.43 over the three month period. For comparison, the average portfolio share allocated to Brazil at the end of the sample in July 2011 is 31.4%. The coefficients on the spillover variables are positive but insignificant, suggesting that there are no significant spillover effects from changes in the IOF on average portfolio allocations to all other countries in the sample. The coefficients on the benchmark weights are positive and highly significant. The coefficient values are also similar in magnitude to other papers which find that benchmark weights are highly correlated with country weights in fund portfolios.<sup>31</sup>

The middle column of Table 5 also reports an additional set of results, but instead of estimating the first-differenced specification in equation (3) reports the levels specification in equation (2). The coefficient estimate of the direct effect of capital controls on Brazil continues to be negative and significant, although now only at the 10% level. The magnitude of the estimate indicates that an IOF of 6% (which is currently in place) would cause the share of a fund's portfolio allocated to Brazil to be 0.60% lower for the entire time that the tax is in place. The interpretation of this coefficient on the level effect of the IOF versus that in the first-differenced equation is important. The first-differenced specification estimates how a change in the IOF causes a change in portfolio allocations to Brazil over a three-month period. The levels specification estimates how the level of the IOF permanently changes the portfolio share allocated to Brazil (until there is another change in the controls). Given the limited number of changes in the IOF in our sample and the zero level of the tax at the beginning of the sample followed by a substantially higher average IOF tax during the later part of the sample, this test for a level effect of capital controls is largely a test for a shift in portfolio allocations to Brazil in the 2<sup>nd</sup> half of the sample. Moreover, there are other reasons why investors may have shifted their portfolio weights later in the sample that are independent of changes in Brazil's capital controls. The levels specification also does not capture any lagged changes in the effects of controls. For all of these reasons, we focus primarily on the first-differenced specification in the following analysis.

To further explore any time dimensions of changes in capital controls, the columns on the right of Table 5 report several specifications based on the first-differenced specification in equation (3). One column adds an additional control variable measuring any effect of changes in the IOF on portfolio allocations in the month prior to the change. This could capture any advance knowledge or expectation of changes to the tax. Since investors may have predicted some type of news, but were unlikely to know the details of the change (as mentioned in the investor interviews in Section 3), we test for any effect in the month before the change with a variable equal to 1 if the IOF is eventually increased or -1 if the tax is

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<sup>31</sup> For example, Gelos and Wei (2005) estimate coefficients on their benchmark index from 0.710 to 0.766 in their baseline specifications (which only include equity funds).

reduced (instead of using the level of the tax).<sup>32</sup> The coefficient estimate of the direct effect on portfolio allocations to Brazil in the month prior to the change in the tax is positive and insignificant, providing no evidence that investors significantly reduced their Brazil allocations in the month prior to an increase in the IOF. Even if investors suspected a forthcoming change in capital controls, they did not significantly adjust their portfolios until after the change was announced.

Next, to test if investors immediately adjusted their portfolios in the month that the change in the IOF was announced, we test for an effect on portfolio allocations in the month of the announcement instead of over a three-month window. Table 5 shows that the estimate of the direct effect of controls on portfolio allocations to Brazil in the month of a change in the IOF is insignificant and smaller in magnitude than estimates that allow for a lagged effect. Finally, to test if investors continued to adjust their portfolios after the three-month window in the base case, the column on the far right of Table 5 tests for any effect on portfolio allocations during the three-months starting when the tax is changed (the base case), as well as any additional effect over the following three months (labelled  $T+1$ ). The coefficient on this delayed effect is positive but insignificant, indicating that investors do not continue to adjust their portfolio weights over longer periods. This set of results confirms a theme in the investor interviews—that investors do not immediately adjust their portfolios in response to changes in capital controls and instead evaluate the policy changes and investor reactions over weeks or even months.

Finally, to better understand how capital controls in Brazil affect different types of investors, Table 6 repeats the base-case regressions for different asset classes (equity and debt) and two different equity fund groups (Global Emerging Market and Latin America). In each case, estimates of the direct effect of changes in the IOF on portfolio allocations to Brazil continue to be negative and significant and estimates of the indirect effects on allocations to other countries continue to be insignificant. The explanatory power of the regression for the bonds is substantially lower than for the other groups and the coefficient on the direct effect of controls on Brazil is no longer significant at the 5% level in several robustness tests for the bond funds. The magnitudes of the coefficient estimates of the direct effects also vary across asset classes and fund groups. The direct effects of changes in controls are about twice as large for Latin American as for Global Emerging Market equities. This is not surprising as Latin American funds have a larger share of their portfolios allocated to Brazil, so any change resulting from the tax would cause a larger change in their portfolio allocations. More surprising is the consistently large and significant estimated effects on equity funds, despite the fact that three of the four capital control events in our sample consisted of changes in taxes on fixed income and no direct changes in the cost for foreigners to invest in equities. This suggests that the capital controls affected foreign investors more

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<sup>32</sup> We also calculate this variable using the change in the value of the IOF that was announced in the next month, with no significant effect on the results.

through a signalling effect rather than the direct cost of the tax. This agrees with the interpretation of capital controls mentioned by several investors in the interviews—that even if the direct cost of a capital control is small, it could be interpreted as a signal that a government was less supportive of foreign investors in general.

While this estimated effect of capital controls is significant, what does the magnitude of the coefficient imply for capital flows to Brazil? Assuming everything else remains constant, the estimates in Table 6 suggest that reducing the current IOF of 6% to zero would increase portfolio shares allocated to Brazil by 0.53% for Global Emerging Market equity funds, 1.39% for Latin American Equity funds, and 0.47% for Global Emerging Market bond funds. Holding AUM constant and assuming no changes in benchmark weights, this corresponds to increased investment of between \$2.6 billion and \$3.9 billion in Brazil over the next three months (with 80% to 90% of the increase in equities).<sup>33</sup> Finally, since the EPFR data covers about 34% of foreign portfolio investment in Brazil’s equities and 17% in debt, it is necessary to “gross up” these estimates to get a sense of the implications for Brazil’s total portfolio flows. To do this, make the very rough assumption that foreign portfolio investment in Brazil is allocated between different types of funds as in the EPFR data.<sup>34</sup> Also assume that Global Emerging Market equity and bond funds and Latin America equity funds are the only investors that reallocate portfolios in response to changes in the IOF. Then, reducing the IOF to zero would correspond to increased portfolio flows into Brazil of about \$9 billion to \$16 billion over 3 months. Whether this is large or small in magnitude depends on the comparison. This is large relative to annual portfolio flows into Brazil—which were \$35.5 billion in 2009 and \$70.8 billion in 2010. This is small when compared to the stock of total foreign portfolio investment in Brazil of \$441.5 billion at year-end 2009.

## 6. Spillover Effects of Capital Controls

The analysis in Section 5 documents a significant negative effect of changes in Brazil’s capital controls on portfolio investment in Brazil but does not find evidence of any significant spillover effects, on average, to other countries in the sample. There are several possible explanations for this seemingly contradictory result. First, the regression analysis may not capture any significant spillovers because the amount of capital shifted from Brazil to other countries is fairly small relative to the total volume of global portfolio flows. This portfolio reallocation may be overwhelmed by other shocks to investment that

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<sup>33</sup> The range is based on whether we use 12/2009 or 07/2011 as the base year for the calculations. In July of 2011, the EPFR dataset had information on \$74.1 billion AUM in Brazil in Global Emerging Markets equity funds, \$28.6 billion in Latin American equity funds, and \$19.8 billion in Global Emerging Markets bond funds, for a total of \$122.4 billion. In December 2009, the EPFR dataset reported information on \$86.8 billion.

<sup>34</sup> In other words, assume that total foreign investment in equities in Brazil was allocated such that: 41% to 55% was held in Global Emerging Market equity funds and 21% to 26% by Latin America Regional equity funds. Of the foreign investment in Brazil’s bond markets, 76% to 80% was held by Global Emerging Market bond funds.

are not captured in the simple analysis. Second, when investors reduce their allocations to Brazil, they may choose to hold the incremental funds in cash instead of investing them in another country.<sup>35</sup> Unfortunately the database used for the main analysis in this paper does not contain information on cash allocations, so we are not able to test this hypothesis directly. A more limited subset of the EPFR data, however, does have information on cash holdings at the fund level.<sup>36</sup> A graph of the portfolio shares allocated to cash in this data does not indicate any significant change in cash allocations around the time of changes in the IOF. Moreover, regressions estimating the correlation between changes in the IOF and cash holdings (relative to AUM) find no significant relationship in either equity or bond funds.<sup>37</sup> Due to the limited coverage in this smaller sample, we do not want to place too much emphasis on these results, but they do not provide any evidence that investors significantly adjusted their cash holdings in response to changes in the IOF.

A final explanation for the lack of general spillover effects when investors adjust their portfolio allocations to Brazil in response to changes in the IOF is that the reallocation effects to other countries and groups of countries is extremely heterogeneous. Investors could make significant adjustments in their exposure to a small group of other countries based on their investment strategies, but these strong spillover effects in selected countries may not be captured in estimates of the average effect for the full sample. Similarly, positive spillover effects in some countries could be balanced by negative effects in other countries, so that the average effect is close to zero. For example, if the increased use of capital controls by Brazil signals a greater probability that other countries will increase their use of controls, there could be negative spillover effects in countries believed to be more sympathetic to the use of controls. When these negative spillover effects are aggregated with positive effects in other countries, the average effect could be close to zero and insignificant.

As an initial attempt to better understand how investors adjust their positions in countries other than Brazil in response to changes in the IOF, we look at the correlations between returns in Brazil and other countries to see which countries' markets tend to commove with Brazil. If investors diversify their portfolios in order to obtain their optimal balance of risk and return, then if they decrease their allocations to Brazil due to a country-specific shock (changes in the IOF), they would be more likely to increase allocations to other countries whose returns are closely correlated with Brazil in order to maintain their optimal diversification. We calculate the "betas" between the returns in equity or debt markets in each country and the returns in the corresponding market in Brazil, controlling for returns in the global

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<sup>35</sup> Investors could also reallocate funds to countries that are not in their benchmark and therefore not covered in the main dataset used for the regressions.

<sup>36</sup> This subset covers less than half of our dataset and does not appear to be representative of the larger sample.

<sup>37</sup> More specifically, a regression of the share of cash holdings (relative to AUM) on changes in the IOF yield the coefficient -0.055 (with a standard error of 0.145) for bond funds and coefficient of -0.014 (and standard error of 0.037) for equity funds. In both cases, the  $R^2$  is 0.00.

emerging market benchmark.<sup>38</sup> Then we estimate the base model in equation (3) and interact the spillover term ( $\Delta Control_t^{ExBrazil}$ ) with each country's beta with Brazil. Next, since any spillover effects may be isolated to the few countries with large betas with Brazil, we interact the spillover term with a dummy variable equal to one for countries with large betas (defined as countries whose beta with Brazil is at least 20%). The left of Table 7 lists these countries with “large betas” with Brazil in equity markets. Including either of these measures of betas with Brazil interacted with the spillover term, however, does not yield any significant estimates for the spillover coefficient. The left of Table 8 reports a typical result-- for the “large beta” measure for Global Emerging Market equity funds.<sup>39</sup> These results suggest that there are no significant spillover effects from the IOF to portfolio allocations in countries whose returns tend to be more correlated with those in Brazil.

Next, to better model how investors think about portfolio reallocation and responded to changes in capital controls in Brazil, we parsed the investor interviews discussed in Section 3. Many managers of global emerging market mutual funds (which constitute most of the EPFR sample) stated that they would often reallocate their portfolios across countries after new capital controls were imposed, although their strategy depended on their investment priorities and reasons for investing in the country originally. Four major themes emerged in these interviews on how investors would decide where to reallocate, especially in response to Brazil's recent changes in the IOF.

- 1) *Region:* Many investors wanted a certain degree of exposure to Latin America, partially due to its weight in their benchmark and partially to diversify away from risk in other major regions. If they reduced their exposure to Brazil due to a country-specific shock, a few investors stated they would at least partially increase their exposure to other countries in the region. Some investors also mentioned that they would only reallocate funds to other countries in the region that shared certain characteristics with Brazil—such as being a large, liquid market and being viewed as “investor friendly”.
- 2) *Market characteristics:* Some investors stated that they would only shift investments from Brazil to countries that had similar market characteristics —especially large and liquid markets that constituted a large share of the benchmark. This consideration was particularly

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<sup>38</sup> We also calculated these betas with no controls for the global emerging market benchmark, with no significant impact on the results.

<sup>39</sup> In the discussion below, we initially focus on spillover effects in global emerging market equity funds as the discussion in Section 5 indicated that these are the funds with the greatest portfolio reallocations in response to changes in the IOF. Moreover, sample coverage in this fund group is significantly greater than for bond funds. Also, we do not include funds dedicated only to Latin America as many spillovers discussed below would be difficult to capture in the small set of countries in the Latin American benchmark.

important for larger funds for which liquidity and the size of their position was important. These funds stated it was only worthwhile to have exposure to a country if they could take a large enough position that investment in the country was “worthwhile” in the sense that strong performance could make a meaningful contribution to raise their returns above the benchmark.

- 3) “Dragon” play: Many investors viewed their allocations to Brazil as an important component of their “dragon play” – basically as a way to benefit from strong growth in China. Different investors, however, focused on different approaches by which to gain exposure to the “China story.” Some investors simply included major commodity exporters in this “dragon play” strategy, while others also included emerging markets in Asia that relied heavily on exports and thereby benefited directly from a rapidly growing China.
  
- 4) “Control risk”: Several investors mentioned that a key issue in their interpretation of any new use of capital controls was the signal it sent about government willingness to use heterodox measures due to concerns about capital inflows. These investors described some governments as generally “market friendly”, as believing “capital controls simply don’t work” (such as Chile), and as viewing surges of capital inflows as presenting challenges but ones that were manageable—or at least best managed through means other than capital controls on foreign investors. In contrast, other governments were viewed as being more concerned about the distortions from large and unstable capital inflows and more sympathetic to using greater government involvement to stabilize capital inflows (including capital controls and adjustments of prudential regulations aimed at international capital movements rather than simply financial system stability). A few investors stated that Brazil’s use of the IOF increased their concerns about greater use of controls in other countries because Brazil was seen as a “development model”. Brazil’s use of controls could make this tool for managing capital inflows more widely accepted by other countries sympathetic to this policy. Some investors worried about the greater use of capital controls only in other emerging markets that had traditionally been fairly open and investor friendly (such as Peru), while others worried about the greater use of controls in countries which had historically maintained widespread capital account restrictions (such as India).

To test if these four factors had a significant effect on how investors reallocated their portfolios in response to changes in the IOF, we reestimate the base model in equation (3) except now attempt to isolate any spillovers to these specific country groups. More specifically, we estimate:

$$\Delta\omega_{i,j,t} = \gamma_D \Delta Control_t^{Brazil} + \gamma_{S1} \Delta Control_t^{Spillover\ Group} + \gamma_{S0} \Delta Control_t^{Other} + \beta \cdot \Delta\omega_{i,t}^{benchmark,j} + \delta \Delta\chi_{it} + \mu_{it} \ , \quad (5)$$

where  $\Delta Control_t^{Spillover\ Group}$  is the change in the IOF if the country allocation ( $i$ ) is to a country in one of the spillover groups listed above;  $\Delta Control_t^{Other}$  is the change in the IOF if the country allocation ( $i$ ) is to a country other than Brazil and not in the spillover group; and all other variables are defined in equation (3). We can then test not only for a direct effect of changes in the IOF on portfolio allocations to Brazil ( $\gamma_D < 0$ ) but also any positive or negative indirect effects on countries in a specific spillover group ( $\gamma_{S1} \neq 0$ ) as well as to the remaining countries in the portfolio ( $\gamma_{S0} \neq 0$ ).

To define the spillover groups, we relied on the investor interviews to form the categories, but then used data to ensure that the relevant countries were included in each group.<sup>40</sup> The countries included in each category are listed in Table 7. “Region” is all countries in Latin America. “Market size” is countries that constitute at least 4% of the relevant benchmark for equities and 10% for bonds. “Dragon–Commodity” is countries that are part of the “dragon play” because they are major commodity exporters.<sup>41</sup> “Dragon–Asia Exporter” is the group of export-oriented emerging markets in Asia that benefit substantially from rapid growth in China. “Dragon–All” is the union of these two groups. Table 8 reports estimates of equation (5) testing for spillover effects from changes in the IOF on each of these groups individually, as well as all groups simultaneously. Although the coefficient estimates for most of the spillover variables are positive, in each case they continue to be insignificant. These estimates suggest that there may not be any significant spillover effects from changes in the IOF, on average, to countries in Latin America, other large emerging markets, or other countries that are part of the “dragon play”. Even when controls for each of the groups are included simultaneously, there continues to be no significant spillover effects to the different groups of countries.

Next, we test for any spillover effects to countries in the final category mentioned by investors: countries that are considered to have a greater risk of implementing controls on capital inflows in the

<sup>40</sup> Many investors just provided an example of a few countries that came to mind as examples of what types of countries they would reallocate to as part of a strategy, but they generally did not provide a complete list of all countries that would be included.

<sup>41</sup> Major commodity exporters are defined as countries for which primary commodity exports/GDP >10%, based on UN Comtrade data. Primary commodities are defined as the codes: 01, 02, 04 - 15, 18, 25 - 28, 45, 47, 74, and 75.

future. Since different investors had different views of which countries were a “control risk”, we use three definitions. “Inflow Anxiety” is the group of countries that are traditionally fairly open to foreign investment but implemented new controls on portfolio inflows sometime from 2005 to 2010. These countries and their new controls over this period are listed in Appendix A. Some countries move in and out of this group based on their implementation or removal of controls.<sup>42</sup> “Control Friendly” is the group of countries that have traditionally maintained widespread capital account restrictions as measured in Chinn and Ito (2008).<sup>43</sup> Finally, “Control Risk” is the union of these countries in the “Inflow Anxiety” and “Control Friendly” groups. The countries included in each group are listed at the right of Table 7.

Table 9 repeats the estimates of equation (5) as reported in Table 8, except now controls for spillovers to countries in one of these groups believed to have a higher risk of implementing new controls on capital inflows. Including these measures of “control risk” do not significantly affect the finding of a direct negative effect of changes in the IOF on portfolio allocation to Brazil, but now show a significant negative spillover effect on other countries assessed to have a greater risk of implementing controls. This negative effect exists for each measure of “control risk” – including both countries that are generally open to foreign investment but recently instituted some type of control on portfolio inflows, as well as countries that traditionally maintain greater restrictions on the capital account. These strong negative spillover effects suggest that changes in capital controls in Brazil acted as an important signal to investors and caused them to reassess the risks of other countries changing their capital controls.

Moreover, Table 9 also shows that when this negative spillover effect of capital controls on other “control risk” countries is controlled for, then there are significant positive spillover effects in the other country groups identified by the investors. More specifically, increases in the IOF that cause investors to reduce their portfolio allocation to Brazil simultaneously cause investors to increase their allocation to other countries in Latin America, to other large emerging markets, and to other “dragon play” countries. These spillover effects are positive and significant in tests for one spillover effect at a time, although when all groups are considered simultaneously, their significance fluctuates based on the measure of “control risk” used. Finally, Table 10 repeats the estimates at the right of Table 9 for Global Emerging Market equity funds and compares them to estimates for Global Emerging Market bond funds. Global Emerging Market bond funds continue to exhibit a direct negative effect of changes in the IOF on

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<sup>42</sup> Colombia is only included from the period from 05/07 through 10/08. Indonesia is only included started in 06/10 and Peru is only included starting in 07/09.

<sup>43</sup> We focus on the KAOPEN measure of capital controls in Chinn and Ito (2008), updated in April 2011. KAOPEN is based on the principal components from four binary variables reported by the IMF: (1) capital account openness; (2) current account openness; (3) the stringency of requirements for the repatriation and/or surrender of export proceeds; and (4) the existence of multiple exchange rates for capital account transactions. The mean at the end of 2007 is 0.3228 and standard deviation is 1.392, so the cutoff to qualify as a country actively using capital controls is a value of the index less than -1.07. The results reported below are sensitive to using different cutoffs (such as a KAOPEN value of less than zero).

portfolio allocation to Brazil, but there is no evidence of significant negative spillovers to countries with “control risk”. There also continues to be no significant positive spillovers to the region, other large markets, or other “dragon play” countries. The explanatory power of the regressions is also much lower for bond funds than equity funds. It is unclear if these differences result from the more limited representation of bond funds in our sample, or if bond investors follow different strategies when reallocating funds after changes in capital controls.

## 7. Conclusions

This paper studies the effects of changes in Brazil’s tax on portfolio inflows from 2006 through 2011 in order to analyze how capital controls affect portfolio investment in the country implementing controls as well as if there are any multilateral effects on other countries. As this is the first paper, to our knowledge, explicitly testing for any multilateral effects of capital controls on portfolio investment, we start with a scenario and framework that would be most likely to capture any direct and indirect effect of capital controls. Our results may not apply to smaller countries implementing capital controls or to countries that are viewed as less “investor friendly” in the sense that they traditionally maintain extensive restrictions on capital flows.

With these caveats, we find that controls on capital inflows can have significant direct effects on the country instituting the controls as well as significant spillover effects—in various forms—on other countries. More specifically, an increase in Brazil’s IOF significantly reduced the share of investors’ portfolios allocated to Brazil for global emerging market equity and bond funds as well as Latin American funds. This portfolio reallocation did not occur instantly, or even in the month that the changes were announced, but instead occurred gradually over a period of about three months. Moreover, an increase in Brazil’s IOF also caused negative and positive spillover effects in other groups of countries. Increases in the IOF caused investors to decrease their portfolio allocations to countries believed to be at greater risk of implementing new controls—in the sense that they had long-standing restrictions on capital account movements and/or had recently implemented new controls on portfolio inflows. At the same time, increases in the IOF caused investors to increase their portfolio allocations to countries seen as sharing some type of similarity to Brazil—such as being in the same region, being a large share of the benchmark index, or being a “dragon play” that benefitted from growth in China.

This series of results indicates that some of the effect of taxes on capital inflows works through changes in investor sentiment and expectations rather than through the direct costs of the controls. Changes in Brazil’s tax on foreign investment in bonds had a significant effect on foreign investment in equities—even though there was no direct change in the cost of investing in equities and even though many equity investors do not have any debt holdings. Similarly, changes in Brazil’s capital control regime

caused investors to reassess the risks of new controls being implemented in other countries—even for countries as diverse as Colombia (which only briefly experimented with controls) and India (which had widespread controls in place). Brazil’s use of the IOF may have signalled to investors a new willingness by emerging markets to impose taxes on capital inflows. It also may have been perceived as making it easier for other countries to follow their example and implement new controls without creating a backlash by investors.

Finally, these results suggest that although new controls on capital inflows can reduce portfolio flows and thereby potentially help a country manage the risks from inflow surges, these policies should not be considered in isolation. There will be multilateral consequences as investors reallocate their portfolios away from the country instituting the controls. The IOF may have slightly reduced the risk of bubbles and overheating in Brazil, but at the same time it may have aggravated these challenges in other countries in Latin America, other large emerging markets, and other “dragon play” countries linked to China’s economy. (Although ironically, controls in Brazil may have simultaneously reduced these risks in other countries that had already implemented controls to manage inflow surges.) Although this paper only focuses on the specific example of the IOF in Brazil, the results support concerns about the use of capital controls in other countries as they could have multilateral effects that create distortions in other economies.

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**Appendix A**  
**New Controls on Portfolio Capital Inflows from Non-Residents: 2005-2010**

<b>Country</b>	<b>Date Implemented</b>	<b>Asset Class</b>	<b>Policy Measure</b>
Argentina	6/2005	Equities	Minimum stay period of 12 months. Compulsory deposit of 30% of money brought into non-interest bearing account.
Colombia	05/2007	Equities & bond	Series of measures introduced, including a 40% URR on all portfolio inflows by foreign investors.
Colombia	06/2008	Equities & bond	URR on inflows raised to 50 % with 2-year minimum stay on FDI. URR removed on 10/08.
Colombia	10/2008	Equities & bond	URR removed.
Indonesia	06/2010	Bonds	One-month holding period introduced for SBIs. Required holding period for certain notes increased to 1 year in 07/10.
Peru	07/2009	Equities & bond	Foreign purchases of CB bills were banned. Fees on foreign purchases of central bank liquidity draining instruments were increased.
Peru	01/2010	Equities	Capital gains tax for non-residents' investments in the domestic stock market were imposed.
Peru	08/2010	Bonds	Increased fee on non-resident purchases of central bank paper from 10bp to 400bp.
Peru	12/2010	Equities	Enacted 30% capital gains tax on non-residents investment in the stock market for transactions through a Peruvian broker and 5% for transactions through a non-resident broker.
Thailand	12/2006	Equities & bonds	URR of 30% put into place for certain types of portfolio inflows. After sharp market reaction, equities then exempted from URR.
Thailand	10/2010	Equities & bond	Reinstated a 15% withholding tax on nonresidents' interest earnings and capital gains on new purchases of state bonds.

**Table 1**  
**EPFR Statistics**

<b>Equity Funds</b>	<b># Observations</b>	<b>Total AUM (\$bn 12/2010)</b>	<b>Avg % of AUM in Brazil</b>	<b>AUM in Brazil (\$bn 12/2007)</b>
Africa Regional	300	2.7	0.0	0.0
Asia ex-Japan Regional	1,402	152.3	0.0	0.0
Emerging Europe Regional	1,535	25.8	0.1	0.0
Europe Regional	1,980	159.0	0.0	0.0
Europe ex-UK Regional	1,539	112.1	0.1	0.0
Europe, Middle East & Africa Regional	1,037	3.7	0.0	0.0
Global Emerging Markets	3,420	439.0	14.7	46.9
Global ex-US	3,784	710.9	1.8	11.4
Global	3,649	990.5	1.2	11.2
Latin America Regional	850	49.6	62.0	29.0
Middle East & Africa Regional	346	1.9	0.0	0.0
Middle East Regional	423	2.0	0.0	0.0
Pacific Regional	1,265	24.0	0.0	0.0
<b>Total</b>	<b>21,530</b>	<b>2,673.5</b>		<b>98.4</b>
<hr/>				
<b>Bond Funds</b>				
Asia ex-Japan Regional	1,039	14.0	0.0	0.0
Emerging Europe Regional	814	2.3	0.0	0.0
Global Emerging Markets	3,277	137.3	15.2	10.9
Global ex-US	432	31.1	0.0	0.0
Global	3,310	442.1	1.2	3.0
Latin America Regional	930	0.8	20.2	0.2
<b>Total</b>	<b>9,802</b>	<b>627.7</b>		<b>14.1</b>

**Notes:** This table reports information on the coverage of international portfolio investment in equity and bond funds in the Emerging Portfolio Funds Research (EPFR) database.

**Table 2**  
**Country Representation in Global Emerging Market Sample**

<b>Country</b>	<b># Observations</b>	
	<b>Equities</b>	<b>Bonds</b>
Argentina	158	80
Brazil	158	80
Chile	158	80
China	79	80
Colombia	158	80
Czech Republic	79	69
Egypt	79	80
Hungary	79	80
India	79	80
Indonesia	79	80
Israel	79	79
Korea (South)	79	80
Malaysia	79	80
Mexico	158	80
Morocco	79	53
Pakistan	79	80
Peru	158	80
Philippines	79	80
Poland	79	80
Russia	79	80
South Africa	79	80
Taiwan	79	39
Thailand	79	80
Turkey	79	80
Venezuela	121	80
<b>Total</b>	<b>2,491</b>	<b>1,920</b>

**Notes:** The fund groups included in the sample described above are: Global Emerging Market equities, Global Emerging Market bonds, and Latin American Regional equities.

**Table 3**  
**Benchmark Index Weightings and the IOF**

<b>Date IOF Added or Raised</b>	<b>Benchmark Index</b>	<b>Change in Brazil weight in the benchmark</b>			
		<b>1<sup>st</sup> month</b>	<b>2<sup>nd</sup> month</b>	<b>3<sup>rd</sup> month</b>	<b>Average</b>
Mar-08	MSCI EM Index	-0.27	0.97	1.50	0.73
	EMBI Global	-0.66	0.29	0.51	0.05
Oct-09	MSCI EM Index	0.62	0.66	-0.04	0.42
	EMBI Global	0.11	-0.15	-0.21	-0.08
Oct-10	MSCI EM Index	-0.25	-0.42	-0.03	-0.23
	EMBI Global	-0.28	-0.31	-0.33	-0.31
Average	MSCI EM Index	0.03	0.40	0.48	0.30
	EMBI Global	-0.28	-0.06	-0.01	-0.11

**Notes:** “MSCI EM Index” is the Emerging Markets (EM) Index for equities produced by MSCI and “EMBI Global” is the EMBI Global Diversified Index produced by JP Morgan

**Table 4**  
**Variable Definitions and Summary Statistics**

Variable	Definition	Source	Levels		Differences	
			Mean	Standard Deviation	Mean	Standard Deviation
$\omega_{i,j,t}$	Share of fund group's portfolio allocated to country $i$	EPFR	4.939	9.336	-0.002	0.364
$Control^{Brazil}$	Level of IOF tax in Brazil * dummy = 1 if country $i$ is Brazil	Calculated	0.063	0.520	0.012	0.222
$Control^{Ex-Brazil}$	Level of IOF tax in Brazil * dummy = 1 if country $i$ is not Brazil	Calculated	1.113	1.893	0.215	0.910
$\omega^{benchmark}$	Weight of country $i$ in the MSCI/EMBI benchmark index	JP Morgan, MSCI	6.006	9.875	-0.001	0.372
$TED\ spread$	U.S.3-month money market rate minus T-Bill rate (in bps)	Datastream	59.382	57.919	-0.248	34.445
$VIX$	U.S. VIX	Bloomberg	-1.763	8.322	0.162	4.768
$FX\ return$	Change in country $i$ 's exchange rate vis-à-vis the US\$	Bloomberg	-0.052	3.852	0.034	5.224
$Interest\ rate$	Country $i$ 's interest rate, lagged one month	Datastream	-0.010	1.690	-0.008	2.673
$U.S.\ equity\ return$	U.S. equity return, lagged one month	Bloomberg	0.338	4.560	-0.071	5.544
$Interest\ rate\ differential$	Country $i$ 's interest rate differential versus the United States, based on the 3-month money market interest rate	Bloomberg	4.747	6.679	0.012	1.719
$Equity\ volatility$	Intra-month equity volatility for country $i$ , lagged one month	Calculated	27.239	16.579	0.033	13.647
$Interest\ rate\ volatility$	Intra-month Interest rate volatility for country $i$ , lagged one month	Calculated	5.038	12.521	-0.027	6.369

**Notes:** Sample statistics are for the base sample which includes Global Emerging Market equity and debt funds and Latin America Regional equity funds.

**Table 5: Regression Results—Effect of Capital Controls**

	Base		Levels	Different Timing for Effects of Controls		
	Base	Base		Prior	Immediate	Additional Lag
$Control^{Brazil}$	-0.0363** (0.0169)	-0.0356** (0.0173)	-0.1006* (0.0577)	-0.0357** (0.0173)		-0.0355** (0.0174)
$Control^{Ex-Brazil}$	0.0032 (0.0043)	0.0038 (0.0051)	-0.0024 (0.0364)	0.0037 (0.0051)		0.0039 (0.0051)
$\omega^{benchmark}$	0.6933*** (0.0463)	0.6979*** (0.0460)	0.8076*** (0.0478)	0.6970*** (0.0469)	0.6978*** (0.0456)	0.6981*** (0.0457)
<i>TED spread</i>		0.0046 (0.0178)	-0.0004 (0.0005)	0.0050 (0.0179)	0.0043 (0.0178)	0.0046 (0.0178)
<i>VIX</i>		-0.0250 (0.1735)	0.0009 (0.0074)	-0.0410 (0.1682)	-0.0279 (0.1696)	-0.0245 (0.1736)
<i>FX return</i>		-0.0059 (0.0791)	-0.0109*** (0.0030)	-0.0033 (0.0778)	-0.0033 (0.0759)	-0.0046 (0.0789)
<i>Interest rate</i>		0.1157 (0.3307)	0.0200 (0.0137)	0.1000 (0.3306)	0.1156 (0.3319)	0.1189 (0.3296)
<i>U.S. equity return</i>		0.0008 (0.0687)	-0.0035 (0.0032)	-0.0059 (0.0683)	-0.0111 (0.0753)	0.0020 (0.0691)
<i>Interest rate differential</i>		-0.1155 (0.4309)	-0.0355 (0.0212)	-0.0915 (0.4323)	-0.1215 (0.4345)	-0.1231 (0.4281)
<i>Equity volatility</i>		-0.0518 (0.0509)	0.0011 (0.0015)	-0.0538 (0.0551)	-0.0538 (0.0510)	-0.0523 (0.0508)
<i>Interest rate volatility</i>		0.0659 (0.0801)	0.0062 (0.0046)	0.0650 (0.0801)	0.0663 (0.0796)	0.0656 (0.0802)
<i>T-1 Control<sup>Brazil</sup></i>				0.0531 (0.1398)		
<i>T-1 Control<sup>Brazil</sup></i>				-0.0155 (0.0254)		
<i>Immed. Control<sup>Brazil</sup></i>					-0.0149 (0.0644)	
<i>Immed. Control<sup>Ex-Brazil</sup></i>					0.0059 (0.0086)	
<i>T+1 Control<sup>Brazil</sup></i>						0.0156 (0.0363)
<i>T+1 Control<sup>Ex-Brazil</sup></i>						0.0007 (0.0035)
<b>Observations</b>	<b>4,288</b>	<b>3,723</b>	<b>3,775</b>	<b>3,723</b>	<b>3,723</b>	<b>3,723</b>
<b>R-squared</b>	<b>0.433</b>	<b>0.445</b>	<b>0.739</b>	<b>0.445</b>	<b>0.444</b>	<b>0.445</b>

**Notes:** “Base” is the base-case regression in equation (3) of the change in the country share in the fund group’s portfolio and allows for effects of changes in  $Control^{Brazil}$  to occur over three months. Each control variable expressed as first differences and coefficients on the macro control variables are multiplied by 100 to facilitate readability. “Level” estimates equation (2) with all variables in levels and a country-fund fixed effect. All estimates include robust standard errors clustered by country and fund group. Constants are not reported. “*T-1 Control*” is a measure of the impact of the control in the month before the tax is changed. “*Immed. Control*” is a measure of the impact in the month of the change. *T+1 Control* measures any additional impact over the 3 months following the 3 month window used for the base case. \*\*\* is significant at the 1% level, \*\* at the 5% level and \* at the 1% level.

**Table 6**  
**Effect of Capital Controls on Different Fund Groups**

	<b>Full Sample</b>	<b>Equity</b>	<b>Debt</b>	<b>Global Emerging Market Equity</b>	<b>Latin America Equity</b>
<i>Control</i> <sup>Brazil</sup>	-0.0356** (0.0173)	-0.0526*** (0.0168)	-0.0263*** (0.0037)	-0.0294*** (0.0026)	-0.0773*** (0.0089)
<i>Control</i> <sup>Ex-Brazil</sup>	0.0038 (0.0051)	0.0034 (0.0080)	0.0037 (0.0062)	0.0004 (0.0068)	0.0175 (0.0321)
$\omega$ <sup>benchmark</sup>	0.6979*** (0.0460)	0.7723*** (0.0295)	0.2185*** (0.0750)	0.7628*** (0.0618)	0.7789*** (0.0238)
<i>TED spread</i>	0.0046 (0.0178)	0.0029 (0.0107)	0.0005 (0.0336)	0.0120 (0.0088)	-0.0413 (0.0420)
<i>VIX</i>	-0.0250 (0.1735)	-0.0424 (0.1653)	-0.0258 (0.3164)	0.0043 (0.1331)	-0.3084 (0.6949)
<i>FX return</i>	-0.0059 (0.0791)	0.0909 (0.1256)	-0.1304 (0.0953)	-0.0026 (0.0991)	0.4506 (0.5486)
<i>Interest rate</i>	0.1157 (0.3307)	-0.0701 (0.3212)	-0.3447 (0.3847)	0.0042 (0.3873)	-0.4998 (0.2945)
<i>U.S. equity return</i>	0.0008 (0.0687)	0.0238 (0.0497)	-0.0437 (0.1433)	0.0150 (0.0592)	0.0360 (0.1045)
<i>Interest rate differential</i>	-0.1155 (0.4309)	-0.1107 (0.5990)	0.1254 (0.5366)	-0.3560 (0.7355)	1.4183 (1.1166)
<i>Equity volatility</i>	-0.0518 (0.0509)	-0.0039 (0.0333)	-0.0671 (0.0972)	-0.0290 (0.0292)	0.1118 (0.1319)
<i>Interest rate volatility</i>	0.0659 (0.0801)	-0.1018 (0.0866)	0.2075** (0.0742)	-0.0132 (0.0552)	-0.2912 (0.2693)
<b>Observations</b>	<b>3,723</b>	<b>2,227</b>	<b>1,496</b>	<b>1,762</b>	<b>465</b>
<b>R-squared</b>	<b>0.445</b>	<b>0.685</b>	<b>0.024</b>	<b>0.630</b>	<b>0.735</b>

**Notes:** Regressions of equation (3) of the change in the country share in the fund group's portfolio. Each control variable expressed as first differences and coefficients on the macro control variables are multiplied by 100 to facilitate readability. All estimates include robust standard errors clustered by country and fund group. Constants are not reported. Full Sample is the full set of Global Emerging Market equity funds, Global Emerging Market bond funds, and Latin American Regional equity funds. Equity is the Global Emerging Market Equity funds and Latin American Regional Equity funds. \*\*\* is significant at the 1% level, \*\* at the 5% level and \* at the 1% level.

**Table 7**  
**Spillover Measures for Global Emerging Market Equity Funds**

Country	High Beta <sup>1</sup>	Region <sup>2</sup>	Market Size <sup>3</sup>	Dragon Plays <sup>4</sup>			Greater Risk of Controls <sup>5</sup>		
				Commodity	Asia Exporter	Both	Inflow Anxiety	Control Friendly	Control Risk
Argentina	Y	Y		Y		Y		Y	
Chile		Y		Y		Y			
China			Y					Y	
Colombia	Y	Y					Y	Y	
Czech Republic									
Egypt									
Hungary									
India			Y					Y	
Indonesia				Y	Y	Y	Y	Y	
Israel									
Korea (South)			Y		Y	Y			
Malaysia				Y	Y	Y			
Mexico	Y	Y	Y						
Morocco								Y	
Pakistan								Y	
Peru	Y	Y		Y		Y	Y	Y	
Philippines					Y	Y			
Poland									
Russia			Y	Y		Y			
South Africa			Y					Y	
Taiwan			Y		Y	Y			
Thailand					Y	Y	Y	Y	
Turkey	Y								
Venezuela		Y		Y		Y		Y	
<b>Total</b>	<b>5</b>	<b>6</b>	<b>6</b>	<b>7</b>		<b>11</b>	<b>5</b>	<b>7</b>	
								<b>10</b>	

**Notes:** All variables report values for 01/10 unless noted below.

- (1) “High Beta”: a dummy equal to one if the beta is greater than 20% in a regression of country returns on returns in Brazil with a control for the global emerging market index.
- (2) “Region”: countries in Latin America.
- (3) “Market Size”: countries for which their market is at least 4% of the MSCI benchmark.
- (4) “Dragon Play”: countries whose returns are believed to be closely linked to growth in China. These include “Commodity”, which are countries for whom commodity exports/GDP >10% based on U.N. Comtrade export data; “Asia Exporter” which are export-dependent emerging markets in Asia; and “Both”, which is the union of these two groups.
- (5) Countries assessed to have a greater risk of implementing new controls on capital inflows. This is divided into three groups. “Inflow anxiety”: countries that implemented new controls on capital inflows from 2005-2010 as listed in Appendix A. Colombia is only included from the period from 05/07 through 10/08. Indonesia is only included started in 06/10 and Peru is only included starting in 07/09. “Control friendly”: countries that have widespread capital controls in place. Defined as having a value of KAOPEN in Chinn-Ito (2008) less than the mean less one standard deviation. “Control risk”: is the union of these two groups.

**Table 8**  
**Spillover Effects of Capital Controls**

	Beta	Region	Market Size	Dragon Plays			All Groups
				Commodity	Asia Exporter	Both	
$Control^{Brazil}$	-0.0294*** (0.0026)	-0.0294*** (0.0026)	-0.0294*** (0.0026)	-0.0294*** (0.0026)	-0.0294*** (0.0026)	-0.0293*** (0.0026)	-0.0290*** (0.0027)
$Control^{Ex-Brazil}$	0.0025 (0.0078)	-0.0004 (0.0083)	-0.0053 (0.0046)	-0.0032 (0.0081)	-0.0069 (0.0068)	-0.0122* (0.0070)	-0.0107 (0.0068)
$\omega^{benchmark}$	0.7629*** (0.0618)	0.7628*** (0.0617)	0.7627*** (0.0621)	0.7625*** (0.0615)	0.7627*** (0.0622)	0.7617*** (0.0622)	0.7622*** (0.0625)
Beta	-0.0077 (0.0111)						
Region		0.0033 (0.0053)					-0.0053 (0.0089)
Market Characteristics			0.0106 (0.0159)				0.0054 (0.0144)
Dragon Play				0.0104 (0.0091)	0.0169 (0.0125)	0.0148 (0.0096)	0.0146 (0.0095)
Macro Controls	Y	Y	Y	Y	Y	Y	Y
Observations	1,762	1,762	1,762	1,762	1,762	1,762	1,762
R-squared	0.630	0.630	0.630	0.630	0.631	0.631	0.631

**Notes:** Variables are defined in Table 7. All regressions are for Global Emerging Market equity funds only. Macroeconomic control variables listed in Tables 5 and 6 are included in the regressions but not reported in the table. Estimates are of equation (5) of the change in the country share in the fund group's portfolio. All estimates include robust standard errors clustered by country and fund group. Constants are not reported. \*\*\* is significant at the 1% level, \*\* at the 5% level and \* at the 1% level.

**Table 9**  
**Spillover Effects: Controlling for the Risk of New Capital Controls**

	<b>Inflow Anxiety</b>	<b>Control Friendly</b>	<b>Control Risk</b>	<b>Region</b>	<b>Market Size</b>	<b>Dragon Play</b>	<b>All Groups</b>		
<i>Control<sup>Brazil</sup></i>	-0.0294*** (0.0026)	-0.0293*** (0.0026)	-0.0293*** (0.0026)	-0.0293*** (0.0026)	-0.0293*** (0.0026)	-0.0292*** (0.0026)	-0.0290*** (0.0027)	-0.0292*** (0.0026)	-0.0292*** (0.0026)
<i>Control<sup>Ex-Brazil</sup></i>	0.0023 (0.0078)	0.0060 (0.0069)	0.0094 (0.0079)	0.0089 (0.0094)	0.0028 (0.0061)	-0.0031 (0.0064)	-0.0108 (0.0068)	-0.0113 (0.0070)	-0.0112 (0.0070)
$\omega^{benchmark}$	0.7629*** (0.0618)	0.7611*** (0.0619)	0.7614*** (0.0620)	0.7614*** (0.0619)	0.7609*** (0.0625)	0.7603*** (0.0624)	0.7619*** (0.0626)	0.7591*** (0.0629)	0.7599*** (0.0628)
<i>Region</i>				0.0112** (0.0040)			-0.0004 (0.0084)	-0.0079 (0.0064)	-0.0015 (0.0050)
<i>Market Size</i>					0.0257** (0.0115)		0.0001 (0.0135)	0.0377*** (0.0098)	0.0190** (0.0072)
<i>Dragon Play</i>						0.0234** (0.0097)	0.0254** (0.0115)	0.0044 (0.0062)	0.0204*** (0.0070)
<i>Inflow Anxiety</i>	-0.0113*** (0.0022)						-0.0353*** (0.0115)		
<i>Control Friendly</i>		-0.0289** (0.0118)						-0.0649*** (0.0166)	
<i>Control Risk</i>			-0.0207** (0.0076)	-0.0300** (0.0111)	-0.0352** (0.0125)	-0.0296*** (0.0092)			-0.0392*** (0.0087)
<i>Macro Controls</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y
<i>Observations</i>	<b>1,762</b>	<b>1,762</b>	<b>1,762</b>	<b>1,762</b>	<b>1,762</b>	<b>1,762</b>	<b>1,762</b>	<b>1,762</b>	<b>1,762</b>
<i>R-squared</i>	<b>0.630</b>	<b>0.631</b>	<b>0.631</b>	<b>0.631</b>	<b>0.632</b>	<b>0.633</b>	<b>0.632</b>	<b>0.634</b>	<b>0.634</b>

**Notes:** All regressions are for Global Emerging Market equity funds only. Macroeconomic control variables listed in Tables 5 and 6 are included in the regressions but not reported in the table. Estimates are of equation (5) of the change in the country share in the fund group's portfolio. All estimates include robust standard errors clustered by country and fund group. Constants are not reported. \*\*\* is significant at the 1% level, \*\* at the 5% level and \* at the 1% level.

**Table 10**  
**Spillover Effects:**  
**Global Emerging Market Equity and Bond Funds**

	<b>GEM Equity</b>	<b>GEM Bonds</b>
<i>Control</i> <sup>Brazil</sup>	-0.0292*** (0.0026)	-0.0264*** (0.0037)
<i>Control</i> <sup>Ex-Brazil</sup>	-0.0112 (0.0070)	0.0035 (0.0079)
$\omega$ <sup>benchmark</sup>	0.7599*** (0.0628)	0.2174*** (0.0759)
<i>Region</i>	-0.0015 (0.0050)	0.0055 (0.0075)
<i>Market Size</i>	0.0190** (0.0072)	-0.0023 (0.0075)
<i>Dragon Play</i>	0.0204*** (0.0070)	-0.0061 (0.0079)
<i>Control Risk</i>	-0.0392*** (0.0087)	0.0138 (0.0091)
<i>Macro Controls</i>	Y	Y
<b>Observations</b>	<b>1,762</b>	<b>1,496</b>
<b>R-squared</b>	<b>0.634</b>	<b>0.025</b>

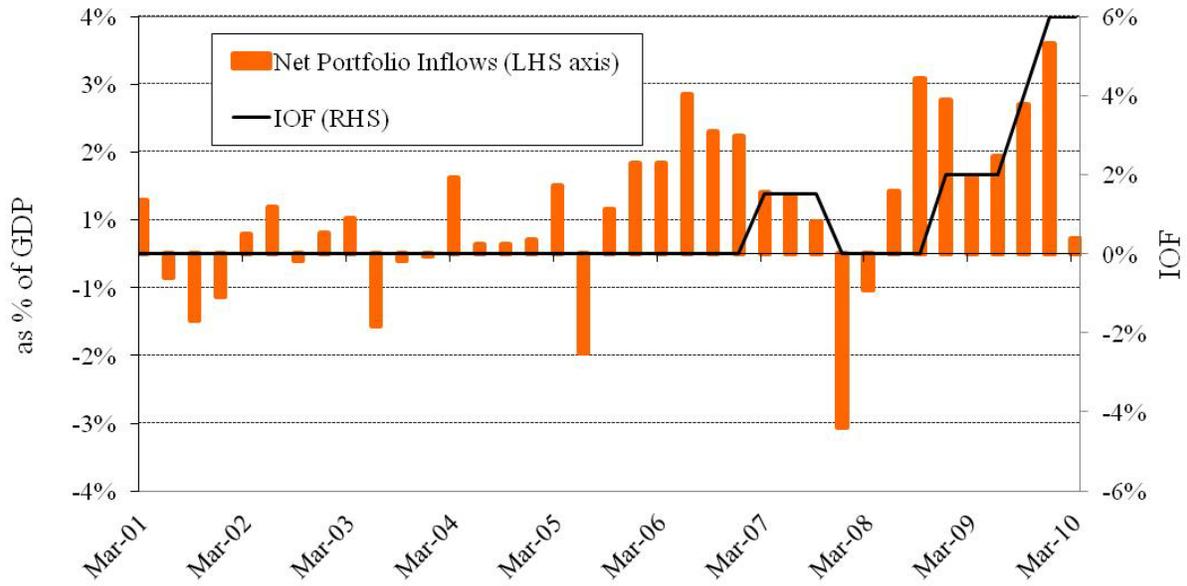
**Notes:** Macroeconomic control variables listed in Tables 5 and 6 are included in the regressions but not reported in the table. Estimates are of equation (5) of the change in the country share in the fund group's portfolio. All estimates include robust standard errors clustered by country and fund group. Constants are not reported. \*\*\* is significant at the 1% level, \*\* at the 5% level and \* at the 1% level.

**Figure 1: Fund Exposure to Brazil and the IOF Tax**



**Notes:** Brazil weight in EPFR is the average share of the funds portfolio allocated to Brazil. Benchmark is the weight of Brazil in the MSCI benchmark for equities or JPMorgan EMBI Global benchmark for bonds. IOF is the tax on foreign investment in fixed income.

**Figure 2:  
Brazil: The IOF and Portfolio Investment Liabilities**



Source: International Monetary Fund's, Balance of Payments Statistics. Accessed online on 10/30/11.